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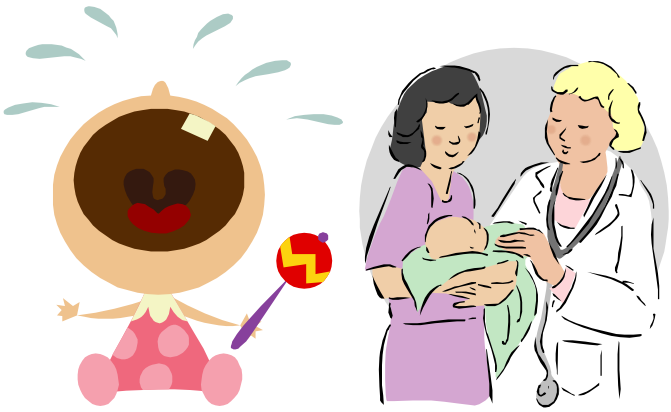
TRANSLATING RESEARCH INTO ACTION

Case study:

Telephone campaigns to encourage child vaccination:

Are they effective?



This case study is based on 'Comparing experimental and matching methods using a field experiment […]' by Kevin Arceneaux, Alan S. Gerber and Donald P. Green, *Political Analysis* 14: 1-36; and on a case study prepared by Poverty Action Lab. We thank the authors for allowing us to use their document and for sharing their data with us.

Introduction

Hello. May I please speak to either Anne or Tomas Simon? Hello. My name is Marc Oyeye, and I'm calling from Vaccination 100%. We are an NGO that promotes children's vaccinations. We'd simply like to remind you that your child can be vaccinated for free at your family physician's office every Saturday morning. Can we count on you to bring your child to the physician to get her vaccinations?

In January 2001, volunteers for the Vaccination 100% Campaign launched an effort to mobilize Nagudan households to vaccinate their children. During that month, they made telephone calls to 60,000 households with children born in 1999, and conveyed the above message to them.

Did the Vaccination 100% campaign increase the vaccination rate of children born in 1999? How can we find out? This case study addresses these questions by examining the various methods that can be used to assess the impact of a program or intervention. While the context of this case study is vaccination in Naguda, the questions raised here are also valid for the assessment of the impact of other public programs (whether social welfare-related or not) in developing countries.

Background

Most child vaccines are administered during the child's first 6 months of life (see table below). In Naguda, the rate of vaccination compliance is very high during this period because most children are monitored directly by a nurse from the NCO (*National Child Office*) up to the age of 12 months. The visits of the NCO nurse are free, and the nurse also pays home visits to families who cannot travel to the health center. After the age of 12 months, children are no longer monitored by the NCO, but instead must be taken by the parents to the family physician, who administers the remaining vaccines. Many parents neglect to get their children onto the family physician's roster, or only bring the child to the doctor if he or she is ill. As a result, the rate of compliance with the 15- to 18-month vaccination schedule is much lower than the rate of compliance in the 2-12 month age range.

Age	**Vaccines**
2 months	DTP, IPV, HBV, Hib, MCC
4 months	DTP, IPV, HBV, Hib, MCC
6 months	DTP, IPV, HBV, Hib, MCC
15 months	**MMR**
18 months	**DTP, IPV, Hib (third dose)**
4 years	MMR
4-6 years	DTP, IPV
14-16 years, and then every 10 years	Td (7)

The Millennium Development Goals (MDGs, adopted by the international community in 2000) call for a 50 percent reduction in infant mortality by the year 2015. A diagnostic study carried out in Naguda in September 2000 in response to the issuance of the MDGs indicated that MMR vaccination rates, as well as the rate of administration of the third dose of the combined DTP-IPV-Hib vaccine were below rates in neighboring countries, and that it was necessary to increase them in order to reach the MDGs. In search of an explanation for this low vaccination rate, and especially in search of a solution, the Minister of Health hired a consultant, who proposed the following strategy:

To: His Excellency the Minister of Health
From: V. Valdori, consultant
Date: December 15, 2000
Ref: Vaccination with MMR and 3rd dose of DTP- IPV-Hib vaccines

Diagnostic

I have implemented a survey of 1000 randomly selected households in Naguda to find out why the vaccination rates for the 12 to 24 month old children is so low. After careful analysis, I conclude that the following are the two most important reasons why families do not vaccinate their children in that age range:
1. They forget
2. They do not know that family physician vaccinates children free of charge.

Proposal
Since the issue is that parents lack information and are forgetful, the Ministry of Health should hire a company to telephone parents and remind them to bring their children to the family physician to be vaccinated. The parents should also be informed that there will be no cost to them for the vaccination. Since most households in Naguda have telephones, this method will be cheaper and more effective than visiting households door-to-door.

The Ministry of Health is skeptical about this proposal. Before rolling out the telephone campaign strategy in the whole country, he decides to hire an NGO,

"Vaccination 100%" to run a pilot experiment to test the efficacy of phone calling campaigns. An impact evaluation will be built into the pilot experiment. **The Minister of Health hires you to run the impact evaluation.**

Question 1 for discussion – What is the **one** basic question that your impact evaluation should be able to answer?

Please complete Question 1 before reading further.

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Did the Vaccination 100% campaign work?

In December 2000, the NGO "Vaccination 100%" obtained telephone numbers for 60,000 households in which children had been born in 1999. In January 2001, volunteers from the NGO called all 60,000 households, but were only able to speak with about 25,000 people. That is to say, the telephone was answered in only 25,000 households. For each of the 60,000 households, the volunteers noted whether the telephone had been answered or not.

The list of 60,000 households was obtained from the archives of the national civil registry of Naguda, in which all children are registered soon after birth. The archives also contain data on the size of the household, the age of the child's mother, the gender of the head of household, whether the household already had older children, where the household is located (i.e., Northern Region or Southern Region), and the level of economic development of the household's district. Finally, Vaccination 100% was able to determine, based on the official files of the National Health System, whether these households had actually brought their children to be vaccinated in 2001.

Analysis of data for 2001

Vaccination 100% has agreed to share with you its data concerning the 60,000 households involved in their telephone campaign. We are asking you to use this data to gauge the impact of the phone-calling campaign on household participation in the 2001 vaccination campaign, i.e. its impact on the percentage of children born in 1999 who were vaccinated in 2001. You are being asked to consider the two methods described below.

Method 1 – Difference in the proportion of vaccinated children, between households that answered the telephone versus those that did not answer the telephone.

Assume that the 25,000 households that answered the telephone constitute the 'treatment' group and the remaining 35,000 households (i.e. those that were called but did not answer the telephone) represent the 'comparison' group. If you want to determine the impact of receiving a phone call on the vaccination rate, you might check to see whether those who answered the telephone were more likely to have their children vaccinated than those who did not. Compare the proportion of households in the 'treatment' group that had their children vaccinated with the proportion of such households in the 'comparison' group.

Table 1a: Percentage of households with children born in 1999 that had those children vaccinated

	… among households that answered the telephone	**… among households that did not answer the telephone**	**Estimated impact**
Method 1:			
Simple difference	64.5 %	53.6 %	10.9 pp*

Question 2 for discussion –Do you think this method can give you a precise idea of the actual impact of the phone-calling campaign on the vaccination rate of children born in 1999? Why or why not?

Please complete Question 2 before reading further.

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Method 2 – Use a multiple regression to determine the differences between households that answered the telephone and those that did not.

If you believe that the households that answered the telephone may have inherent characteristics different from those of non-answering households, you can figure out these differences by using a multivariate regression, as follows:

The participant group and the comparison group are defined in the same way as in Method 1. To estimate the impact of the program, one does a regression in which the 'dependent variable' is either zero or a variable indicating whether the household had its child vaccinated or not (i.e., 0 = did not have its child vaccinated, 1 = had its child vaccinated). The 'key explanatory variable' is a zero or a variable indicating whether someone answered the telephone or not (i.e., 0 = answered, 1 = did not answer). Potential differences in the characteristics can be discerned by using other 'explanatory variables' such as the age of the child's mother, the gender of the head of household, the number of older children in the household, etc. The explanatory variable coefficient (i.e., 'answered the phone') represents the estimated impact of the program.

Table 1b shows the estimated impact of the Vaccination 100% Campaign using the multivariate method. Table 2 compares the average characteristics of the 'treated' groups and 'comparison' groups used in these two methods.

Table 1b: Percentage of households with a child born in 1999 that had that child vaccinated

	… among households that answered the telephone	**… among households that did not answer the telephone**	**Estimated impact**
Method 1:			
Simple Difference	64.5 %	53.6 %	10.9 pp*
Method 2:			
Multiple regression [a]			6.1 pp*

pp=percentage points
**: statistical significance = 5 %*
a: Controls include size of household, age of the child's mother, a variable indicating whether there are older children in the household, a variable indicating whether the head of household is a woman, the level of economic development in the household's district, a variable indicating whether the household is in the Northern Region.

Table 2: Average characteristics of households

	Households that answered the telephone	**Households that did not answer**	**Difference**
Size of household	4.56	4.50	0.06

Average age of child's mother	35.8	31.0	4.8
Percentage of households with older children	56.2 %	53.8 %	2.4 pp*
Percentage of female-headed households	7.3 %	9.6 %	-2.3 pp*
Percentage of households located in a highly developed district	50.3 %	49.8 %	0.5 pp
Percentage in the Northern Region	54.7 %	46.7 %	8.0 pp*
Sample size	25,043	34,929	

pp=percentage points
**: statistical significance = 5 %*

Question 3 for discussion – Why do you think that the impact estimated using Method 2 is smaller than the impact estimated using Method 1?

Question 4 for discussion – Do you think the impact estimated with Method 2 represents the true causal effect of the phone-calling campaign on the vaccination of children born in 1999? Why or why not?

Question 5 for discussion – Can you correct the weaknesses of Method 1 by taking a random sample of households who answered the phone and a random sample of households who did not answer the phone?

Question 6 for discussion – Using the data described above, can you come up with some more convincing methods for estimating the impact of the Vaccination 100% campaign? What kind of information would be helpful?

Please complete questions 3 through 6 before reading further.

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Using panel data

If you are still concerned about differences in characteristics between households that answered the telephone and those that did not, you might use panel data, i.e. you could follow the same households over time.

As it turns out, the archives of the *NCO* also had data indicating whether households had vaccinated their older child or children (or not) when those children were aged 12 to 24 months. The households' past behavior with regard to the vaccination of the older children can be a solid predictor of their future behavior regarding the vaccination of subsequent children. Table 3 shows the past vaccination behavior for the group of households that answered the telephone versus that of households that were called but did not answer the telephone.

Table 3: Percentage of households with children born prior to 1999 that vaccinated those children at 12 – 24 months			
	… among households that answered the telephone	**…among those that did not**	**Difference**
Had the child born in 1999 vaccinated	64.5 %	53.6 %	10.9 pp*
Had children born in 1993, 1994 or 1995 vaccinated (a)	71.7 %	63.3 %	8.4 pp*
Had children born in 1996, 1997 or 1998 vaccinated (a)	46.6 %	37.6 %	9.0 pp*
Difference between children born in 1999, versus those born in 1996, 1997 and 1998 (a)	17.9 %	16.0 %	1.9 pp*

pp=percentage points
**: statistical significance = 5 %*
(a) among households that had at least one child born during this period

Question 7 for discussion – How could you use this data on behavior regarding vaccination of the older children to improve your analysis? What kind of method could you use? Based on the information in Table 3, what would be your new estimate of the impact of the telephone campaign on vaccination rates?

Question 8 for discussion – Compare your new estimate to the estimates you obtained with Method 1 and Method 2. Is the estimated impact lower or higher? Why do you think this is?

Please complete questions 7 and 8 before reading further.

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Randomized experiment

As it turns out, the 60,000 households were chosen ***at random*** from the archives of the national civil registry of Naguda. This is similar to the random drawing done in a clinical trial, where the treatment/drug is administered randomly so as to be received by one group of patients but not the other. We can exploit this random drawing of 60,000 households to estimate the impact of the Vaccination 100% Campaign. The idea is that the 60,000 households that received telephone calls from Vaccination 100% (now referred to as the 'treatment' group) should be identical to the 200,000 other Nagudian households (now referred to as the 'control' group) that had children in 1999, in terms of observable and non-observable characteristics. The only difference between the first and second groups is that the first group received a telephone call and the second did not. Table 4 compares the 'treatment' group and the 'control' group on the basis of observable characteristics. Table 5 shows the estimated impact of the Vaccination 100% Campaign by comparing the percentage of children (born in 1999) vaccinated in the treatment group with the percentage of children vaccinated in the control group.

Table 4: Characteristics of treatment and control groups

	'Treatment' group (Received phone call)	**'Control' group (Did not receive phone call)**	**Difference**
Had children born in 1993, 1994 or 1995 vaccinated	66.7 %	66.4 %	0.3 pp
Had children born in 1996, 1997 or 1998 vaccinated	42.7 %	43.1 %	-0.4 pp
Size of household	4.50	4.50	0.00
Average age of child's mother	32.0	32.2	-0.2
Percentage of households with older children	54.6 %	55.2 %	-0.6 pp
Percentage of female-headed households	11.6 %	11.6 %	0.0 pp
Size of sample	60,000	200,000	

pp=percentage points

**: statistical significance = 5 %*

Question 9 for discussion – Notice that the two groups seem very similar in Table 4. Is this what you were expecting? Why or why not?

Table 5: Randomized treatment and control groups			
Percentage of households that (in 2001) vaccinated a child or children born in 1999			
	'Treatment' group	**'Control' group**	**Estimate impact**
Method 4a: Random Simple difference	58.2 %	58.0 %	0.2 pp
Method 4b: Random Multiple regression			0.2 pp

pp=percentage points
**: statistical significance = 5 %*

Question 10 for discussion – Notice that the impact estimates in Table 5 are close to zero, and are not statistically different from zero. This result is different from those obtained under the preceding methods. What might explain this difference in the results?

Please complete questions 9 and 10 before reading further.

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Technical note: Adjustment for take-up rate

Table 5 shows the simple comparison of treatment and control groups, where the treatment group consists of all those receiving phone calls from Vaccination 100%, and the control group consists of all those who did not receive phone calls. This estimated impact does not take into account the fact that 35,000 individuals in the 'treatment' group were called but were not reached.

If we wish to estimate the impact of "reaching" the family, rather than just "calling" the family, then we would need to adjust the estimate using the methodology of Instrumental Variables.

A possible formula for making the adjustment is as follows:

$$\frac{\text{Estimate from method 4 a}}{\text{Difference in take - up rate between treatment and control groups}}$$

So:

$$\frac{\text{Estimate from method 4 a}}{\text{Difference in take - up rate between treatment and control groups}} = \frac{0.2}{\frac{25{,}000}{60{,}000} - 0} = 0.48$$

Conclusion

Table 6 shows the estimated impacts of the telephone campaign on vaccination rates using the various methods discussed in this case study.

Table 6 – Summary of estimated impacts of the telephone campaign

Method	Estimated impact
Method 1: Simple difference	10.8 pp*
Method 2: Multiple regression	6.1 pp*
Method 3: 'Double difference' based on panel data	1.9 pp*
Method 4a and 4b: Randomized experiment	0.2 pp
Method 4c: Randomized experiment with adjustment for take-up rate	0.48 pp

pp=percentage points
**: statistical significance = 5 %*

As you can see, not all methods yield the same results. It is therefore critical to choose the appropriate method. The purpose of this case study was not to assess a specific telephone campaign, but to test various assessment methods in this particular context.

In the analysis of the telephone campaign, we noticed not only that those who answered the telephone were probably going to vaccinate any children they had who were born in 1999, but that they were also more likely to have had their earlier child or children vaccinated. Even when we accounted statistically for (known!) observable characteristics of households, including demographic characteristics and the vaccination of older children, there were still some inherent non-observable differences between the groups, independent of the vaccination campaign. Thus, when our non-random methods demonstrated a positive and significant impact, this result was attributable to a 'selection bias' (in this case, the selection of those who answered the telephone) rather than to a successful vaccination campaign.

Application to development

Selection bias is a problem that occurs in many program evaluations. Think about some of the non-random development programs that you have evaluated or seen evaluated. Discuss how the participant group was chosen and how the 'selection' may have affected the evaluators' capacity to gauge the true impact of the program.