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Evaluation of a Community-based Information Campaign on Health Demand in Mali : Results from a Natural Experiment

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Evaluation of a Community-based Information Campaign on Health Demand in Mali: Results from a Natural Experiment *

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Abstract

This paper estimates the impact of a community-based information campaign about prenatal cares and assisted childbirth on health demand in Mali. We use a natural experiment provided by a national vaccination campaign against Tetanus, phased into several health districts from 2002 to 2004. The vaccination campaign was reinforced by an information content to promote assisted childbirths, the schedule being set according to Tetanus prevalence. We use an unique dataset on primary health centers on the period 2002-2007. Using a difference-in-differences estimator, we find that providing information is an effective way of increasing the uptake of health services in Mali.

JEL Classification: I18; H51; O55; C1.

Keywords: Primary health care demand; demand side barriers; vaccination campaign; natural experiment

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1 Introduction

"A woman dies from complications in childbirth every minute - about 529,000 each year - the vast majority of them in developing countries"
UNICEF

Since the signature of the United Nations Millennium Declaration in 2000, efforts have been accelerating in developing countries in order to reduce maternal and child mortality rates. This unprecedented global consensus on this question, involving 149 heads of State, creates additional stimulus for increasing the international public aid allocated to health.

According to UNICEF, a woman has a 1 in 16 chance of dying in pregnancy or childbirth around the world. Mali is one of the worst country in terms of maternal and child health. The Malian infant and maternal mortality rates are one of the highest around the world (respectively 191 for 1,000 and 464 for 100,000 births).[1]

If weak health care delivery systems remain a barrier, one of the reason of poor health care performances is the very low uptake of skilled health services (Audibert and De Roodenbeck, 2004). Despite consequent investment in the health sector,[2] only 18% of the population goes to the primary health care structures in case of a need of care (Thome, 2002). While the World Health Organization strongly argues for "skilled care at every birth", only 49% of births are attended by skilled health attendance in Mali (Audibert and De Roodenbeck, 2004).

Finding an efficient way of overcoming the demand-side barriers for heath care services has become as well a necessity for policy makers as a main concern for

[1] According to the last survey on Health in Mali in (*EDSM IV* in 2006).

[2] According to the Malian National Health Accounts, the spending related to the Malian Health sector raised from 109 to 165 billions of euros for from 1999 to 2004.

development economists. In addition to increase service provision, it is required to increase the current low level of people's expectations of health care providers (Banerjee et al., 2004) and to improve care seeking behaviors.

Increasing development literature on the role of information in changing health behaviors suggests that the low level of demand for primary care could be explained by distrust (Whetten et al., 2006) and a lack of information concerning health center's activities (Audibert and De Roodenbeck, 2004). Evidence from developing countries suggests that providing information to people could be a way of changing care seeking behaviors. Madajewicz et al. (2007) shows for instance that informing households respectively in Bangladesh about the unsafe concentration of arsenic in their water increases the probability that they change to another well by 37%. In Kenya, Dupas (2009) concludes that providing information on HIV relative risk can change sexual behavior among teenagers. In a cohort study conducted in Uganda, De Walque (2007) finds the same results but underlines that the HIV information campaign has a higher positive impact among educated individuals.

Although the question is almost not theorized (Mitchell et al., 2001), the general consensus was that working closely with communities is an efficient way to reach better health outcomes (Portela and Santarelli, 2003).[3] Indeed, Chopra and Ford (2005) underline the need to take into account local practice and preferences instead of applying "generalized models". Disappointing results of health programs could be explain by a lack of community participation. Bjorkman and Svensson (2009), in a randomized field experiment on primary health care services in Uganda, show that involving communities in the monitoring of providers leads

[3]The Ottawa Charter for Health Promotion (1986) states to involve as much as possible communities in health promotion.

to higher efforts from the medical staff, larger utilization of the services and better health outcomes.

Many randomized and controlled trials, conducted to evaluate the impact of community-based information programs on health outcomes, confirms that reinforcing community participation can positively influence the outcomes of health promotional projects (Campbell, 1999). For instance, Bang et al. (1990) find that an information program about childhood pneumonia provided by village health workers in Gadchiroli district (India) leads to a 30% reduction in pneumonia childhood mortality. In rural India, community-based projects in which trained villagers provide simple neonatal care (Bang et al., 1999) or promote oral vitamin A delivery (Rahmathullah et al., 2003) leads to a significant reduction in infant mortality rate. In Makwanpur district (Nepal), Manandhar et al. (2004) show that a participatory intervention with women's groups about perinatal problems reduce the neonatal mortality of 30%. In a study conducted across six African Countries, Stephenson et al. (2006) shows that the choice of place of delivery is influenced by community factors. This result reinforces the relevance of community-level interventions. Working closely with communities can also contribute to make an information campaign more credible and culturally appropriate (Galbraith et al., 1996).

In this paper, we evaluate if a community-based campaign can be a way to increase the demand addressed to health care structures and reduce maternal and child mortality rates in Mali. More specifically, we use the national information campaign promoting assisted childbirth which took place in Mali between 2002 and 2004. This campaign has involved as much as possible the local population. All

the recommendations about the necessity to involve communities were closely followed. In each village, the community leaders were beforehand informed about the utility of the campaign in order to obtain their support. Besides, the message was provided by voluntary villagers directly chosen by communities. This campaign was added to a vaccination campaign against the Maternal and Neonatal Tetanus (MNT campaign), realized in three stages between 2002 and 2004. The three waves of the MNT campaign give us an unique opportunity to evaluate the impact of a community-based information campaign. Whereas an increasing number of information campaigns promoting assisted childbirth is implemented in Sub-saharan countries,[4] there is almost no paper using a natural experiment to evaluate their impact on health seeking behaviors. With a difference-in-differences estimator, we exploit the temporal variations to evaluate how the provided information impacts the level of health care demand.

Our identification strategy relies on the assumption that the evolution of prenatal consultations or assisted childbirth rates are not linked to Tetanus risk. As the health districts were indeed selected considering the level of Tetanus risk, this leads to potential different evolutions of the Tetanus rate, but less probably to differences in the evolution of the prenatal care rates. We thus claim that this campaign represents a natural experiment to evaluate the impact of this community-based campaign on the use of health care structures for assisted childbirth. We use an administrative Malian database that gives precise information on activities of all Malian primary health care structures between 2001 and 2007. We observe that the community-based information campaign is an effective way of improving the prenatal care and assisted childbirth rates. We show that the campaign leads to an

[4]UNICEF has implemented the same campaign in Niger and Mauritania.

increase of at least 17% of the assisted childbirth rate. The impact on the prenatal care is even higher (25%), but vanishes with time. By contrast, the increase in assisted childbirth rate appears persistant.

This paper is organized as follows. Section 2 provides background information on the Malian health system and on the vaccination campaign against MNT. Section 3 presents the database we used. Section 4 presents the identification strategy, while section 5 shows the main results. The final section concludes.

2 Background

2.1 The Malian health system

The national Malian health care system is pyramid-shaped and involves three different level (See for more clarification Figure 1). The first level includes public and private national or regional hospitals. Referral Health Centers (*CSREF*) are present in each district and correspond to the second level. We count 59 districts around the country. In our paper, we focus on the third level of the Malian health care division, which corresponds to local health areas. This level includes all Community Health Centers (*CSCOM*).

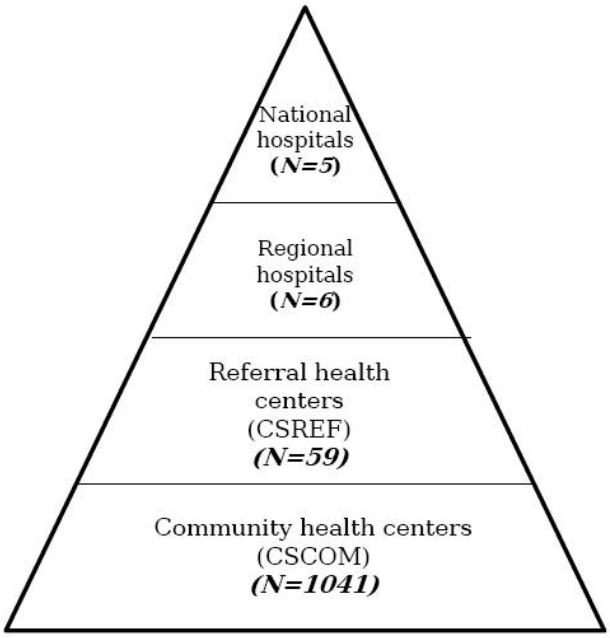

Figure 1: Organization of the Malian Health System.

The creation of *CSCOM* in Sub-Saharan Africa is closely linked to the concept

of primary health care which emerged during the 1978 Alma Alta International Conference (Ridde, 2004). Ten years later, the Bamako Initiative adopted by African Health Ministers aimed to raise access to primary health care by defining effective implementation strategies and by overcoming the lack of resources. The Bamako Initiative is based on the idea that elected village committees have to be engaged in health-facility management and control of financial and human resources. The orientations adopted by Sub-Saharan Health Ministers correspond to a deep political process that aims to change the nature of relationship between the staff providing health care and users. The creation of health committees representing directly the villager's community ensures the accountably of public health services. Sub-Saharan countries which implemented some form of scaling up achieve positive results. They succeed in increasing the use of health structures among the poorest women and children and lead to significant reductions in maternal and child mortality (UNICEF, 1999).

In Mali, the first primary health care centers were created in the 80's following difficulties for the Malian State to satisfy the basic health needs of its population. These primary health care structures were considered by the Malian government as an efficient strategy to extend the health coverage to rural areas. The Malian State, by the adoption of an official political declaration in 1990, recognized the central role played by *CSCOM* in the improvement of access conditions to primary health care. Each *CSCOM* includes a clinic, a maternity hospital and a drugstore. They are managed by a local association of users called *ASACO*. These health Committees are linked with State by the signature of a convention. *CSCOM* are charged of providing primary health care services in their designated areas.

Although the State got partially involved in the financing of the construction of *CSCOM* and gives a first endowment, *CSCOM* have a private status and must rely on their own resources. Each *ASACO* is responsible for the accounting of the health center and has to support the salaries of the staff. We count around 1,000 *CSCOM* , depends on year considered. The number of areas increases continuously with time.

2.2 The campaign against maternal and neonatal Tetanus (MNT)

If Neonatal and Maternal Tetanus have been eliminated in the great majority of countries, today it still remains endemic in 40 countries among the poorest in the world, included Mali. Tetanus occurs when a bacterium, *Clostridium tetani*, succeeds in entering the body through an open puncture and produces a poison that strikes rapidly and attacks the central nervous system. Tetanus could kill newborns in few days after birth. Generally, the disease causes facial paralysis and newborns affected are no longer able to breastfeed. The Maternal and Neonatal Tetanus explains a large part of the high child mortality rates in developing countries. For example, Kapoor et al. (1996) show that Tetanus caused 36% of newborn deaths in Indian urban slums in 1996.

The International Organizations, in particular WHO and UNICEF, thought the MNT Elimination Initiative, aims at reducing considerably the number of Tetanus cases around the world. Maternal and Neonatal Tetanus could be easily prevented by immunizing mothers with vaccine. If the mother is protected from the disease, the newborn could not be affected in the first weeks of his life. In developing

countries, because it is impossible to identify pregnant women, immunization of all women in reproductive age is considered as the best alternative strategy (Black et al., 1980).

The Malian Health Minister, with the help of NGOs and the international institutions, implemented a three-year vaccination campaign between 2002 and 2004. The campaign aimed at reducing the Maternal and Neonatal Tetanus prevalence rate. The tetanus toxoid immunization policy followed closely the recommendations of WHO. 2,330,000 women in childbearing age was targeted by the campaign.

Mobile teams were mobilized for rural areas. Some villages are often hardly reachable and women rarely possess convenient means of transportation. As the marginal benefit of vaccination cannot be directly perceived, the opportunity cost increases with distance (Buor, 2003). Mobile teams that could go to the most remote areas assured a greater efficiency than vaccination in a center.

Because all of the health districts could not be vaccinated at the same time, three years were required and an order of priority was determined. In 2002, the UNICEF and the WHO, conjointly with the Malian Health Minister, established a classification of health districts. The decision rule uses three criteria: the level of MNT risk, the current vaccination rate against Tetanus and an aggregated indicator of the feasibility, durability and visibility of the action. Four categories of districts were defined. First, in 2002, a pilot phase took place and the vaccination campaign was carried only in six districts presenting the higher Tetanus risk levels (see Figure 2 for the geographical allocation of the health districts). In 2003, the second wave targeted twenty districts: the thirteen presenting a very high level of risk and seven among those with a high level of risk. For the remaining districts,

the campaign began lateness in 2004 and finished in 2005. Because its vaccination rate was already very high, the Bamako region was not concerned by this national campaign against MNT.

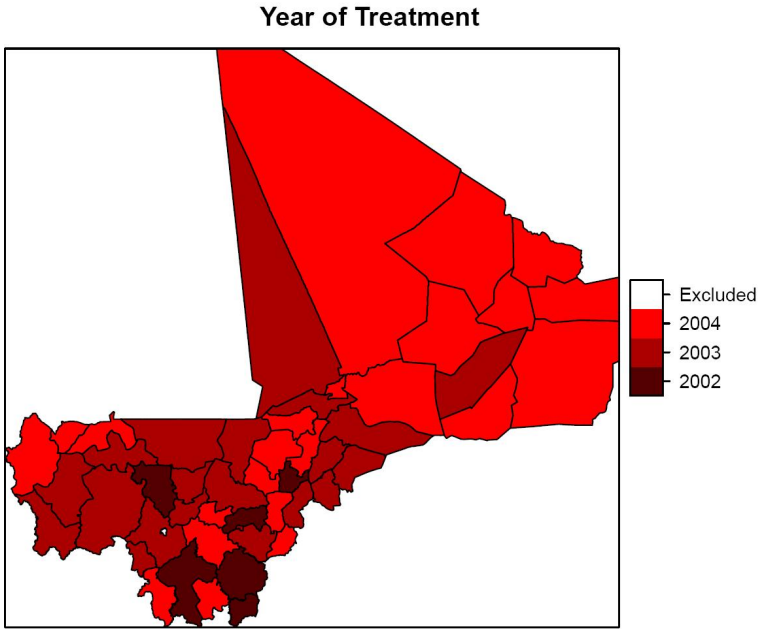

Figure 2: Schedule of the Vaccination campaign against MNT.

Figure 3 graphs the trend of the vaccination rate against MNT according to the year of treatment in the identified groups.

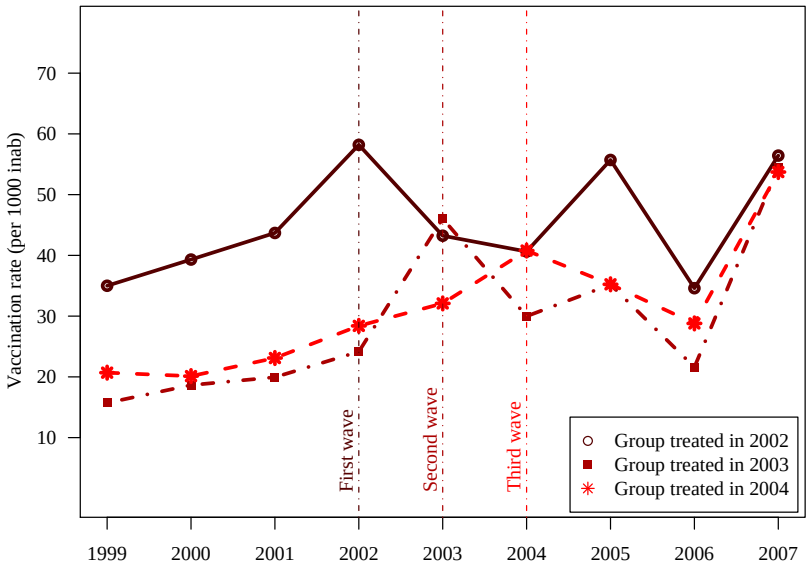

Figure 3: Vaccination rates against MNT, 1999-2007.

It provides evidence that the campaign took place as described in the Plan of Action. We observe a significant increase in the vaccination rate in 2002 (resp. 2003) for the districts of the first wave (resp. second wave). The impact of the third waves is less noticeable because of the preceding increase observed before the introduction of the campaign in these areas. An impact evaluation of the campaign conducted by the WHO concluded that the number of reported cases of neonatal tetanus has fallen from 73 cases in 2000 to 20 cases after the campaign.[5]

2.3 The community-based information campaign

The Plan of Action added a community-based information campaign to the vaccination campaign. Each vaccination team, independent on the chosen strategy

[5]According to the WHO, Mali registers about 650 000 births a year.

(fixed or mobile), was reinforced by a local voluntary worker charged of the information campaign. The information campaign had two main goals: to increase the level of knowledge on MNT and to promote assisted childbirths. If the immunization of women against MNT contributes to cut the number of newborns deaths, stimulating the demand for maternal care given by skill attendants in health structures is the only effective way to reduce the high maternal and neonatal mortality rates.

Following the recommendations given by international organizations (Portela and Santarelli, 2003; Gryboski et al., 2006), the Malian government tried to involve as much as possible local communities in the organization of the campaign. In each village, community leaders were beforehand informed and closely associated to the information campaign. In its report on community-based interventions, the World Health Organization underlines that the role of men or of decision makers in general has to be considered in the design of community programs for maternal and child health. In fact, involving the opinion leaders was a way to ensure a positive image of the campaign among population and to make it more culturally appropriate. The local women's associations were also mobilized. Information during the vaccination sessions was provided by a voluntary worker directly chosen by his community. This strategy, based on communities, was the one adopted to improve care-seeking behaviors among women and was considered as the most efficient communication channel.

Meetings and debates about Tetanus and assisted childbirths were organized in each village, in order to clarify and illustrate the global message delivered by the Medias and to improve the understanding of the issues of Tetanus immunization

and the use of skilled care throughout pregnancy, childbirth and the postpartum periods. These debates provided also opportunities for women to meet health workers.

3 Data

We use for our estimate the CROCEP database.[6] This base was developed as a steering tool by the Health Malian authorities to evaluate an health development program. It constitutes the sole exhaustive source about activities of the primary health care structures. Data are collected annually since 2001 in each of the eight Malian regions and in the Bamako district. The CROCEP base contains mainly information on health structures activities at different levels.

Data are organized in 14 sections which concerned mainly geographical and demographical information about districts and its involved local areas, material and human resources, financial aspects and different kinds of activities realized in the structure.[7] We use a panel data at a disaggregated level, i.e. the primary health care centers *CSCOM* over the period 2002-2007.[8]

Until 2005, data are collected between the 1st of July and the 30th of June of the next year (as a rule, we will denote by year t the period beginning in July of the year $t-1$ and ending in June of year t). The reference period changed in 2005. In

[6] Orientation, Coordination and Evaluation Regional Committee of PRODESS (Five-year Program of Social and Health Development)

[7] Note that some data are sometimes missing: Community Health Centers (CSCOM) are not always functional at the time of the data collect, or CSCOM can refuse to give information about their activities.

[8] On previous period (1999-2001) we only observe data on district level, but not at the level of primary health care centers. Indeed, at the district level, a table give us retrospective data for the three previous year (1999-2001)

addition to the original one, we have data collected in a period corresponding to the calendar year. We have no observations for the year 2006, which is missing, while we have two measures for the year 2005 (the first corresponds to an overlapping measure over 2004 and 2005, the second to the calendar year 2005). Data collected in 2007 corresponds also to the calendar year. We will check the robustness of our results to this change in reference period (see section 5).

The targeting population of the 1,041 primary health centers are large : 10,000 persons on average (Table 1). Notwithstanding, the personal is scarce. The presence of a GP in the center is rare, except in the Bamako district. However, most of the centers benefited of more than one "health worker", qualified nurses, midwives, nurses or more frequently matrons (i.e. woman trained to assist childbirths). This shortage in health workforce is quite similar in different district, except for the Bamako district. As in many sub-Saharan Africa countries, the density of health workers is highest in urban centers where hospitals tend to be located and where incomes are highest. The activity of these primary health care centers is very low. We adjust all figures by the targeting population of the centers, because no more precise data on the local proportion of pregnant women are available. The average number of curative consultations is around 130 for 1,000 persons. The number of prenatal consultations is 17 for 1,000 persons.

The births attended by skilled health workers are also rare in comparison to the targeting population. With an estimated average of 5% of pregnant women, our data suggest that in some districts only one out of five pregnant women gave birth in these primary health centers in 2002.[9] Since they do not include childbirths

[9]For instance in the centers of the third waves, we observe 9 childbirths attended by assisted childbirth for 1,000 persons, a sample that includes on average 50 pregnant women.

in private health centers, in the other public structures as CSREF for example, in regional hospitals nor assisted childbirth at home, these figures are lower than those observed on macro data.

We observe strong discrepancies between different districts in terms of activity. An evaluation of the information campaign could not rely on a simple comparison of the activity of the centers after the campaign. Note however that while one could expect that the rate is lower in districts with the highest tetanus risk (because it could be due to insufficient health demand), we observe on the contrary a higher activity rates in the health districts of the first wave of the campaign. As we will see below, our estimates relies on the much less stringent assumption that these differences are stable over time, absent the campaign.

Table 1: Basic descriptions of the different groups (in year 2002)

	Total	Group 2002	Group 2003	Group 2004	Bamako District
N. of primary health centers	1,041	149	462	371	59
Targeting population per centers	10,275	10,165	10,285	8,747	20,085
Staff in primary health centers (average number by center)					
N. of manager	0.55	0.72	0.43	0.57	0.86
N. of GP	0.14	0.11	0.08	0.07	1.02
N. of any "health worker" (except GP)	1.69	2.03	1.44	1.40	4.43
N. of qualified nurses	0.26	0.24	0.25	0.21	0.69
N. of midwives	0.14	0.02	0.06	0.03	1.67
N. of nurses	0.39	0.52	0.31	0.38	0.69
N. of matrons	0.95	1.25	0.90	0.80	1.38
Primary health centers activity / pop (*1000)					
N. of curative consultations	129	147	100	143	222
N. of prenatal consultations	17	26	13	16	27
N. of skilled deliveries	12	18	9	10	29

Sources : CROCEP database.

4 Identification Strategy

We evaluate the impact of the campaign on primary health care structures' activity using a difference-in-differences estimator (for description of this method see for instance Imbens and Wooldridge, 2009). Identification is provided by using the three different waves of the vaccination campaign against the Maternal and Neonatal Tetanus (MNT) which took place in Mali between 2002 and 2004. The standard difference-in-differences design can be summarized as follow. Let Y_{it} denotes the activity of a primary health care structure i at time t, and T_{it} the fact of having benefited of the vaccination campaign (and thus of the campaign aiming at promoting assisted childbirth), i.e. the treatment. The primary health care structure i belongs to one of the three groups G_i, defined by the waves of the

vaccination campaign.

The observed data are the triple (Y_i, G_i, T_i). Using the potential outcome notation advocated in the treatment effect literature by Rubin (1974, 1978), let Y^0 denote the outcome for primary health care structure i if this structure does not receive the treatment, and let Y^1 be the outcome for the same center if it does receive the treatment. Thus, if T_{it} is an indicator for the treatment for the center i at date t, the realized (observed) outcome for center i is

$$Y_{it} = T_{it}Y_t^1 + (1 - T_{it})Y_t^0 \tag{1}$$

The outcome for the primary health care structure i in the absence of the campaign satisfies

We could more generally use a fixed-term specification:

$$Y_{it}^0 = e_i + e_t + X_{it} + u_{it} \tag{2}$$

The first coefficient, e_i, represents a individual fixed-effect. The second coefficient, e_t, represents the time-period effect. The third term X_{it} stands for observable characteristics of the structure (for instance staffs). The fourth term, u_{it}, stands for unobservable characteristics of the individual. This term is assumed to be independent of the group indicator and to have the same distribution over time, i.e.,

$$u_{it} \perp T_{it}|t, e_i, X_i \tag{3}$$

and is normalized to have mean zero.

This decomposition means that if structures are different in terms of potential outcome, these differences are stable over time. Thus the evolution of outcome in the untreated group is a good counterfactual of the evolution of outcome in the treated group, would have it been not treated.

We also assume that the treatment effect is constant across individuals, so that

$$Y_t^1 = Y_t^0 + \delta \tag{4}$$

Combining this restriction with (1) and (2) we have the model for the realized (observed) outcome:

$$Y_{it} = T_{it}\delta + e_i + e_t + X_{it} + u_{it} \tag{5}$$

Under assumption (3), simple OLS gives consistent estimate of the causal impact of the treatment T on the outcome Y.[10] As standard least square standard errors could be biased in the presence of correlations within groups (Bertrand et al., 2004), we use clustered standard-errors.

In order to measure the impact of the information campaign led during the vaccination campaign on primary health care demand, our identification strategy is based on the fact that the campaign did not take place at the same time in all Malian health districts. We use this source of variation to create groups, according to the year of treatment (2002, 2003 or 2004).[11] The validity of assumption (3)

[10]Note that one could relax this assumption and state that the effect of the intervention might differ across individuals. Then estimation of (5) gives the average effect of the intervention on the treatment group.

[11]We choose not to use districts in the Bamako area. This area is indeed very specific, and the evolution of health demand do not present similar evolution for the outcome of interest (see Figure 7 in Appendix).

depends on the outcome of interest. In particular, one should be cautious to use our design to evaluate the effectiveness of the campaign in reducing the Tetanus prevalence. Health districts were not randomly assigned to treatment, but selected considering the level of Tetanus risk in the region. The Tetanus rate's evolution would probably not have been the same in each group without the vaccination campaign.

By contrast, it is much less probable that the evolution of prenatal care and assisted childbirths rates would have been different in group if the vaccination campaign did not happen. We indeed do observe similar trends in various groups in years preceding the campaign (Figures 4 and 5) for both indicators.

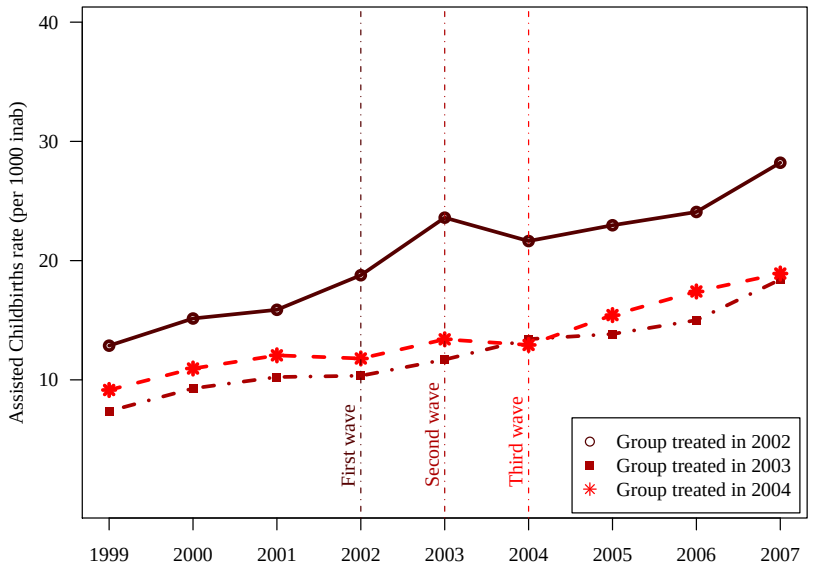

Figure 4: Evolution of the assisted childbirth ratio in groups of the TCN campaign, 1999-2007.

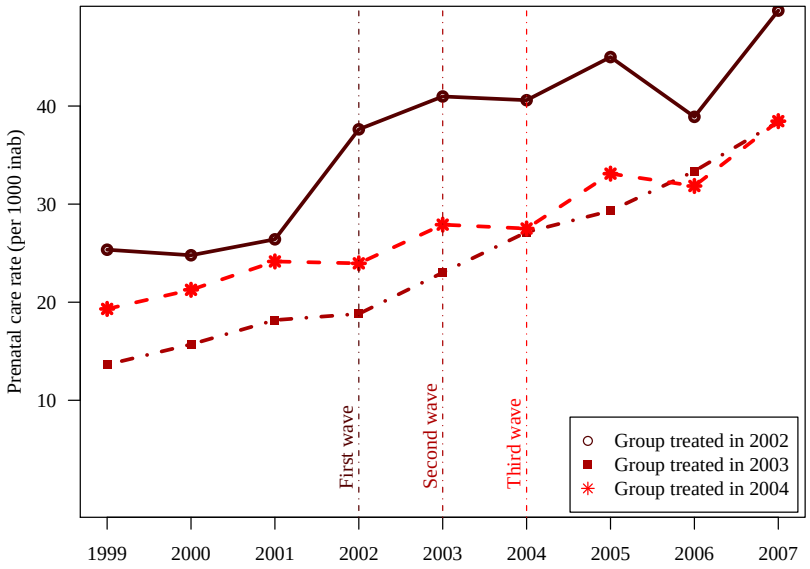

Figure 5: Evolution of the prenatal care ratio in groups of the TCN campaign, 1999-2007.

This strikingly similar evolution in the period before the campaign comforts, if does not prove, the validity of our identification assumption. The evolution of our outcome of interest in a yet treated group provides a credible estimator of the counterfactual outcome evolution in the treated group, and the relative change according to group before and after the information campaign could be attributed to it. We will estimate the extent of this effect in the next section.

Finally, the identification assumption is less credible for assessing the effectiveness of the vaccination campaign on the overall consultation rate. The previous evolution (before the campaign) of the consultation rate is indeed quite different in several groups (see Figure 6).

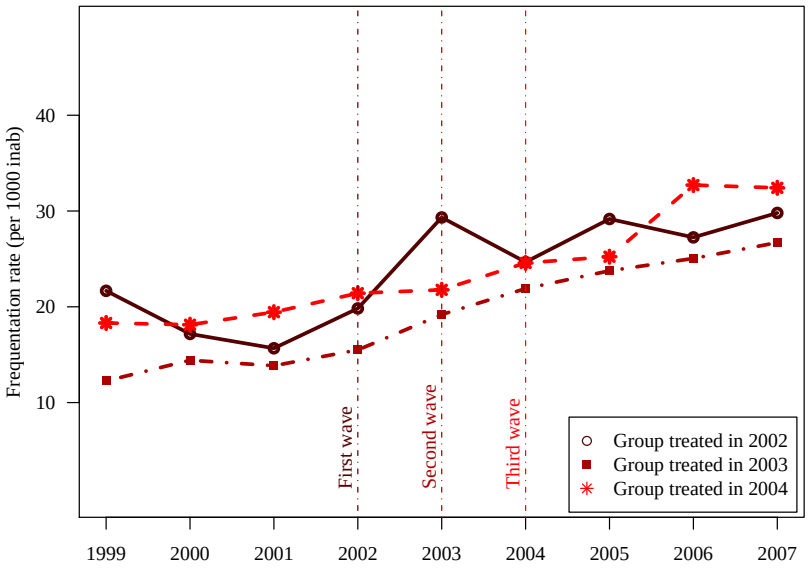

Figure 6: Evolution of the overall consultation rate in groups of the TCN campaign, 1999-2007.

As groups were selected considering the Tetanus risk level in the district, higher disease rates could induce distinct trends in health demand. In the districts with a higher risk of a Tetanus pandemic, the pace of increase in the number of curative consultations is likely to be higher than in the others districts. It could thus be difficult to distinguish between these intrinsic differences and the causal impact of the information campaign.

5 Results

Table 2 shows results from the difference-in-differences analysis. To deal with potential heterogeneity of the centers, we use a fixed-effect specification as in equation (2).[12] It includes dummies for each time period.

Table 2: Impact of a Tetanus Vaccination on various indicators of health demand (Fixed-Effect specification)

	Prenatal Care	Assisted Childbirths
Treatment	0.314^{***} (0.043)	0.258^{***} (0.049)
Year=[2003]	0.147^{***} (0.035)	0.118^{***} (0.038)
Year=[2004]	0.265^{***} (0.049)	0.202^{***} (0.053)
Year=[2005]	0.288^{***} (0.063)	0.162^{**} (0.080)
Year=[2006]	0.224^{***} (0.069)	0.116 (0.080)
Year=[2007]	0.414^{***} (0.058)	0.435^{***} (0.070)
N. of GP	0.073^{*} (0.040)	0.128^{**} (0.052)
N. of qualified nurses	0.110^{***} (0.028)	0.064^{*} (0.034)
N. of midwives	0.077 (0.072)	0.184^{**} (0.080)
N. of nurses	0.042^{*} (0.025)	0.102^{***} (0.033)
N. of matrons	0.007 (0.022)	0.084^{***} (0.026)
N. of managers	0.181^{***} (0.043)	0.265^{***} (0.059)
Intercept	-4.227^{***} (0.051)	-4.927^{***} (0.062)
R-squared	0.18	0.13
N of Obs.	4146	4185

Note: Robust standard errors are indicated in parenthesis.

Our main outcomes of interest are the (log) rate of assisted childbirth and of

[12] We compute cluster-robust standard errors by using the cluster-correlated Huber-White covariance matrix method.

prenatal care. We observe a strong positive impact of the campaign on prenatal care and assisted childbirth rates. After the introduction of information campaign, we observe an increase of 31% in the prenatal care, and 26% in assisted childbirths (Table 2)

We have performed several robustness checks (Table 3).

Table 3: Robustness tests

	Prenatal Care	Assisted Childbirths
Alternative control group		
Group 2002 vs Group 2003	0.333^{***} (0.060)	0.142^{**} (0.059)
Group 2002 vs Group 2004	0.444^{***} (0.054)	0.446^{***} (0.065)
Group 2003 vs Group 2004	0.249^{***} (0.061)	0.174^{**} (0.068)
With Bamako District	0.411^{***} (0.043)	0.306^{***} (0.046)
Before 2006		
	0.254^{***} (0.048)	0.212^{***} (0.054)

Notes: Fixed-Effect Specification (equation (2)), the other controls are the same as in Table 2. Cluster Robust standard-error are in brackets.

First, we use the fact that we dispose of three groups treated at different periods. We thus could perform estimation using the treated groups one by one. We also use the Bamako districts, that have never been treated, as a additional control group. Whatever specification is taken, the estimated impact of the MNT campaign on assisted childbirth and prenatal care ratio is positive and significant. In the least favorable model, the information campaign would increase the prenatal care by 25% and the assisted childbirth rates by 17%. Finally, we restrict the estimation to the the sub-period 2002-2005 (in particular because the reference

time period has changed after 2005). Once again, results appears positive and significant.

Note that using groups treated at different time-period implicitly assumes that the impact of the campaign does not alleviate nor spread with time. This is obviously a strong assumption. A more precise analysis of the time effects requires data on a longer period of time. However, we test a specification with a linear time trend :

$$Y_{it} = T_{it}\delta + T_{it} * (t - t_i)\delta_t + e_g + e_t + X_{it} + u_{it} \tag{6}$$

where t_i is the first year of the vaccination campaign for the district corresponding to the primary health center i.

Table 4: Temporal Impact of a Tetanus Vaccination Campaign on Various Indicators of Health Demand (Fixed-Effect specification)

	Prenatal Care	Assisted Childbirths
Treatment	0.401^{***} (0.045)	0.274^{***} (0.053)
Treatment*t	-0.110^{***} (0.021)	-0.020 (0.027)
R-squared	0.07	0.19
N of Obs.	4408	4415

Fixed-Effect Specification (equation 6), other controls are the same as in equation (2). Robust standard-error are in brackets.

Interestingly, we observe that the impact of the information campaign on prenatal consultations rapidly decreases with times, while the impact on assisted childbirths is more stable (see Table 4). The positive short-run effect on prenatal care could also be explained by smaller and not directly perceived marginal benefits

associated with prenatal consultations. Moreover, because of distance and time, prenatal consultation represents an immediate cost. Several studies underline the role of opportunity costs in explaining the low level of demand for preventive and more specially pre- and postnatal care in African developing countries (Buor, 2003). The fact that the impact is not persistent in contrast with the impact on assisted childbirth rate suggests that the opportunity cost for the latter is higher.

Finally, we estimate the impact on the global consultation rate. We are less confident on the validity of the identification assumption in this case. Tetanus prevalence (that determines the inclusion of one district on a wave of the vaccination campaign) are obviously linked with differences in population in the health area as well as unobserved characteristics of the structure. These characteristics could alter the evolution of health demand addressed to the center. The Figure 6 shows indeed markedly different features in the evolution of this rate before the introduction of the vaccination campaign. The estimated impact of the vaccination campaign (Table 5) appears insignificant.

Table 5: Estimated impact of the vaccination campaign on the consultation rate (fixed-effect specification)

	Consultation rate
Treatment	0.049
	(0.049)
Year=[2003]	0.037
	(0.031)
Year=[2004]	0.138***
	(0.047)
Year=[2005]	−0.016
	(0.069)
Year=[2006]	0.123*
	(0.071)
Year=[2007]	0.340***
	(0.060)
N. of GP	0.188***
	(0.051)
N. of qualified nurses	0.126***
	(0.031)
N. of midwives	−0.065
	(0.083)
N. of nurses	0.057*
	(0.030)
N. of matrons	−0.011
	(0.027)
N. of managers	0.171***
	(0.043)
Intercept	−2.135***
	(0.046)
R-squared	0.07
N of Obs.	4139

6 Conclusion

In this paper, we use a natural experiment to evaluate the impact of a community-based information campaign on the care seeking behaviors of women concerning prenatal care and assisted childbirth.

We show that the information campaign added to the Tetanus immunization increases the level of demand for maternal care. The fact of being in a area benefiting of the vaccination campaign against MNT results in an increase estimated of 24% of the number of assisted childbirth, as a ratio to the global population in the areas. Note that the level of this variable was 0.012 in 2002 (see Table 1): as the estimated level of pregnant women is on average 5%, the campaign results in an increase of 7 points of percentage, from an initial level of 28%.

The similar evolutions of the prenatal consultation and assisted childbirth rates before the introduction of the program seem to prove the validity of our identification strategy. Moreover, our results are robust whatever the specification or control group we use.

The findings reported in this paper have important implications. Increasing the uptake of primary health services in developing countries is considered as an effective way to reduce the current high maternal and child mortality rates. Our results suggest that a community-based information campaign involving as much as possible the villagers and their opinion leaders could be an efficient strategy for increasing the demand for skilled health care. Our results are in line with the previous medical literature in development area and confirm the relevance of the orientations taken by the international institutions.

However, we could not identify in our data what comes from the sole involvement of the communities and isolates it from others specificity of that information campaign (e.g. the communication mediums or the clearness of the message). Because of the extent of the effects produced by the campaign, our results call for a close look at the potential channels. Administrative data are clearly not adapted to this analysis. As the stake is high and the potential impact suggested by our results are consequent, we argue that it deserves the cost of field experiments in order to identify if such a community-based information campaign could be an effective strategy to change women's care seeking behaviors and lead to a long-term improvement of child and maternal health in developing countries.

References

Audibert, M. and E. De Roodenbeck, "Utilisation des services de santé de premier niveau au Maliă: analyse de la situation et perspectives," World Bank Working Paper, World Bank 2004.

Banerjee, A., Deaton A., and Duflo E., "Health, Health care, and Economic Development: Wealth, Health, and Health Services in Rural Rajasthan," *The American economic review*, 2004, *94* (2), 326.

Bang, A. T., R. A. Bang, O. Tale, P. Sontakke, J. Solanki, R. Wargantiwar, and P. Kelzarkar, "Reduction in pneumonia mortality and total childhood mortality by means of community-based intervention trial in Gadchiroli, India," *The Lancet*, 1990, *336* (8709), 201 – 206.

Bang, A.T., R.A. Bang, S.B. Baitule, M.H. Reddy, and M.D. Deshmukh, "Effect of home-based neonatal care and management of sepsis on neonatal mortality: field trial in rural India," *The Lancet*, 1999, *354* (9194), 1955–1961.

Bertrand, M., E. Duflo, and S. Mullainathan, "How much should we trust differences-in-differences estimates?," *The Quarterly Journal of Economics*, 2004, *119*, 249–275.

Bjorkman, M. and J. Svensson, "Power to the People: Evidence from a Randomized Field Experiment on Community-Based Monitoring in Uganda*," *Quarterly Journal of Economics*, 2009, *124* (2), 735–769.

Black, R. E., D. H. Huber, and G. T. Curlin, "Reduction of neonatal tetanus by mass immunization of non-pregnant women: duration of protection provided

by one or two doses of aluminium-adsorbed tetanus toxoid," *Bulletin of the World Health Organization*, 1980, *58* (6), 927–930.

Buor, D, "Analysing the primacy of distance in the utilization of health services in the Ahafo South District, Ghana," *International Journal of Health Planning Management*, 2003, *18*, 293–311.

Campbell, C., "Understanding the impact of a community-led HIV prevention program in South Africa: context, conceptual framework and methodology," *Australian journal of primary health*, May 1999, *124* (2), 735–769.

Chopra, M. and N. Ford, "Scaling up health promotion interventions in the era of HIV/AIDS: challenges for a rights based approach," *Health Promotion International*, 2005, *20* (4), 383.

Dupas, P., "Do teenagers respond to HIV risk information? Evidence from a field experiment in Kenya," 2009.

Galbraith, J., I. Ricardo, B. Stanton, M. Black, S. Feigelman, and L. Kaljee, "Challenges and rewards of involving community in research: an overview of the" Focus on Kids" HIV risk reduction program," *Health Education & Behavior*, 1996, *23* (3), 383.

Gryboski, K., N.V. Yinger, R.H. Dios, H. Worley, and F.F. Fikree, "Working with the community for improved health," *Health Bulletin*, 2006.

Imbens, G. W. and J. M. Wooldridge, "Recent Developments in the Econometrics of Program Evaluation," *Journal of Economic Literature*, March 2009, *47* (1), 5–86.

Kapoor, R. K, A. K. Srivastava, P. K. Misra, B. Sharma, S. Thakur, K. L. Srivastava, and G. K. Singh, "Perinatal mortality in urban slums in Lucknow," *Indian pediatrics*, 1996, *33*, 19–24.

Madajewicz, M., A. Pfaff, A. Van Geen, J. Graziano, I. Hussein, H. Momotaj, R. Sylvi, and H. Ahsan, "Can information alone change behavior? Response to arsenic contamination of groundwater in Bangladesh," *Journal of Development Economics*, 2007, *84* (2), 731–754.

Manandhar, D.S., D. Osrin, B.P. Shrestha, N. Mesko, J. Morrison, K.M. Tumbahangphe, S. Tamang, S. Thapa, D. Shrestha, B. Thapa et al., "Effect of a participatory intervention with women's groups on birth outcomes in Nepal: cluster-randomised controlled trial," *The Lancet*, 2004, *364* (9438), 970–979.

Mitchell, K., S. Nakamanya, A. Kamali, and JAG Whitworth, "Community-based HIV/AIDS education in rural Uganda: which channel is most effective?," *Health education research*, 2001, *16* (4), 411.

Portela, A. and C. Santarelli, "Empowerment of women, men, families and communities: true partners for improving maternal and newborn health," *British medical bulletin*, 2003, *67* (1), 59.

Rahmathullah, L., J.M. Tielsch, RD Thulasiraj, J. Katz, C. Coles, S. Devi, R. John, K. Prakash, AV Sadanand, and N. Edwin, "Impact of supplementing newborn infants with vitamin A on early infant mortality: community based randomised trial in southern India," *Bmj*, 2003, *327* (7409), 254.

Ridde, V., "Kingdon à Bamako: conceptualiser l'implantation d'une politique publique de santé en Afrique," *Politique et Sociétés*, 2004, *23*, 183–202.

Stephenson, R., A. Baschieri, S. Clements, M. Hennink, and N. Madise, "Contextual influences on the use of health facilities for childbirth in Africa," *American journal of public health*, 2006, *96* (1), 84.

Thome, J.M., "Etude de faisabilité, Mission d'économie de santé, Projet d'appui de la zone sanitaire de Sélingué (Mali)," Rapport MSF, MSF 2002.

Walque, D. De, "How does the impact of an HIV/AIDS information campaign vary with educational attainment? Evidence from rural Uganda," *Journal of Development Economics*, 2007, *84* (2), 686–714.

Whetten, K., J. Leserman, R. Whetten, J. Ostermann, N. Thielman, M. Swartz, and D. Stangl, "Exploring lack of trust in care providers and the government as a barrier to health service use," *American journal of public health*, 2006, *96* (4), 716.

Appendix

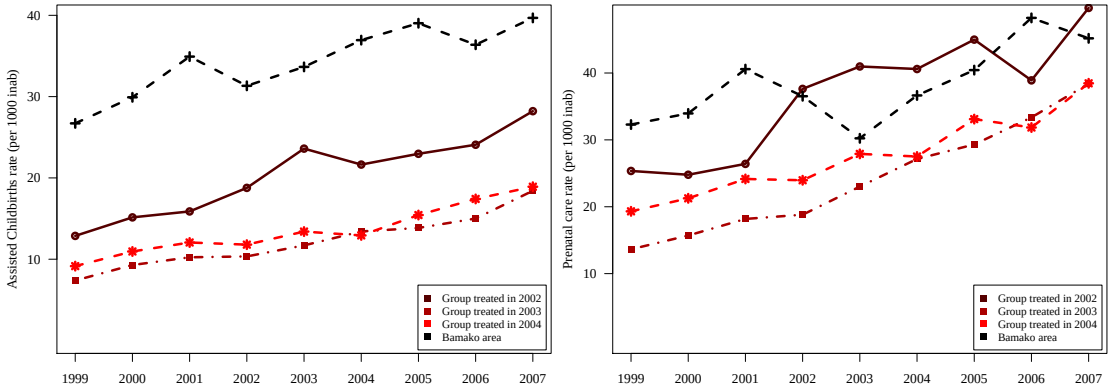

Figure 7: Evolution of the assisted childbirths (left) and prenatal care (right) ratios in groups of the TCN campaign, 1999-2007
Sources : CROCEP database.