

# Aid Crowd-Out: The Effect of NGOs on Government-Provided Public Services \*

(Preliminary Draft)

Erika Deserranno,<sup>†</sup> Aisha Nansamba,<sup>‡</sup> Nancy Qian<sup>§</sup>

March 20, 2019

## Abstract

We study whether the presence of NGOs hinder or help the development of public services in poor countries. We do so in a context where both the government and a large NGO employ community health workers to provide basic health services. We show that when the NGO enters a village with a pre-existing government health worker, the total number of health workers in the community increases, but the number of government health workers decreases, and there is a reduction in total health service delivery. The evidence is consistent with the concern that NGOs can crowd out public services.

**Keywords:** Foreign Aid, Aid Effectiveness.

**JEL:** O01, O02.

---

\*We thank Edoardo Teso for his insights; and participants of the Development Conference for Chicago Area Economists for useful comments.

<sup>†</sup>Northwestern Kellogg MEDS, erika.deserranno@kellogg.northwestern.edu

<sup>‡</sup>nansamba.aisha@NGO.net, the NGO LIBERIA, IERC

<sup>§</sup>Northwestern Kellogg MEDS, BREAD, NBER, CEPR, nancy.qian@kellogg.northwestern.edu

# 1 Introduction

The effectiveness of foreign aid is a central question for development economists and probably one of the most controversial policy debates for the past twenty to thirty years. Well-known arguments have been made both for and against the effectiveness of traditional aid (e.g., Burnside and Dollar, 2000; Easterly, 2006). In response to the criticisms, particularly those regarding aid being tied to the strategic objectives of donor countries (e.g., Alesina and Dollar, 2000; Kuziemko and Werker, 2006), aid policy makers have given increasing support to non-government organizations (NGOs) (e.g., Buthe et al., 2012; Dreher et al., 2007; Nancy and Yontcheva, 2006).<sup>1</sup> For example, Faye and Niehaus (2012) document that donors use bilateral aid to influence elections in developing countries, but that this strategic behavior is not present for aid administered by NGOs. In the past twenty years, the number of NGOs and overall aid from major donors such as the World Bank and European bilateral agencies channeled through NGOs have more than quadrupled (Pfeiffer et al., 2008). In addition, several of the largest NGOs, such as BRAC, Living Goods, Grameen, VisionSpring, SolarSister, HealthStore Foundation and HoneyCare Africa are aiming for financial self-sustainability to further reduce their reliance on large donors.

Understanding how NGOs can hinder (or help) the development of public services in poor countries is a question of obvious importance for development. This question has received little attention from researchers.<sup>2</sup> Thus, the primary goal of this paper is to make progress on this agenda by providing rigorous empirical evidence from a highly relevant context, where both the government and one of the world's largest NGOs

---

<sup>1</sup>Nancy and Yontcheva (2006) studies NGO aid allocation across countries and finds that it is unrelated to donor strategic objectives and strongly associated with poverty in recipient countries. See Buthe et al. (2012) for a discussion of the motivations USAID that is administered by NGOs and Dreher et al. (2007) for a discussion of the motivations of Swedish aid that is administered by NGOs.

<sup>2</sup>Existing studies typically examine the average effect of the introduction of NGOs on population outcomes, and do not consider the effect on public service capacity of the recipient government. We discuss the literature in more detail later in the Introduction.

provide basic health services to the ultra poor, with a focus on pregnant women and children under five.

As we discussed earlier, the primary perceived advantage of NGOs over traditionally administered bilateral aid is that it is seen to be free of the strategic objectives of the donor government. Nevertheless, NGOs face numerous other challenges. Critics point out that NGOs are largely unregulated and, for the most part, do not coordinate with each other or recipient-country governments.<sup>3</sup> This could create inefficiencies by replicating services and even harming the development of public service delivery by competing with the recipient government for resources and reduce the government's capacity to provide services and, in turn, increase the country's future reliance on aid. A second concern stems from the fact that NGOs in their effort to increase financial independence often ask field workers to perform parallel tasks: deliver free services to needy individuals and sell households products using an Avon-like business model.<sup>4</sup> The latter has the advantage of providing income to field workers and the NGO, and the disadvantage that monetarily incentivized activities can crowd out service delivery.

In the context of health services, these concerns are reflected in a call from medical doctors and public health experts for NGOs to establish a "NGO Code of Conduct for Health System Strengthening", where the proposed items include "Limit hiring of public systems", "Limit pay inequity between the public and private sectors" and "Commit to joint planning [with the recipient government]" (Pfeiffer et al., 2008). Similarly, the NGOs who use the parallel-task model are aware of the potential downsides. For example, BRAC, the world's largest NGO, states "Clearly there is a potential programmatic trade-off here between increasing her sales and monthly income, while still ensuring that the preventative and health education aspects of the program are being

---

<sup>3</sup>For a few examples, see Bromideh (2011) for a discussion of NGO performance in Iran, Rahman (2003) for a discussion of NGOs in South Asian countries and Pfeiffer et al. (2008) for a discussion of NGOs in sub-Saharan Africa.

<sup>4</sup>All of the aforementioned NGOs use such a model.

sufficiently addressed” (Reichenbach and Shimul, 2011).

Both of these concerns are highly relevant in the context of this study. The communities we study are the “ultra poor” in rural Uganda, with an average annual per capita income of \$522 USD, and where basic health care provision is limited. The infant mortality rate is 43.8 per 1,000, one of the highest in the world. Approximately half of the villages in our sample have a government-provided community health worker, referred to as members of the Village Health Team (VHT). The VHT are volunteers and provide basic health services and products, all free of charge, to their local communities. One year after the VHT is established, the NGO randomly roll out health services in the same region. NGO health workers provide similar services, also free of charge, as the government. In addition, NGO workers sell products to households. These include the basic health products that the VHT give for free, as well as other small household products such as soap, oil or gloves. The profits from sales partly goes towards paying NGO village health workers, and partly goes towards funding the NGO more generally.<sup>5</sup>

In this context, the most obvious channel for the NGO to crowd *out* public service delivery is labor supply because this is a context with very few individuals who are able and willing to be health workers for their local community. Prior to the arrival of the NGO, the government was able to recruit at most one VHT member per village, and in many villages, no VHT was established. Since the VHT comprises of unpaid volunteers, it could be that they prefer to work for the NGO, which targets workers with similar skills and pays a positive income from selling household goods.<sup>6</sup> In principle, the NGO can also crowd *in* public health services if increased awareness about health

---

<sup>5</sup>Each sale yields a profit for the health worker and generates funds for the NGO to cover the program costs. The products are bought by the NGO at the wholesale price, sold to the workers at a price that is higher than the wholesale price but lower than the market price, and subsequently sold to the community at the market price.

<sup>6</sup>Note that in our context, many villages with a total of one health worker. Thus, if the VHT shifts to work for the NGO and no new VHT is hired, then this can also reduce the community’s access to free health products. However, as we will discuss later, the price of the health products is quite low. Thus, while it may play a role in our mortality results, we do not focus on it as the main channel.

issues increases overall take up rates of health services from all providers. For example, mothers who learn the usefulness of vaccines from either the NGO or VHT, are more likely to take up vaccines offered by both providers. Our empirical estimates will capture the net of the crowding-out and crowding-in forces.

The analysis proceeds in several steps. First, we investigate the interaction effect of the presence of a VHT and the introduction of the NGO on the total labor supply of health workers in the community. The presence of the VHT is non-random, while the presence of the NGO is random. Therefore, the presence of the VHT and the NGO are independent and the interaction can be interpreted as causal. The main challenge for interpretation is that the presence of the VHT may be associated with other factors that can influence the efficacy of the NGO. We find no significant baseline differences between villages with and without the VHT. Nevertheless, we address this concern by controlling for the interaction of the introduction of the NGO and potentially important baseline characteristics, such as mortality, village size and distance to a clinic.

We find that the arrival of the NGO when there is a VHT at baseline changes the labor supply of health workers on the extensive and intensive margins. It increases the number of total health workers by one per every two village; and induces around half of the existing VHT to shift to work for the NGO. This is consistent with a survey conducted by the NGO, where 82% of NGO community health workers self-report that they were formerly VHT workers. These results are consistent with the concern that NGOs compete with the government for labor and workers are likely to move to NGOs, which pay a higher income.

Second, we investigate the effect on health service delivery, which depends on the time allocation of the NGO workers. The results show that households in villages that have the VHT at baseline and then receive the NGO are substantially *less* likely to see a health worker than those living in villages with a VHT at baseline and no the NGO.

This is consistent with survey data provided by the NGO, which show that workers spend only 21-36% of their time providing health services. The results imply that the reduction in the supply of health services due to shifting from working for the VHT to the NGO is not sufficiently compensated by an increase in the total number of hours from NGO workers on the extensive margin. Since pregnant women and children under five years of age are central aims of both the VHT and the NGO, we narrow our focus to the delivery of services related to delivery and post-natal care. Consistent with the reduction in overall service delivery, we find that post-natal services are worse in villages with both a VHT and the NGO than villages with only the VHT. These results are consistent with the concern that the NGO crowds out government public services.

Finally, we examine the consequences on infant mortality. Ex ante, the effect of the shift to the NGO on community health outcomes is ambiguous. On the one hand, the reduction in labor supply and the effective increase in the prices of health products could increase mortality. On the other hand, the NGO may provide higher quality care, which can offset the negative supply effects. Our empirical estimates, which obtain the net effect, show that in villages with a VHT, the NGO brings no benefit to mortality (i.e., does not reduce mortality).

Interestingly, note that when the NGO enters villages with no other health workers (i.e., no VHT), it increases the total labor supply of health workers and health service delivery, and reduces infant mortality.

Taken together, the evidence shows that NGOs can crowd out public health services provided by the government. This occurs through labor supply channels and could potentially have serious health consequences for the population that the NGO aims to help.

The results of our paper should be cautiously interpreted as specific to the context of our study. However, the findings that NGOs can distort the local labor market and the

implication that the incentive structure of NGO compensation can have externalities for the local government are generalizable. Our results have several policy implications and motivates several questions for future research, which we discuss in the Conclusion.

Our study contributes to several branches within the large literature on foreign aid. First, it adds to studies on the effectiveness of aid, and particularly, recent ones which provide rigorous empirical evidence that the effect of aid is heterogeneous across contexts (e.g., Crost et al., 2014; Nunn and Qian, 2014).<sup>7</sup> Another branch include studies that attempt to identify the sources of the heterogeneity, the most well known is probably Burnside and Dollar (2000). In focusing on NGOs, we add to the recent study of Faye and Niehaus (2012), which finds that NGOs are less strategically aligned with donor countries than bilateral aid. Our results complement this earlier work by pointing to coordination with recipient governments as an important dimension for improving NGO-administered aid. To the best of our knowledge, we are the first to examine the presence of government services as a determinant for aid effectiveness. Fourth, our findings complement studies which argue that foreign aid effectiveness would improve with better coordination. These typically focus on donor coordination (e.g., Bigsten and Tengstam, 2015). We are the first to provide evidence related to NGO-recipient-government coordination. Finally, our study contributes to the discussion that higher wages from foreign aid can distort local labor markets (e.g., Koch and Schulpen, 2018). To the best of our knowledge, there is relatively little rigorous empirical evidence and we are the first to connect this phenomenon to the crowding out of public services.

We also adds to the large literature in public economics on private-public spending crowd out. The large body of evidence mainly focuses on developed countries and on how government spending crowds out private spending (e.g., Gruber and Hungerman, 2007; Kingma, 1989; Payne, 1998).<sup>8</sup> Our study provides a new and policy relevant

---

<sup>7</sup>See Easterly (2009) and Qian (2015) for literature overviews.

<sup>8</sup>In two well-known earlier studies, Kingma (1989) finds that U.S. government contributions to

context for the flip-side by examining how private spending can crowd out government-provided services in a very poor country.<sup>9</sup>

Finally, our work is related to the growing number of papers evaluating the effectiveness of NGOs in providing health services to the very poor. The findings vary across contexts.<sup>10</sup> In finding that the entry of the NGO reduces mortality in villages with no pre-existing government VHT, our results support studies which find that NGOs can provide benefits (e.g., Bjorkman-Nyqvist et al., Forthcoming).<sup>11</sup> Our contribution to this literature is to show that the effects of NGOs can be heterogeneous depending on the presence of government-provided VHTs, and thus, better targeting of NGOs can improve the well-being of the population which both the government and NGOs aim to help.

The paper is organized as follows. Section 2 describes the context. Section 3 presents the empirical strategy. Section 4 describes the data and descriptive statistics. Section 5 presents the results. Section 6 concludes.

---

National Public Radio crowds out private donations, while Payne (1998) finds little evidence that government spending crowds out private donations to U.S. homeless shelters. More recently, Gruber and Hungerman (2007) finds that U.S. government spending crowded out church spending on social services during the Great Depression.

<sup>9</sup>Note that we do not show crowd out of government spending since we do not have data on government expenditures.

<sup>10</sup>For example, Kumar et al. (2008) and Baqui et al. (2008) document large reductions in neonatal mortality (36- 54%) following the introduction of a new health worker program; while Darmstadt et al. (2010); Bhutta et al. (2011); Bhandari et al. (2012); Kirkwood et al. (2013); Boone et al. (2016) document smaller effects (below 15%). Kidane and Morrow (2000) find that community-based training of mothers reduces under-5 mortality by 40%, while Sloan et al. (2008) finds that teaching child care to expectant and postpartum women has no significant impact on neonatal and infant mortality.

<sup>11</sup>Bjorkman-Nyqvist et al. (Forthcoming) examines the average effect of the randomized rollout of an NGO on child mortality in a context that is similar to ours. They find is that the NGO lowers under-five mortality rates by 27% on average.



## 2 Background

### 2.1 Government Health Service Provision

Rural Uganda is one of the poorest regions in the world, where average per capita income is \$522. In 2014, the infant mortality rate was 43.8 per 1,000 live births, one of the highest in the world. According to the World Health Organization, the main contributors of infant mortality in this context are neonatal mortality (60%), diarrhea (14%), malaria (9%), pneumonia (6%) and other causes (11%). For neonatal mortality, the main causes are birth asphyxia/trauma (30%), premature births (28%), sepsis (18%), congenital anomalies (12%), acute respiratory infections (6%) and other causes (6%).<sup>12</sup>

Public health services in this context ranges from non-existent to scarce. In 2009, the Ugandan government introduced Village Health Team community health workers (the VHT) to provide basic health services. The goal of the government was to have one VHT community health worker per every 200 households. (Note that in our context, there is never more than one VHT per village).

The main job the VHT is to provide the following services during home visits: health education (e.g., about the benefits of a hospital delivery, methods of disease prevention), post-natal check ups, basic medical advice, referrals to health clinics in urban areas. The VHT also provide basic medicines, such as ACT (artemisinin combination therapy for malaria), ORS (oral rehydration solution), Zinc, antibiotics, and deworming tablets free of charge.

The government recruits workers locally. The VHT are given basic training, a uniform (e.g., t-shirt with the official logo) that makes them easily identifiable as a government health worker, and free medical products to disperse to the community.

---

<sup>12</sup>Source: WHO Global Health Observatory Data Repository (2012).

They are not paid or given any other support or incentives. Thus, they are generally considered to be motivated by altruism (Kasteng et al., 2015; Deserranno, 2019). All VHT community health workers are part time workers, who work on average ten to fifteen hours per week (Mays et al., 2017).

The presence of a VHT is not random. According to the government and workers in the field, the key determinant is limited labor supply of those who are both able and willing to work as part of the VHT. This is important to keep in mind for our considering our empirical strategy later in the paper.

## **2.2 The NGO**

The NGO that we study provides numerous different services across the world. In our context, the NGO has the same aims and provides the same services as the VHT. It is the only other source of health care services in our context. It entered in 2010 by randomly rolling out its program. Thus, when it rolled out, the VHT was already in place.

NGO workers are also recruited locally. Although the NGO tries to avoid hiring from the VHT, it does not have a formal mechanism to systematically screen them out. And since they look for individuals with the same skills, VHT community health workers who apply to work for the NGO are typically more competitive than other applicants.

Like the VHT, the NGO workers provide free basic health services. However, they sell medicines for a small fee instead of providing them free of charge. In addition, the NGO workers also sell other household products. Then, based on sales, the NGO workers receive an income (where as the VHT receive no income). The motivation of the parallel-task model is to provide financial sustainability. This model is used by several of the largest and most successful the NGOs today, including Living Goods, Grameen,

VisionSpring, SolarSister, HealthStore Foundation and HoneyCare Africa. The NGO workers are also easily identifiable in villages because they wear the NGO uniforms.

NGO workers buy the products from the NGO at a price that is slightly higher than the wholesale price, and then sell to households at a retail price that is designated by the NGO. The difference between the wholesale price and the buying price for the community health worker goes towards the revenues of the NGO at large. The difference between the buying price and the retail price constitutes the income of the NGO community health worker. Figure 1 shows the products that are sold by the NGO, as well as the retail price (what households pay) and the profit margin for the NGO community health worker. It shows that the products which are also given away by the VHT (oral rehydration salts, pain reliever, zinc, antimalarials, cold capsules, salt, deworming tablets) are sold at very low retail prices and provide negligible profits to the NGO agent. The products that provide the highest profits to the NGO workers are, on average, less related to the most concerning health outcomes: fortified oil, cotton, soap, fortified flour and toothpaste.

### **2.3 Supply of Health Services from the VHT and the NGO**

Both the VHT and the NGO workers are part-time employees. VHT workers work on average ten hours per week delivering health services (Mays et al., 2017), whereas the NGO workers work approximately fourteen hours a week, where 7.4 hours, or around half of total labor supply, is devoted to health activities (Reichenbach and Shimul, 2011; Deserranno, 2019). Thus, NGO workers provide 30% fewer hours of health services than the VHT. We note that since patient visits can also be used to sell products, the self-reported the NGO allocation of time to health services may be an upper bound of actual service delivery.

Table 1 presents more granular data on time allocation from the NGO. It shows that

over one month, the NGO workers supply a total of 48.65 hours (2,919 minutes), where 36% is given to providing health services (including attending refresher training) and 64% is spent on market activities. However, the report notes that the time allocated for refresher training includes visits to the branch office to resupply the products they sell. Thus, 36% is the upper bound of health-related activities. The lower bound can be obtained if we attribute the time attending refresher training to market activities. When we do this, we find that the NGO workers spend 21% of their total effort on health related activities and 79% of their time on health activities.

Health services provided by the VHT can be crowded in or crowded out by the introduction of the NGO. On the one hand, the presence of the NGOs can complement existing government-provided services if there are fixed costs in provision, such as recruiting and training workers, or if there are positive externalities. For example, increasing general awareness of the benefits of basic health services could increase the supply of individuals who are willing to work to deliver these services and the demand for these services for both the government and the NGO. This could, in turn, lead to an increase in the efficacy of health care for both organizations – e.g., a mother who is aware of the benefits of vaccination is more likely to take up an offered vaccine from a government health workers as well as an the NGO.

On the other hand, the NGO can crowd out health care delivery in several ways. The NGO distorts the local labor market by providing the monetarily incentivized activity of selling goods to health workers, which can crowd out the more altruistically motivated health service provision. The NGO, itself, has expressed concerns along these lines. For example, the NGO’s evaluation of the community health program in 2011 state that “There is a perception among the NGO staff that women in Uganda are more commercial-minded and very much motivated by financial incentives as opposed to non-financial incentives” (Reichenbach and Shimul, 2011).

The potentially negative effects of this distortion on the supply of health services can be exacerbated by the fact that total compensation is much higher working for the NGO than the government such that VHT workers may switch to working for the NGO. If the government is unable to recruit another worker to replace the VHT who switched, then the introduction of the NGO can reduce the total supply of health services unless if the community health worker increases the total supply of hours on the extensive margin sufficiently to offset the increase in the share of hours spent away from health service delivery on the intensive margin.

In this scenario where the government is unable to replace the VHT worker who switches to working for the NGO, villagers will lose access to free-of-charge health products.

Note that the quality of service may differ between the VHT and the NGO workers. Specifically, because the NGO will provide training to all of its workers, the VHT who switch to the NGO will receive training twice, once with the government and once with the NGO, which could increase the quality of the service. There is also some evidence from the existing literature that NGOs provide higher quality care and products than the VHT (Bjorkman Nyqvist et al., 2012; Bjorkman-Nyqvist et al., Forthcoming).

### 3 Empirical Strategy

The baseline equation is the following:

$$y_i = \alpha + \beta(VHT_i \times NGO_i) + \delta VHT_i + \gamma NGO_i + \Gamma X_i + \lambda_i + \varepsilon_i. \quad (1)$$

The outcome of interest in village  $i$  at end line in 2012,  $y_i$ , is a function of: the interaction of a dummy that takes a value of 1 if the village receives a community health worker at baseline in 2009,  $GHW_i$ , and a dummy that takes a value of 1 if it

is designated to participate in the NGO program in 2010,  $NGO_i$ ; the uninterrupted dummy variables; and area (branch) fixed effects,  $\lambda_i$ . Standard errors are clustered at the branch level. There are 12 branches, 5 located in Central Uganda and 7 in Northern Uganda.

$NGO_i$  is a randomly assigned variable.  $VHT_i$  is not randomly assigned.  $\delta$  is the relationship between having a VHT and the outcome of interest.  $\gamma$  is the causal effect of the NGO on the outcome of interest.

Note that equation (1) is a cross sectional estimate. However, timing is important: the VHT were recruited in 2009 and already present when the NGO randomly rolled out in 2010.

Our study is mainly interested in the interaction coefficient,  $\beta$ . For example, if the outcome of interest is child mortality rates,  $\beta < 0$  is consistent with the NGO crowding in VHT, where as  $\beta > 0$  is consistent with the NGO crowding out VHT. The interaction of an exogenous variable and a non-random variable can be interpreted as causal as long as the two variables are independent, which is given by the random assignment of  $NGO_i$ .

The main concern for interpretation is that the presence of a VHT is correlated with other factors that will reduce the effectiveness of the NGO. To address this, we will control for the interaction of important baseline characteristics and being assigned to receive the NGO,  $\Gamma X_i$ . We will discuss these controls when they become relevant.

## 4 Data

The sample used in this study are from 127 villages in North/Center Uganda.

Survey data on mortality and access to health services were collected in 2010 and 2012 by the NGO. We will refer to 2010 as “baseline” even though the VHT were

introduced in 2009, and 2012 as “endline”. There are two surveys, one at the village level and one at the household level. The village-level survey was administered by a team of enumerators and answered by the village head (LC1) at baseline and endline. The household-level survey was administered by the same team of enumerators and answered by a random 20% of the households at baseline and endline. We will use both and identify the relevant survey when we present the results. Note that not all questions were asked in both the baseline and endline. We will discuss this when relevant. Finally, we have access to basic census information on household size, mortality and occupation from *all* households in the village at baseline only.<sup>13</sup>

Table 2 presents the mean baseline characteristics for villages. Columns (1)-(2) show the means and standard deviations for the full sample. Columns (3) -(6) divide the data according to whether the villages were randomly assigned to receive the NGO. Column (7) presents the p-value for the difference between the two subsamples. Columns (8)-(11) divide the data according to whether the villages had a VHT community health worker (aka, “Gov’t CHW”) at baseline. Column (12) presents the p-value for the difference between the two subsamples. Panel A presents variables from the village-level survey. Panel B presents variables from the census data, aggregated at the village level. Table A.2 presents variables from the 20% random subsample of households.

Several interesting facts emerge from the descriptive statistics. First, we observe only one statistically significant difference across the two different ways of cutting the sample. Panel A shows that villages that were assigned to receive an NGO health workers are more likely to be within 10km of a private clinic. However, the magnitude of the difference is negligible (0.86 versus 0.85).

Specifically, note that there is no difference in the number of children under five years of age or child mortality rates. This is important because these variables could influence

---

<sup>13</sup>These census data were used by the NGO to draw a random sample of households (20%) to be interviewed more extensively at baseline and endline.

the demand for health services. For example, if villages with the VHT have lower infant mortality, then the entry of the NGO could shift workers from the VHT to the NGO, and from providing health services to selling goods, because there is less demand for health services and more demand for household products in such villages. The descriptive statistics suggest that this is not the case. Nevertheless, in acknowledgment of the potential confounders due to the non-random assignment of the VHT, we will conduct robustness checks where we control for all of important baseline characteristics interacted with the introduction of the NGO after the main results.

These balance statistics are consistent with the random rollout of the NGO, and show that there are no discernible differences between villages with and without VHT workers even though their presence are not randomly assigned.

Second, we observe that the government is less successful at recruiting than the NGO. Table 2 Panel A column (1) shows that only 57% of villages have a VHT in 2010, one year after the government introduced the program to all villages. In contrast, 98% of the villages that the NGO entered in 2010 has one the NGO worker (not in the tables because this is an end-line characteristics). This suggests that the NGOs monetary incentives were very successful in villages where the government could not find a suitable volunteer.

All NGO workers were interviewed at endline and another interesting fact is that 82% of those hired in villages with the Government program report having formally worked as a VHT in the past.

Appendix Table A.1 illustrates the allocation of NGO workers and VHT workers across the villages of our sample.



## 5 Results

### 5.1 Labor Supply

Table 3 investigates the presence of crowd out by estimating equation 1 with labor supply of health workers at end line as the outcome. The sampled used for this analysis is at the village level. Column (1) examines the number of all community health workers, which is the sum of the VHT and the NGO workers, and can take a value of 0, 1 or 2. Recall that the end line survey is approximately 2.5 years after the baseline, and that in our context, there are no community health workers from other organizations and no village had more than one VHT at baseline. The results show that villages that had one VHT at baseline and where the NGO was never introduced have approximately 0.79 health workers at end line. The interaction of  $VHT_i \times NGO_i$  is  $-0.446$  and statistically significant at the 1% level. It means that the introduction of the NGO to a village with a VHT reduces the number of VHT by approximately half of a person. This is evidence of crowd out.

Villages that had no VHT at baseline and where the NGO was introduced had on average 0.98 health worker at end line. Both estimates are statistically significant at the 1% level. That the estimates are slightly less than one reflects attrition.

If we sum the two uninteracted coefficients for VHT and the NGO and the interaction coefficient for  $VHT_i \times NGO_i$ , we see that the predicted number of health workers in a village with a VHT at baseline and that received the NGO is 1.325 ( $-0.446 + 0.791 + 0.98 = 1.325$ ). This is shown at the bottom of the table in row [4].

These estimates show that in villages with a VHT, the introduction of the NGO has an effect on the intensive and extensive margins of the labor supply of health workers. The interaction effect shows that on the intensive margin, the NGO induces

approximately 56% of VHT workers to move to work for the NGO ( $.446/.791 = .56$ ). On the extensive margin, the NGO increases the total number of health workers by approximately half a person per village ( $1.325 - 0.791 = 0.534$ ), or one person per very two villages. In other words, when the NGO arrives at two villages with the VHT, in one village, the VHT will work for the NGO, and in the second village, the NGO will hire an additional worker while the VHT will continue to work for the government.

Columns (2) and (3) examine the number of the VHT and the NGOs at end line as outcome variables. Unsurprisingly, we find that the interaction effect is driven by the VHT (column 2) and not the NGO workers (column 3). These serve as sanity checks on our estimates.

As another sanity check, we investigate the presence of traditional healers and drug stores as outcome variables. Traditional healers provide non-Western medical treatments and drug stores sell health products and also provide basic medical advice. The worker in the latter is typically also the owner. The mean dependent variables at the top of the table show that there is approximately one traditional healer per every five villages, and one drug store per every two villages. Because the skills of traditional healers and drugstore owners are so different from what the NGO looks for in health workers, it is unlikely that the arrival of the NGO will affect the presence of these other entities. The regression estimates show that this is indeed the case.

## 5.2 Service Delivery

The effect of the change in labor supply on service delivery depends on the time allocation of the NGO workers. For example, if the NGO worker spends all of her time delivering health services, the introduction of the NGO in a village with a VHT, which adds “half” of a health worker to each village, should increase the supply of health services. In the other extreme, if she spends all of her time selling products, then there

would be a reduction in total health services.

We use two proxies for the delivery of health services. The first is a dummy variable for whether a household has sought medical advice from a community health worker in the past year. The number of observations is much larger than the earlier analysis because we use a household-level survey here. Column (1) examines whether the household has sought advice from any health worker, VHT or the NGO. It shows that that having a VHT or a the NGO worker increases the probability of receiving medical attention by 36.1% and 28.8% respectively. Both estimates are statistically significant at the 1% level. However, the interaction of  $VHT_i \times NGO_i$  is  $-0.415$  and statistically significant at the 1% level. This means that the introduction of the NGO in a village with a VHT at baseline reduces the probability that a household will receive medical attention. Note that the magnitude is large. At the bottom of the table, row [4] shows that 33.2% of households in villages with both a VHT and the NGO are predicted to receive medical attention ( $0.361 + 0.288 - 0.415 = 0.332$ ). This is 13 percentage-points less than the probability of receiving medical attention if there were only a VHT and no the NGO (0.46, see row [2] at the bottom of the table), and the difference is statistically significant at the 1% level (see row “[4]-[2]” at the bottom of the table).

This result is consistent with the NGO crowding out the VHT. Moreover, it is consistent with the concern that the NGO workers spend a small part of their time providing health services such that the shift of some of the VHT to working for the NGO that we observed in the labor supply estimates leads to a reduction in the total amount of health services that is delivered.

In columns (2) and (3), we investigate the source of the change in services. Column (2) examines services from VHT. It shows that having a VHT at baseline increase the probability of having seen a VHT for health advice by 42.8% and has no effect on whether the household has seen a the NGO worker for health advice. The interaction

of  $VHT_i \times NGO_i$  is  $-0.240$  and statistically significant at the 1% level. This means that in a village with a VHT, the introduction of the NGO reduces the probability that a household sees a VHT by 24%. Column (3) examines the effect on seeking advice from the NGO. The interaction effect is zero. Thus, the results in columns (2) and (3) imply that the reduction in service delivery that we observe in villages that have VHT and the NGO is driven by a reduction in services from the VHT. This is consistent with our interpretation of crowd-out.<sup>14</sup>

Columns (4)-(7) show that we find no effect on health advice from other sources in the (traditional healers and drug stores), or sources in more urban areas (government hospital or health centers, and private clinics that administer Western medicine).

The second measure of service delivery we examine pertains specifically to pre-natal and ante-natal care. This is motivated by the fact that the core mission of both the VHT and NGO is to reduce infant mortality by improving these services. Since it makes sense to focus on households which have given birth during the interim between the baseline and the end-line surveys, we would need to first establish that fertility is not endogenous to the presence VHTs and/or NGOs. To this end, column (1) examines the presence in the household of a woman who delivered in the past year as the outcome variable. We find no relationship between this proxy for fertility and our main right-hand-side variables. Therefore, in columns (2)-(5), we will restrict our sample to households with at least one woman who delivered in the past year. This results in the sample size decreasing from 2,747 to 407 households.

Columns (2)-(4) examines three variables which may be affected by the VHT and NGO: whether the woman delivered in a hospital, whether the delivery was assisted by a health professional, and whether the mother received post-natal care within two days

---

<sup>14</sup>Note that column (3) shows that having the presence of a VHT in a village without the NGO will reduce the probability of seeking advice from the NGO and that the mean rate of seeking advice from NGOs in villages with no health worker at all is 5.1% (see row [1] at the bottom of the table). This is due to the fact that a few households seek health advice from NGOs in other villages.

of birth. We find no effect on having a hospital delivery, but statistically significant effects on whether the delivery was assisted by a health profession (e.g., hospital doctor or nurse). Specifically, column (3) shows that the predicted mean of supervised delivery in a village with both the VHT and NGO is 66.2% (row [4]), which is lower than the predicted mean of 71.9% in a village with only the VHT (row [2]). The comparison between the estimates for hospital delivery and a hospital delivery supervised by a doctor or a nurse is consistent with the high rate of absenteeism from hospitals and the fact that one of the tasks of the community health workers is to coordinate for the delivery to take place when the nurse and doctor is present.<sup>15</sup>

In column (4), we examine the probability of having had a follow up visit within two days of birth for women who delivered in the past year, which is considered as an important preventer against infant mortality (Jones et al., 2003) and is used as a key measure of access to health services by the WHO, UNICEF and the World Bank. The estimates show a negative and statistically significant interaction effect of  $-0.216$ . This means that for village with a VHT at baseline, the introduction of the NGO reduced the probability of a follow up visit by 21.6% percentage-points. At the bottom of the table in row [4], we show that for such villages, the predicted probability of a two-day follow up is 18.1 percentage-points. This is much lower than the predicted 26.9 probability of a two day follow up visit in a village with VHT, but which never received the NGO.

In column (5), we examine whether mothers breastfeeding. Ex ante, we do not expect any effect because almost all mothers already breastfeed in this context. Our results are consistent with expectations.

Next, we examine ante-natal service delivery. For this exercise, we restrict the estimates to households with at least one pregnant woman. As with our earlier exercise, this raises the concern that pregnancy may be endogenous to the presence of a VHT

---

<sup>15</sup>Appendix Table A.2 shows that the average rate of absenteeism is 31%.

and/or NGO. Column (6) examines the presence of pregnant woman as an outcome variable. The coefficient for the uninteracted VHT dummy variable is positive and statistically significant at the 5% level. The coefficients for the uninteracted NGO dummy variable and the interaction of presences of the VHT and NGO are small and statistically insignificant. In light of these estimates, we will cautiously interpret the results in columns (7) and (8) as descriptive.

Column (7) shows that for village with a VHT at baseline, the introduction of the NGO reduced the probability of an ante-natal visit by 16.2% percentage-points. At the bottom of the table in row [4], we show that for such villages, the predicted probability of a an ante-natal visit is 99.3 percentage-points, which is slightly lower than the predicted 99.7 percentage-point probability of an ante-natal visit in a village with VHT, but which never received the NGO. Column (8) shows no effects on whether pregnant women take anti-malarial drugs.

### 5.3 Child Mortality

To understand whether the crowding-out has real-world consequences, we examine under-one and under-five child mortality, the reduction of which is a focal point for both the VHT and the NGO workers. Ex ante, the effect of the shift to the NGO on community health outcomes is ambiguous and mainly occurs through three channels. On the one hand, the reduction in labor supply and the effective increase in the prices of health products could increase mortality. On the other hand, the NGO may provide higher quality care, which can offset the negative effects. Our empirical estimates obtain the net effect of the reduction in supply and any change in the quality.

Table 5 columns (1)-(4) examine under-infant mortality using different measures. Column (1) uses the household-level survey to examine a dummy that equals one if at least one infant died within the household since the baseline. To account for differential

fertility, column (2) examines infant mortality as a share of children who were born and died before age one since the baseline. This significantly reduces the sample size since it is restricted to households that have had at least one child, which leads to the difficulty that the estimate is conditioning on an potential outcome variables. Column (3) addresses this by examining infant mortality at the village level as the number of infants who died per 1,000 births. Since all villages have had at least one birth, this uses the full sample of village-level observations.

The results in column (1) shows that the presence of the VHT in a village with no NGO reduces the probability of infant mortality in household by 2.6 percentage-points, relative to the 4.6 percentage-point mortality in villages with no health worker of any type. The introduction of the NGO in a village with no VHT reduces mortality by 2.3 percentage-points. In contrast, the introduction of the NGO in a village with no VHT has increases the probability of mortality by 0.3 percentage-points ( $-0.026 + 0.029 = 0.003$ ). However, the increase is not statistically significant (see row “[4]-[3]” at the bottom of the table).

We observe a similar pattern in columns (2) and (3), when we normalize the outcome variable by the number of births. For mortality per 1,000 births in column (3). The results show that the presence of the VHT in a village with no NGO reduces mortality by 116 per 1,000 relative to the mean of the omitted group, which is 159 per 1,000. The introduction of the NGO in a village with no VHT reduces mortality by 75 per 1,000. In contrast, the introduction of the NGO in a village with no VHT has no effect on mortality ( $-116 + 116 = 0$ ).

Rows [1]-[4] at the bottom of the table compares the predicted mean mortality rates for the four types of villages. It shows that the predicted mortality rate is lowest for villages with only the VHT, at 43 per 1,000, and higher in villages with both the VHT and the NGO, at 85 per 1,000. However, the p-values below show that these differences

are statistically insignificant. Thus, we interpret the mortality results as conservatively showing the NGO, at best, brings no value added to villages with a VHT in terms of reducing infant mortality. This is consistent to the decline in service delivery shown earlier for these villages.

Column (4)-(6) examine under-five mortality. The results are similar to before, but statistically less precise in some of the estimates. This is consistent with the fact that under-five mortality in our context is mainly driven by infant mortality.

## **5.4 Robustness**

### **5.4.1 Additional Controls**

The main caveat for our preferred interpretation is that the presence of VHT at baseline is correlated with other variables that can affect the outcome of interest. For brevity, we will focus on the main outcomes of interest: the number of health workers at end line, the probability of seeing a health care worker, the probability of having an assisted delivery, the probability of receiving ante-natal care, and under-one mortality (a dummy variable for at least one infant died within the household and the share of infants who died in the household). We categorize the additional controls into four groups. For each variable, we will control for the variable and its interaction with the presence of the NGO. This addresses the concern that the non-random presence of the VHT is correlated with factors which may influence the effect of the NGO. We do not need to symmetrically control for the variables interacted with the presence of the VHT because the introduction of the NGO is random.

The first group comprises of variables that can influence the effectiveness of a community health worker: distance to nearest government hospital, distance to the nearest government health center, distance to the nearest private clinic, the presence of a drug



store and the presence of a traditional healer. Access to these resources could help or hinder the effectiveness of the NGO. For example, on the one hand, proximity to a government clinics could allow referral made by the NGO to be more effective (i.e., the patients are more likely to go to a nearby clinic than a far away one). On the other hand, the presence of a traditional healer may be correlated with community members not believing in Western medicine, which lowers take up of the NGO's services. Note that these factors can influence the effects on service delivery and mortality, but it is hard to see how they would affect the labor supply of health workers.

Second, we consider demographic variables: the number of households in the community, the number of children under five per household and the number of infants per household. These variables could affect the labor supply of and demand for health workers. For example, it may be easier to find additional health workers in larger villages. Alternatively, the demand for services may be larger in more populous villages or villages with more young children.

Third, we consider baseline morbidity: the number of children under five who died in the past year and the number of children under one who died in the past year. The variables could be correlated to the demand for health workers, and reflect underlying well-being (e.g., income) of the population. For example, a village with higher child mortality rate may face a higher disease burden (e.g., near jungles), where it is more difficult to reduce mortality. Or, a village with a higher mortality rate may be poorer, where there is a lower supply of community health workers or where the VHT is more motivated to work for higher pay with the NGO.

Finally, we consider household-level demographic variables: the age of the female household head, the percent of households involved in farming as the main activity, and the percent who are Catholic. These factors may affect the availability of health workers for the VHT and NGO. The age of the female household head and the percent

who are Catholic may also affect beliefs in Western medicine.

Note that the balance statistics shown earlier in Table 2 demonstrate that these variables are not correlated with the presence of a VHT or the presence of the NGO. Thus, including them as controls will only affect the main results if there is a non-zero relationship between these variables (and between these control variables and the outcomes of interest) that the balance statistics are under powered to detect.

#### **5.4.2 Non-Linear Estimation**

The estimates on service delivery in Table 4 examines a dummy variable with a Linear Probability Model. In Appendix Table A.3, we alternatively use a non-linear Logit model. The results are similar.

### **5.5 Is the community worse off?**

We interpret the main results to be consistent with the concerns that NGOs sometimes poach workers from the recipient country government, and that the monetary incentives from selling goods crowd out health service provision. Our findings on mortality show that at best, NGOs add no value to VHTs in terms of mortality reduction. Taken at face value, this means that NGOs are redundant.

An alternative explanation is that villages with VHTs have higher demand for the goods that the NGO sells (and which the VHT does not provide for free), such as soap and oils, relative to their demand for health services. It could be the case that the NGO provides little health benefits in VHT villages, but makes villagers better off by providing goods that are in high demand and are otherwise unavailable. This would be consistent with the NGO finding that their products are in high demand (Reichenbach and Shimul, 2011).

Earlier, when we presented the descriptive statistics, we argued that this is unlikely

given the similarity in baseline characteristics between the two types of villages. Moreover, in the previous exercise, we showed that our main results are very robust when we control for potential proxies of demand such as village demographics, distance to more urban areas (i.e., government health facilities) and the presence of a drug store.

Here, we can examine this question another way. Since the villages in our study often have drug stores that dispense the same products as the NGO, if the reduced effectiveness of the NGO is due to high demand for the products that the NGO sell, we should find that the NGO is less likely to reduce the total labor supply of health workers and health service delivery, and more effective in reducing mortality in villages where there is a drug store.<sup>16</sup> We find no interaction effect between the presence of a drug store and NGO.<sup>17</sup>

## 6 Conclusion

This paper presents novel and rigorous empirical evidence that the NGOs can crowd out government-provided community health services. We show the labor supply health workers is one channel through which crowd out can occur. When the NGO arrives to villages with volunteer government health workers, the labor supply of all health workers increases slightly. This reflects changes on the intensive and extensive margins of labor supply. In some cases, the government health worker shifts to work for the NGO and there is no change in the total number of health workers. In other cases, the NGO is able to recruit an additional person, which increases the number of total health workers.

However, even though the supply of health workers increase slightly, health service

---

<sup>16</sup>We note that the NGO may provide higher quality products (Bjorkman-Nyqvist et al., Forthcoming). However, if demand was an important channel, the presence of a drug store should still increase the NGO worker's supply of health services on the margin.

<sup>17</sup>The results are available upon request.

delivery declines relative to when there was only a government health worker. This is consistent with the descriptive evidence that the NGO workers spend a large proportion of their time selling goods, which contributes to their income, instead of providing health services, which has no direct influence on their income. In other words, the decline in health services caused by the shift from working for the government to working for the NGO is not fully compensated by the increase in the number of total workers on the extensive margin. The result is that the NGO not only crowds out government-provided health services, but reduce the total supply of health services.

When we examine infant mortality, the reduction of which is a central objective of both the government and the NGO, we find that at best, the NGO provides no added value to a village with a government health worker. At worst, it increases mortality. Our analysis lacks the necessary statistical power to be conclusive on this point.

The results of this study should be cautiously interpreted as specific to the context of this study. There are two features of our context that are particularly important to keep in mind. The first is that the government-provided public services we study are very new at the time of the arrival of the NGO. One could imagine that the entry of the NGO into a location with a mature program, where the government workers have been working for many years and have presumably more employer loyalty, could attract fewer workers from the government to work for the NGO. Similarly, a place with a longer history of having government health workers may also have a larger supply of able and willing individuals who could work for the government and NGO (e.g., because there is a better understanding about the importance of the job, and more people have knowledge about good health practices). This means that the NGO is less likely to poach (i.e., there are others equally qualified as the government health worker) and poaching will have less of an effect on service delivery (i.e., the government health worker who switches can be replaced by another qualified individual from the village).

Yet, infant public services is exactly the relevant context for foreign aid policy makers since the concern is that uncoordinated entry of NGOs could stymy the development of local capacity. A second important feature of our environment to keep in mind is the fact that government workers are all volunteers and do not receive any pay, while the NGO workers can earn an income. The magnitude of the difference will be specific to our context. However, the facts that NGOs pay more and that altruism is used to motivate local public service workers is quite common across poor countries. Finally, note that part of the crowding out of health services is due to the NGO only providing monetary incentives for non-health tasks. While this may seem extreme, it is very policy relevant since the NGO we study is one of the largest in the world and this business model is generally known as a success in its ability to provide financial sustainability. Furthermore, as we discussed in the Introduction of the paper, many of the largest the NGOs use the same business model.

The results of our study provide an important generalizable insight: NGOs can cause significant distortions to the local labor market. This can, in turn, reduce the service delivery that is the primary goal of both the NGO and recipient government. It may even negatively affect health outcomes of the target population.

For policymakers, our results have several implications. The first is that the NGOs working in very poor countries that are trying to develop their own infant public services should carefully consider the structure of their incentives so as to minimize crowding out recipient government public services. Second, they should take local labor market conditions into account. For example, the issues highlighted in this study will be less problematic in places where there is a larger supply of individuals who can work for the NGO and government (even though the principle of the problem would remain the same). Third, they should consider how to not let the money-making activities crowd out other ones. Some NGOs which use the business model that we study in this paper,

such as BRAC in Uganda, has recently started to do this, for example, by providing monetary incentives to health services. Finally, the NGOs may improve the targeting of their programs – e.g., only entering regions with no local provision of similar services.

This study highlights the interaction of the NGOs and other service providers as an important subject for future study. It raises the question of the other channels through which the NGOs can crowd out (or crowd in) native public service delivery. The results also show that understanding the role that pre-existing market conditions play in the effectiveness of the NGOs is an interesting avenue of future research. Our study focuses on the labor market. But it is easy to see that a similar argument can be made for the importance of understanding the pre-existing conditions of product or commodity markets.<sup>18</sup>

---

<sup>18</sup>For example, food aid may crowd out locally produced agricultural products. This is another example of an issue that policymakers and aid workers have been expressing concern for many years, but for which we lack rigorous empirical evidence.

## References

- Alesina, Alberto and David Dollar**, “Who Gives Aid to Whom and Why?,” *Journal of Economic Growth*, 2000, 5 (1), 33–63.
- Baqi, Abdullah H, Shams El-Arifeen, Gary L Darmstadt, Saifuddin Ahmed, Emma K Williams, Habibur R Seraji, Ishtiaq Mannan, Syed M Rahman, Rasheduzzaman Shah, Samir K Saha et al.**, “Effect of community-based newborn-care intervention package implemented through two service-delivery strategies in Sylhet district, Bangladesh: a cluster-randomised controlled trial,” *The lancet*, 2008, 371 (9628), 1936–1944.
- Bigsten, Arne and Sven Tengstam**, “International Coordination and the Effectiveness of Aid,” *World Development*, 2015, 69, 75 – 85. Aid Policy and the Macroeconomic Management of Aid.
- Bjorkman-Nyqvist, Martina, Andrea Guarison, Jakob Svensson, and David Yanagizawa-Drott**, “Reducing Child Mortality in the Last Mile: Experimental Evidence on Community Health Promoters in Uganda,” *American Economic Journal: Applied Economics*, Forthcoming.
- Bromideh, Ali Akbar**, “The widespread challenges of NGOs in developing countries: Case studies from Iran,” *International NGO Journal*, 2011, 6 (9), 197–202.
- Burnside, Craig and David Dollar**, “Aid, Policies, and Growth,” *American Economic Review*, 2000, 90 (4), 847–868.
- Buthe, Tim, Solomon Major, and Andre de Mello e Souza**, “The Politics of Private Foreign Aid: Humanitarian Principles, Economic Development Objectives, and Organizational Interests in NGO Private Aid Allocation,” *International Organization*, 2012, 66 (4), 571 – 607.
- Crost, Benjamin, Joseph Felter, and Patrick Johnston**, “Aid under Fire: Development Projects and Civil Conflict,” *American Economic Review*, June 2014, 104 (6), 1833–56.
- Deserranno, Erika**, “Financial incentives as signals: experimental evidence from the recruitment of village promoters in Uganda,” *American Economic Journal: Applied Economics*, 2019, 11 (1), 277–317.
- Dreher, Axel, Florian Molders, and Peter Nunnenkamp**, “Are NGOs the Better Donors? A Case Study of Aid Allocation for Sweden,” Kiel Working Paper 1383, Kiel Institute for the World Economy 2007.
- Easterly, William**, *The White Man’s Burden: Why the West’s Efforts to Aid the Rest Have Done So Much Ill and So Little Good*, New York: Penguin Press, 2006.

- , “Can the West Save Africa,” *Journal of Economic Literature*, 2009, 47, 373–447.
- Faye, Michael and Paul Niehaus**, “Political Aid Cycles,” *American Economic Review*, December 2012, 102 (7), 3516–30.
- Gruber, Jonathan and Daniel M. Hungerman**, “Faith-based charity and crowd-out during the great depression,” *Journal of Public Economics*, June 2007, 91 (5-6), 1043–1069.
- Jones, Gareth, Richard W Steketee, Robert E Black, Zulfiqar A Bhutta, Saul S Morris, Bellagio Child Survival Study Group et al.**, “How many child deaths can we prevent this year?,” *The lancet*, 2003, 362 (9377), 65–71.
- Kasteng, Frida, Stella Settumba, Karin Kallander, Anna Vassall, and in-SCALE Study Group**, “Valuing the work of unpaid community health workers and exploring the incentives to volunteering in rural Africa,” *Health policy and planning*, 2015, 31 (2), 205–216.
- Kidane, Gebreyesus and Richard H Morrow**, “Teaching mothers to provide home treatment of malaria in Tigray, Ethiopia: a randomised trial,” *The lancet*, 2000, 356 (9229), 550–555.
- Kingma, Bruce Robert**, “An Accurate Measurement of the Crowd-out Effect, Income Effect, and Price Effect for Charitable Contributions,” *Journal of Political Economy*, 1989, 97 (5), 1197–1207.
- Koch, Dirk-Jan and Lau Schulpen**, “An exploration of individual-level wage effects of foreign aid in developing countries,” *Evaluation and Program Planning*, 2018, 68, 233 – 242.
- Kumar, Vishwajeet, Saroj Mohanty, Aarti Kumar, Rajendra P Misra, Mathuram Santosham, Shally Awasthi, Abdullah H Baqui, Pramod Singh, Vivek Singh, Ramesh C Ahuja et al.**, “Effect of community-based behaviour change management on neonatal mortality in Shivgarh, Uttar Pradesh, India: a cluster-randomised controlled trial,” *The Lancet*, 2008, 372 (9644), 1151–1162.
- Kuziemko, Ilyana and Eric Werker**, “How Much is a Seat on the Security Council Worth? Foreign Aid and Bribery at the United Nations,” *Journal of Political Economy*, 2006, 114 (5), 905–930.
- Mays, Daniel C, Edward J O’Neil, Edison A Mworozzi, Benjamin J Lough, Zachary J Tabb, Ashlyn E Whitlock, Edward M Mutimba, and Zohray M Talib**, “Supporting and retaining Village Health Teams: an assessment of a community health worker program in two Ugandan districts,” *International journal for equity in health*, 2017, 16 (1), 129.



- Nancy, Gilles and Boriana Yontcheva**, “Does NGO Aid Go to the Poor? Empirical Evidence from Europe,” IMF Working Paper 39, International Monetary Fund 2006.
- Nunn, Nathan and Nancy Qian**, “US Food Aid and Civil Conflict,” *American Economic Review*, June 2014, 104 (6), 1630–66.
- Nyqvist, Martina Bjorkman, Jakob Svensson, and David Yanagizawa-Drott**, “Can good products drive out bad? evidence from local markets for (fake?) anti-malarial medicine in Uganda,” 2012.
- Payne, A. Abigail**, “Does the government crowd-out private donations? New evidence from a sample of non-profit firms,” *Journal of Public Economics*, September 1998, 69 (3), 323–345.
- Pfeiffer, James, Wendy Johnson, Meredith Fort, Aaron Shakow, Amy Hagopian, Steve Gloyd, and Kenneth Gimbel-Sherr**, “Strengthening health systems in poor countries: a code of conduct for nongovernmental organization,” *American Journal of Public Health*, 2008, 98 (12), 2134–40.
- Qian, Nancy**, “Making Progress on Foreign Aid,” *Annual Review of Economics*, 2015, 7 (1), 277–308.
- Rahman, Muhhamed**, “Management of NGOs: A Study in SAARC Countries,” Ph.D. Dissertation, University of Karachi 2003.
- Reichenbach, Laura and Shafiun Nahin Shimul**, “Sustaining Health: The Role of the NGO’s Community Health Volunteers in Bangladesh, Afghanistan and Uganda,” NGO Research Monograph Series 49, BRAC 2011.
- Sloan, Nancy L, Salahuddin Ahmed, Satindra N Mitra, Nuzhat Choudhury, Mushtaque Chowdhury, Ubaider Rob, and Beverly Winikoff**, “Community-based kangaroo mother care to prevent neonatal and infant mortality: a randomized, controlled cluster trial,” *Pediatrics*, 2008, 121 (5), e1047–e1059.

Table 1: NGO Time Allocation Across Tasks

**Table 39. CHP reported activities and how she spent her time in the last month**

Activity	Provided in the last month?	Average time to perform service	Average number of times provided	Average total number of minutes per month
Pregnancy identification	Yes – 98% No – 2%	25 minutes	7	175
Attending delivery and providing newborn care	Yes – 97% No – 3%	28 minutes	7	196
Referral to Government, NGO clinic or hospitals	Yes – 88% No – 12%	21 minutes	11	231
Attending refresher training <sup>8</sup>	Yes – 94% No – 6%	231 minutes	28	461
Selling medicines	Yes – 99% No – 1%	23 minutes	46	1058
Selling health commodities	Yes – 97% No – 3%	21 minutes	38	798

<sup>8</sup> Refresher trainings are held once a month; it is likely that some SSs included visits to the branch office to resupply in their response to this question which is why there are more than one time listed in the last month.

Source: Reichenbach and Shimul (2011).

Table 2: Baseline Summary Statistics

Sample:	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)		
	Mean	SD	All	SD	No NGO CHW	Mean	SD	NGO CHW	Mean	SD	NGO CHW	Mean	SD	P-value	No Gov't CHW	Mean	SD	Gov't CHW	Mean	SD	Gov't CHW	Mean	SD
<i>Number of villages</i>	127		61		66		73																
<b>A. Presence of health providers in the village</b>																							
Village is assigned to NGO CHW (1=yes)	0.52	0.50	0.00	0.00	1.00	0.00	1.00	0.00	0.56	0.50	0.49	0.50	0.50		0.56	0.50	0.49	0.50	0.49	0.50	0.49	0.50	0.50
Presence of a Gov't CHW (1=yes)	0.57	0.50	0.61	0.49	0.55	0.50	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00
Presence of a Traditional Healer (1=yes)	0.48	0.50	0.49	0.50	0.47	0.50	0.85	0.37	0.49	0.56	0.56	0.50	0.50	0.85	0.37	0.49	0.56	0.50	0.56	0.50	0.56	0.50	0.50
Presence of a Drug Store (1=yes)	0.68	0.47	0.72	0.45	0.64	0.48	0.45	0.64	0.48	0.38	0.56	0.50	0.50	0.45	0.83	0.38	0.56	0.50	0.56	0.50	0.56	0.50	0.50
Gov't Hospital is less than 10km away (1=yes)	0.56	0.50	0.64	0.48	0.48	0.50	0.51	0.59	0.50	0.50	0.53	0.50	0.50	0.51	0.59	0.50	0.53	0.50	0.53	0.50	0.53	0.50	0.50
Distance to closest Gov't Hospital if <10km	8.05	14.07	7.25	9.27	8.79	17.42	0.99	8.42	19.31	7.78	8.46	8.46	8.46	0.99	8.42	19.31	7.78	8.46	7.78	8.46	7.78	8.46	8.46
Gov't Health Center is less than 10km away (1=yes)	0.72	0.45	0.70	0.46	0.73	0.45	0.53	0.57	0.50	0.82	0.39	0.82	0.39	0.53	0.57	0.50	0.82	0.39	0.82	0.39	0.82	0.39	0.39
Distance to closest Gov't Health Center if <10km	6.72	10.91	6.96	12.64	6.50	9.12	0.81	6.36	5.82	6.98	13.53	6.98	13.53	0.81	6.36	5.82	6.98	13.53	6.98	13.53	6.98	13.53	13.53
Private Clinic is less than 10km away (1=yes)	0.86	0.35	0.85	0.36	0.86	0.35	0.00	0.91	0.29	0.82	0.39	0.82	0.39	0.00	0.91	0.29	0.82	0.39	0.82	0.39	0.82	0.39	0.39
Distance to closest Private Clinic if <10km	1.91	2.23	1.45	1.81	2.33	2.50	0.18	1.59	1.99	2.17	2.40	2.17	2.40	0.18	1.59	1.99	2.17	2.40	2.17	2.40	2.17	2.40	2.40
<b>B. Household composition and mortality (from census data)</b>																							
Number of households (HHs) in the village	182.07	125.45	189.28	146.53	175.41	102.93	0.55	229.52	159.69	146.97	76.38	146.97	76.38	0.55	229.52	159.69	146.97	76.38	146.97	76.38	146.97	76.38	76.38
Number of children under-5 per HH	1.63	0.19	1.62	0.19	1.64	0.20	0.90	1.52	0.16	1.71	0.17	1.71	0.17	0.90	1.52	0.16	1.71	0.17	1.71	0.17	1.71	0.17	0.17
Number of infants (under-1) per HH	0.29	0.09	0.29	0.08	0.29	0.10	0.74	0.31	0.08	0.28	0.10	0.28	0.10	0.74	0.31	0.08	0.28	0.10	0.28	0.10	0.28	0.10	0.10
Number of children under-5 per HH who died in past year	0.05	0.07	0.05	0.08	0.05	0.07	0.48	0.02	0.04	0.07	0.08	0.07	0.08	0.48	0.02	0.04	0.07	0.08	0.07	0.08	0.07	0.08	0.08
Number of infants per HH who died in past year	0.04	0.06	0.04	0.07	0.04	0.05	0.61	0.02	0.04	0.06	0.07	0.07	0.07	0.61	0.02	0.04	0.06	0.07	0.06	0.07	0.06	0.07	0.07
% female HH heads who gave birth in the past 2 years (1=yes)	0.54	0.12	0.54	0.12	0.54	0.12	0.46	0.51	0.10	0.56	0.13	0.56	0.13	0.46	0.51	0.10	0.56	0.13	0.56	0.13	0.56	0.13	0.13
Age of female HH head	31.16	3.00	31.08	3.07	31.23	2.96	0.54	30.08	3.18	31.96	2.61	31.96	2.61	0.54	30.08	3.18	31.96	2.61	31.96	2.61	31.96	2.61	2.61
% HHs involved in farming as main activity	0.57	0.38	0.53	0.37	0.60	0.40	0.18	0.36	0.40	0.72	0.29	0.72	0.29	0.18	0.36	0.40	0.72	0.29	0.72	0.29	0.72	0.29	0.29
% HHs who are catholic	0.57	0.20	0.57	0.20	0.58	0.21	0.92	0.50	0.17	0.63	0.21	0.63	0.21	0.92	0.50	0.17	0.63	0.21	0.63	0.21	0.63	0.21	0.21

Notes: This table reports summary statistics in the overall sample of 127 villages, and in the subsample of villages assigned (not assigned) to the NGO CHW at baseline and with/ without a Government CHW at baseline. P-values are based on regressions of baseline variable on the dummy treatment with branch (area) fixed effects as controls and robust standard errors. Panel B collapses household census data at the village level.

Table 3: The Effect of  $VHT_i \times NGO_i$  on Labor Supply of Community Health Workers

	Dependent Variable: Presence of health providers at endline in the village				
	(1)	(2)	(3)	(4)	(5)
	Gov't or NGO [takes value 0, 1 or 2]	Gov't CHW [takes value 0 or 1]	NGO CHW [takes value 0 or 1]	Traditional healer [takes value 0 or 1]	Drug store [takes value 0 or 1]
Mean Dep.Var.	0.945	0.425	0.512	0.236	0.512
Gov't	0.791*** (0.074)	0.791*** (0.074)	-0.048 (0.046)	-0.003 (0.135)	-0.002 (0.101)
NGO	0.980*** (0.027)	-0.020 (0.027)	0.987*** (0.016)	0.027 (0.122)	-0.011 (0.096)
Gov't * NGO	-0.446*** (0.099)	-0.446*** (0.099)	-0.016 (0.020)	-0.120 (0.158)	0.013 (0.122)
Observations	127	127	127	127	127
R-squared	0.798	0.709	0.973	0.210	0.663
[1] Mean omitted group: 0 Gov't + 0 NGO	0.000	0.000	0.000	0.292	0.792
[2] Predicted Mean: 1 Gov't + 0 NGO	0.791	0.791	-0.048	0.288	0.789
[3] Predicted Mean: 0 Gov't + 1 NGO	0.980	-0.020	0.987	0.319	0.781
[4] Predicted Mean: 1 Gov't + 1 NGO	1.325	0.325	0.923	0.195	0.791
[4]-[2] p-value: NGO + NGO*Gov't	0.000	0.000	-	0.339	0.975
[4]-[3] p-value: Gov't + NGO*Gov't	0.000	0.000	-	0.330	0.906
[4]-[1] p-value: Gov't + NGO + NGO*Gov't	0.000	0.001	-	0.480	0.999
[2]-[3] p-value: Gov't - NGO	0.004	0.000	-	0.804	0.918

Notes: Village-level regressions. All regressions are OLS and control for branch (area) fixed effects. Robust standard errors in parenthesis. Independent variables: Gov't =1 if village had a Gov't CHW at baseline; NGO =1 if village was assigned to NGO CHW at baseline. Dependent variables: presence of Gov't CHW / NGO CHW / Traditional healer / Drug store in the village at endline. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 4: The Effect of  $VHT_i \times NGO_i$  on Health Services

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample:	All households	Households with a woman who delivered in the past year	All households	All households	Households with a pregnant woman	All households	Households with a pregnant woman	Households with a pregnant woman
Dependent Variable:	Presence in the household of a woman who delivered in the past year (1=yes)	Delivered in the hospital (1=yes)	Delivery was assisted by a health professional (1=yes)	Received post-natal visit within 2 days of birth (1=yes)	Breastfeeds child (1=yes)	Presence in the household of a woman who is pregnant (1=yes)	Received ante-natal visit (1=yes)	Takes anti-malarials during pregnancy (1=yes)
<b>Mean Dep. Var.</b>	<b>0.148</b>	<b>0.744</b>	<b>0.533</b>	<b>0.265</b>	<b>0.995</b>	<b>0.100</b>	<b>0.928</b>	<b>0.580</b>
Gov't	0.028 (0.026)	-0.053 (0.067)	0.355*** (0.106)	0.224*** (0.080)	-0.014 (0.012)	0.048** (0.022)	0.170** (0.073)	-0.070 (0.085)
NGO	0.014 (0.017)	0.045 (0.062)	0.200* (0.105)	0.128** (0.063)	-0.018 (0.019)	0.012 (0.019)	0.157** (0.070)	-0.018 (0.066)
Gov't * NGO	-0.053 (0.034)	-0.049 (0.088)	-0.257** (0.116)	-0.216* (0.110)	0.027 (0.021)	-0.045 (0.029)	-0.162** (0.079)	-0.092 (0.110)
Observations	2,747	407	407	407	407	2,747	276	276
R-squared	0.098	0.143	0.105	0.181	0.044	0.009	0.108	0.071
[1] Mean omitted group: 0 Gov't + 0 NGO	0.078	0.795	0.364	0.045	1.000	0.092	0.827	0.673
[2] Predicted Mean: 1 Gov't + 0 NGO	0.106	0.743	0.719	0.269	0.986	0.139	0.997	0.604
[3] Predicted Mean: 0 Gov't + 1 NGO	0.091	0.840	0.564	0.173	0.982	0.104	0.984	0.655
[4] Predicted Mean: 1 Gov't + 1 NGO	0.067	0.738	0.662	0.181	0.995	0.107	0.993	0.493
[4]-[2] p-value: NGO + NGO*Gov't	0.175	0.944	0.300	0.304	0.287	0.141	0.896	0.208
[4]-[3] p-value: Gov't + NGO*Gov't	0.399	0.093	0.228	0.930	0.169	0.917	0.839	0.068
[4]-[1] p-value: Gov't + NGO + NGO*Gov't	0.709	0.461	0.009	0.119	0.703	0.579	0.021	0.053
[2]-[3] p-value: Gov't - NGO	0.573	0.035	0.043	0.218	0.599	0.103	0.757	0.517

Notes: Household-level regressions. All regressions are OLS and control for branch (area) fixed effects. Standard errors clustered at village level presented in parenthesis.

Independent variables: Gov't =1 if village had a Gov't CHW at baseline; NGO =1 if village was assigned to NGO CHW at baseline. Dependent variables: questions on access to delivery and post-natal services were asked only to households in which a woman delivered in the year preceding endline; questions on pre-natal services were asked only to households in which a woman was pregnant at endline. In 0.2% of the households, more than one woman delivered in the past year in which case we collapse woman-level data at the household level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 5: The Effect of  $VHT_i \times NGO_i$  Child Mortality

	Dependent Variable						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Number of CHWs (Gov't or NGO) present in the village [takes value 0, 1 or 2]	Household sought medical advice from any CHW in the past year (1=yes)	Delivery was assisted by a health professional (1=yes)	Received post-natal visit within 2 days of birth (1=yes)	Received ante- natal visit (1=yes)	At least one infant died	# Infants who died as share of births (%)
<b>Mean Dep. Var.</b>	<b>0.945</b>	<b>0.457</b>	<b>0.533</b>	<b>0.265</b>	<b>0.928</b>	<b>0.040</b>	<b>0.088</b>
Gov't	0.782*** (0.118)	0.389*** (0.062)	0.449*** (0.093)	0.484*** (0.097)	0.319*** (0.081)	-0.050*** (0.013)	-0.128*** (0.040)
NGO	0.462 (0.989)	-0.105 (0.536)	1.710** (0.798)	-0.788 (0.926)	0.362 (0.592)	0.238 (0.146)	0.414 (0.315)
Gov't * NGO	-0.506*** (0.164)	-0.425*** (0.075)	-0.465*** (0.116)	-0.570*** (0.118)	-0.298*** (0.094)	0.052*** (0.017)	0.138*** (0.049)
Observations	127	2,747	407	407	276	2,747	936
R-squared	0.841	0.299	0.156	0.307	0.226	0.037	0.116
Additional Controls: X & NGO * X	Y	Y	Y	Y	Y	Y	Y
X={Access to health providers}*	Y	Y	Y	Y	Y	Y	Y
X={Village size and composition}**	Y	Y	Y	Y	Y	Y	Y
X={Under-5 mortality}***	Y	Y	Y	Y	Y	Y	Y
X={HH characteristics}****	Y	Y	Y	Y	Y	Y	Y

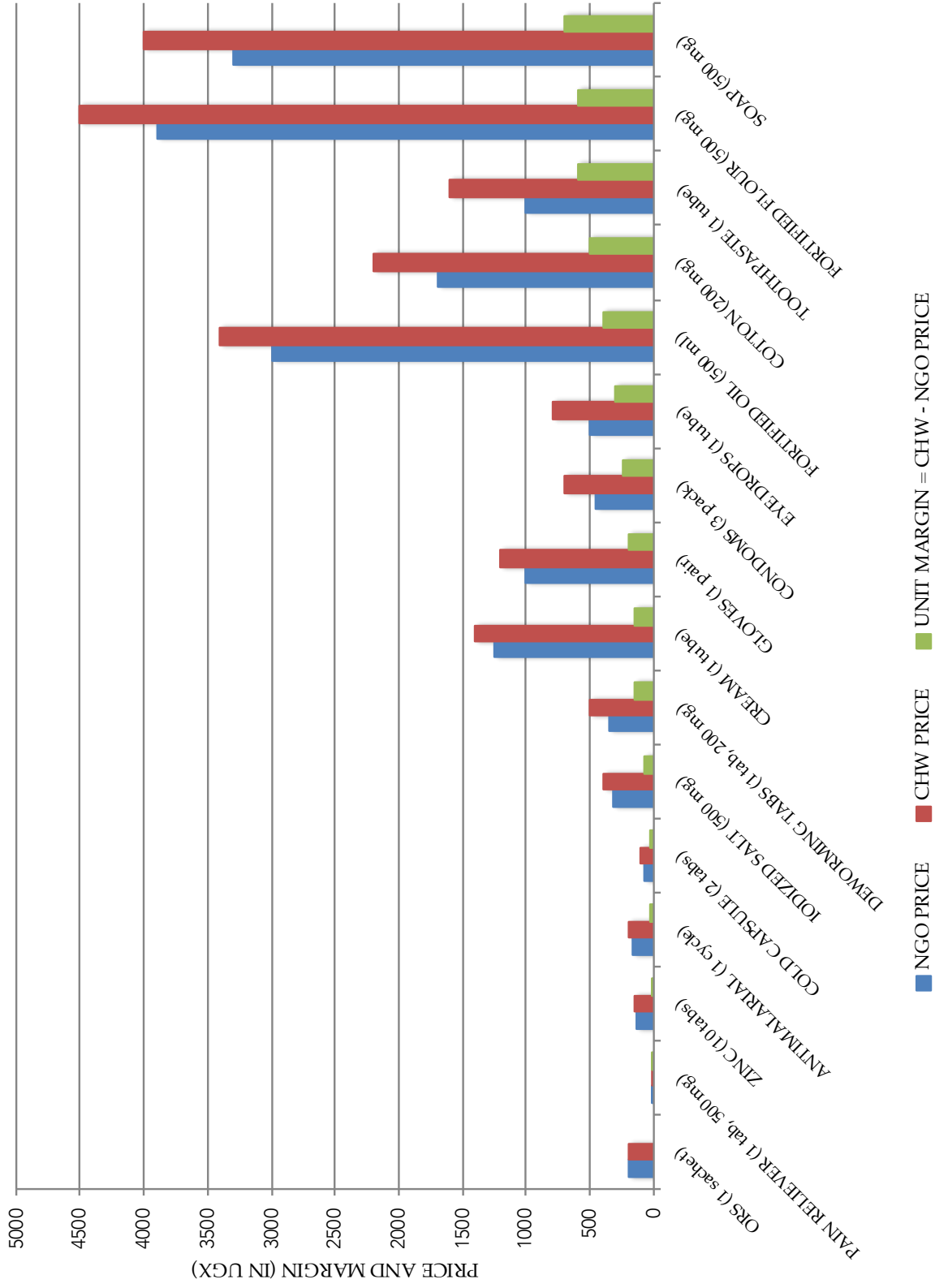
Notes: Household-level regressions. All regressions are OLS and control for branch (area) fixed effects. Standard errors clustered at village level presented in parenthesis. Independent variables: Gov't =1 if village had a Gov't CHW at baseline; NGO =1 if village was assigned to NGO CHW at baseline. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1  
 \*X={Distance to closest Gov't Hospital, Distance to closest Gov't Health Center, Distance to closest Private Clinic, Presence of a Drug Store, Presence of a Traditional Healer}  
 \*\*X={Number of HHs, Number of children under-5 per HH, Number of infants per HH}  
 \*\*\*X={Number of children under-5/under-1 per HH who died in past year}  
 \*\*\*\*X={Age of female HH head, % HHs involved in farming as main activity, % HHs who are catholic}

Table 6: The Effect of  $VHT_i \times NGO_i$  on Labor Supply of Community Health Workers, Service Delivery and Mortality – Robustness to Controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent Variable						
	Number of CHWs (Gov't or NGO) present in the village [takes value 0, 1 or 2]	Household sought medical advice from any CHW in the past year (1=yes)	Delivery was assisted by a health professional (1=yes)	Received post-natal visit within 2 days of birth (1=yes)	Received ante-natal visit (1=yes)	At least one infant died	# Infants who died as share of births (%)
<b>Mean Dep. Var.</b>	<b>0.945</b>	<b>0.457</b>	<b>0.533</b>	<b>0.265</b>	<b>0.928</b>	<b>0.040</b>	<b>0.088</b>
Gov't	0.782*** (0.118)	0.389*** (0.062)	0.449*** (0.093)	0.484*** (0.097)	0.319*** (0.081)	-0.050*** (0.013)	-0.128*** (0.040)
NGO	0.462 (0.989)	-0.105 (0.536)	1.710** (0.798)	-0.788 (0.926)	0.362 (0.592)	0.238 (0.146)	0.414 (0.315)
Gov't * NGO	-0.506*** (0.164)	-0.425*** (0.075)	-0.465*** (0.116)	-0.570*** (0.118)	-0.298*** (0.094)	0.052*** (0.017)	0.138*** (0.049)
Observations	127	2,747	407	407	276	2,747	936
R-squared	0.841	0.299	0.156	0.307	0.226	0.037	0.116
Additional Controls: X & NGO * X	Y	Y	Y	Y	Y	Y	Y
X={Access to health providers}* X={Village size and composition}**	Y	Y	Y	Y	Y	Y	Y
X={Under-5 mortality}***	Y	Y	Y	Y	Y	Y	Y
X={HH characteristics}****	Y	Y	Y	Y	Y	Y	Y

Notes: Household-level regressions. All regressions are OLS and control for branch (area) fixed effects. Standard errors clustered at village level presented in parenthesis. Independent variables: Gov't =1 if village had a Gov't CHW at baseline; NGO =1 if village was assigned to NGO CHW at baseline. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1  
\*X={Distance to closest Gov't Hospital, Distance to closest Gov't Health Center, Distance to closest Private Clinic, Presence of a Drug Store, Presence of a Traditional Healer}  
\*\*X={Number of HHs, Number of children under-5 per HH, Number of infants per HH}  
\*\*\*X={Number of children under-5/under-1 per HH who died in past year}  
\*\*\*\*X={Age of female HH head, % HHs involved in farming as main activity, % HHs who are catholic}

Figure 1: Unit Price & Margin per Product Sold by the NGO CHWs



Notes: This figure presents the list of products sold by the NGO CHWs, ranked from lowest to highest unit margin. The unit margin equals the price at which the CHW sells the products in her community ("CHW price") minus the price at which she buys the products from the NGO ("NGO price"). Prices are expressed in Ugandan Shillings (1\$=3,713 UGX).



Table A.1: Allocation of NGOs and VHTs Across Villages

Sample =>	All villages (N=127)		Villages not assigned to NGO CHW at baseline (N=61)		Villages assigned to NGO CHW at baseline (N=66)	
	Villages not assigned to NGO CHW at baseline	Villages assigned to NGO CHW at baseline	Villages without a Gov't CHW at endline	Villages with a Gov't CHW at endline	Villages without a Gov't CHW at endline	Villages with a Gov't CHW at endline
Villages without a Gov't CHW at baseline	19% (N=24)	23% (N=30)	40% (N=24)	0% (N=0)	45% (N=30)	0% (N=0)
Villages with a Gov't CHW at baseline	29% (N=37)	28% (N=28)	3% (N=2)	57% (N=35)	26% (N=17)	29% (N=10)

Notes: This table reports the number of villages by presence of a Government CHW at baseline / endline and by assignment to the NGO CHW.

Table A.2: Descriptive Statistics

Sample of villages =>	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)		(12)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	P-value diff.	
<i>Number of HHs interviewed at baseline and endline</i>	2,747		1,338		1,409		1,472		1,472		1,472		1,472		1,472		1,472		1,472		1,472			
<b>Household characteristics and composition</b>																								
Number of children under-5 in the HH	1.56	0.82	1.57	0.81	1.55	0.83	0.78	0.78	1.50	0.80	1.61	0.83	0.85	0.85	1.50	0.80	1.61	0.83	0.85	0.85	0.85	0.85	0.85	
Number of infants (under-1) in the HH	0.29	0.49	0.28	0.48	0.30	0.51	0.53	0.53	0.30	0.49	0.29	0.49	0.87	0.87	0.30	0.49	0.29	0.49	0.87	0.87	0.87	0.87	0.87	
HH member is pregnant (1=yes)	0.10	0.30	0.11	0.32	0.09	0.29	0.09	0.09	0.09	0.28	0.11	0.32	0.89	0.89	0.09	0.28	0.11	0.32	0.89	0.89	0.89	0.89	0.89	
HH head is married (1=yes)	0.82	0.38	0.82	0.38	0.82	0.38	0.90	0.90	0.78	0.42	0.86	0.35	0.32	0.32	0.78	0.42	0.86	0.35	0.32	0.32	0.32	0.32	0.32	
Age of HH head	35.55	10.80	35.67	11.00	35.44	10.61	36.23	36.23	34.81	10.11	36.23	11.36	0.22	0.22	34.81	10.11	36.23	11.36	0.22	0.22	0.22	0.22	0.22	
Highest education level attended by HH head (1 to 6)	2.24	1.45	2.29	1.45	2.19	1.45	0.90	0.90	2.62	1.40	1.90	1.40	0.19	0.19	2.62	1.40	1.90	1.40	0.19	0.19	0.19	0.19	0.19	
HH has covered latrines (1=yes)	0.60	0.49	0.61	0.49	0.58	0.49	0.73	0.73	0.55	0.50	0.63	0.48	0.68	0.68	0.55	0.50	0.63	0.48	0.68	0.68	0.68	0.68	0.68	
HH house: high quality exterior walls material (1=yes)	0.47	0.50	0.49	0.50	0.45	0.50	0.98	0.98	0.68	0.47	0.29	0.46	0.58	0.58	0.68	0.47	0.29	0.46	0.58	0.58	0.58	0.58	0.58	
HH house: high quality floor material (1=yes)	0.48	0.50	0.50	0.50	0.46	0.50	0.84	0.84	0.70	0.46	0.30	0.46	0.58	0.58	0.70	0.46	0.30	0.46	0.58	0.58	0.58	0.58	0.58	
HH house: high quality roof material (1=yes)	0.64	0.48	0.66	0.47	0.62	0.48	0.90	0.90	0.80	0.40	0.50	0.50	0.97	0.97	0.80	0.40	0.50	0.50	0.97	0.97	0.97	0.97	0.97	
Number of assets owned (1 to 11)	5.87	2.81	6.00	2.79	5.75	2.81	0.92	0.92	6.52	2.44	5.31	2.97	0.44	0.44	6.52	2.44	5.31	2.97	0.44	0.44	0.44	0.44	0.44	
Food security (1 to 4)	2.32	0.88	2.35	0.88	2.29	0.87	0.40	0.40	2.58	0.81	2.08	0.87	0.98	0.98	2.58	0.81	2.08	0.87	0.98	0.98	0.98	0.98	0.98	
<b>Access of health services</b>																								
HH sought medical advice from [...] in the past year (1=yes)																								
Gov't CHW	0.03	0.18	0.03	0.17	0.03	0.18	0.39	0.39	0.01	0.12	0.05	0.21	0.47	0.47	0.01	0.12	0.05	0.21	0.47	0.47	0.47	0.47	0.47	
NGO CHW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Traditional healer	0.02	0.15	0.02	0.15	0.02	0.15	0.70	0.70	0.01	0.12	0.03	0.17	0.63	0.63	0.01	0.12	0.03	0.17	0.63	0.63	0.63	0.63	0.63	
Drug store	0.15	0.35	0.16	0.37	0.13	0.34	0.84	0.84	0.17	0.38	0.13	0.33	0.89	0.89	0.17	0.38	0.13	0.33	0.89	0.89	0.89	0.89	0.89	
Government hospital / health center	0.50	0.50	0.51	0.50	0.49	0.50	0.65	0.65	0.43	0.49	0.56	0.50	0.48	0.48	0.43	0.49	0.56	0.50	0.48	0.48	0.48	0.48	0.48	
Private clinic	0.39	0.49	0.40	0.49	0.38	0.48	0.97	0.97	0.44	0.50	0.34	0.47	0.56	0.56	0.44	0.50	0.34	0.47	0.56	0.56	0.56	0.56	0.56	
Self-reported constraints to getting medical advice or treatment																								
Cannot afford costs of treatments (1=yes)	0.76	0.43	0.78	0.42	0.74	0.44	0.10	0.10	0.73	0.44	0.78	0.41	0.64	0.64	0.73	0.44	0.78	0.41	0.64	0.64	0.64	0.64	0.64	
Health facility is too distant (1=yes)	0.51	0.50	0.51	0.50	0.51	0.50	0.60	0.60	0.42	0.49	0.59	0.49	0.87	0.87	0.42	0.49	0.59	0.49	0.87	0.87	0.87	0.87	0.87	
Absence of health provider at the health facility (1=yes)	0.31	0.46	0.32	0.46	0.31	0.46	0.32	0.32	0.30	0.46	0.33	0.47	0.91	0.91	0.30	0.46	0.33	0.47	0.91	0.91	0.91	0.91	0.91	
Among women who delivered in the past year...																								
Delivered in the hospital (1=yes)	0.76	0.42	0.77	0.42	0.76	0.43	0.45	0.45	0.82	0.38	0.71	0.45	0.62	0.62	0.82	0.38	0.71	0.45	0.62	0.62	0.62	0.62	0.62	
Delivery was assisted by a health professional (1=yes)	0.66	0.47	0.66	0.47	0.66	0.48	0.34	0.34	0.74	0.44	0.59	0.49	0.51	0.51	0.74	0.44	0.59	0.49	0.51	0.51	0.51	0.51	0.51	
Received post-natal visit within 2 days of birth (1=yes)	0.12	0.33	0.11	0.31	0.13	0.34	0.17	0.17	0.11	0.32	0.13	0.34	0.92	0.92	0.11	0.32	0.13	0.34	0.92	0.92	0.92	0.92	0.92	
Breastfeeds child (1=yes)	1.00	0.07	1.00	0.05	0.99	0.08	0.32	0.32	0.99	0.07	1.00	0.07	0.25	0.25	0.99	0.07	1.00	0.07	0.25	0.25	0.25	0.25	0.25	
Among women who are pregnant...																								
Received ante-natal visit (1=yes)	0.64	0.48	0.64	0.48	0.64	0.48	0.84	0.84	0.75	0.43	0.57	0.50	0.10	0.10	0.75	0.43	0.57	0.50	0.10	0.10	0.10	0.10	0.10	
Takes antimalarials during pregnancy (1=yes)	0.53	0.50	0.54	0.50	0.52	0.50	0.90	0.90	0.57	0.50	0.50	0.50	0.95	0.95	0.57	0.50	0.50	0.50	0.95	0.95	0.95	0.95	0.95	
<b>Diseases and mortality among under-5 children</b>																								
Among HHs with at least one under-5 child...																								
Child suffered from cough in the past year (1=yes)	0.55	0.46	0.54	0.47	0.55	0.46	0.61	0.61	0.62	0.46	0.49	0.46	0.77	0.77	0.62	0.46	0.49	0.46	0.77	0.77	0.77	0.77	0.77	
Child suffered from diarrhea in the past year (1=yes)	0.28	0.42	0.28	0.41	0.29	0.42	0.79	0.79	0.27	0.41	0.30	0.42	0.56	0.56	0.27	0.41	0.30	0.42	0.56	0.56	0.56	0.56	0.56	
Child suffered from worms in the past year (1=yes)	0.31	0.44	0.31	0.44	0.31	0.44	0.65	0.65	0.34	0.45	0.29	0.43	0.58	0.58	0.34	0.45	0.29	0.43	0.58	0.58	0.58	0.58	0.58	
Child suffered from TB in the past year (1=yes)	0.01	0.10	0.01	0.10	0.01	0.08	0.11	0.11	0.01	0.08	0.01	0.11	0.08	0.08	0.01	0.08	0.01	0.11	0.08	0.08	0.08	0.08	0.08	
Child suffered from malaria in the past year (1=yes)	0.57	0.45	0.56	0.45	0.59	0.45	0.22	0.22	0.55	0.46	0.59	0.44	0.58	0.58	0.55	0.46	0.59	0.44	0.58	0.58	0.58	0.58	0.58	
Child with malaria was treated within 1 day of fever (1=yes)	0.63	0.47	0.61	0.47	0.65	0.47	0.18	0.18	0.62	0.46	0.65	0.46	0.93	0.93	0.62	0.46	0.65	0.46	0.93	0.93	0.93	0.93	0.93	
Children sleep under mosquito net to prevent malaria (1=yes)	0.67	0.47	0.68	0.46	0.66	0.47	0.29	0.29	0.66	0.47	0.68	0.47	0.81	0.81	0.66	0.47	0.68	0.47	0.81	0.81	0.81	0.81	0.81	
Children drink boiled water to avoid diarrhea (1=yes)	0.50	0.50	0.51	0.50	0.50	0.50	0.88	0.88	0.60	0.49	0.42	0.49	0.21	0.21	0.60	0.49	0.42	0.49	0.21	0.21	0.21	0.21	0.21	
At least one child under-5 died in the HH in past 2 years (1=yes)	0.05	0.21	0.05	0.22	0.05	0.21	0.53	0.53	0.04	0.20	0.05	0.23	0.84	0.84	0.04	0.20	0.05	0.23	0.84	0.84	0.84	0.84	0.84	
Number of children under-5 who died in the HH in past 2 years	0.06	0.31	0.06	0.30	0.06	0.31	0.98	0.98	0.05	0.29	0.07	0.32	0.73	0.73	0.05	0.29	0.07	0.32	0.73	0.73	0.73	0.73	0.73	
Number of children under-5 exposed to death in past 2 years	1.62	0.88	1.63	0.86	1.61	0.89	0.78	0.78	1.55	0.84	1.68	0.91	0.93	0.93	1.55	0.84	1.68	0.91	0.93	0.93	0.93	0.93	0.93	
Share of exposed children who died in past 2 years	0.02	0.11	0.03	0.11	0.02	0.11	0.89	0.89	0.02	0.11	0.03	0.11	0.97	0.97	0.02	0.11	0.03	0.11	0.97	0.97	0.97	0.97	0.97	
<i>Attrition (1=yes)</i>	0.27	0.44	0.26	0.44	0.28	0.45	0.42	0.42	0.21	0.41	0.31	0.46	0.33	0.33	0.21	0.41	0.31	0.46	0.33	0.33	0.33	0.33	0.33	

Notes: This table reports summary statistics in the sample of households who are interviewed both at baseline (2010) and at endline (2012) in all the 127 villages but also in the subsample of villages assigned (not assigned) to the NGO CHW at baseline and in villages with/without a Government CHW at baseline. P-values are based on regressions of baseline variable on the dummy treatment with branch (area) fixed effects as controls and standard errors clustered at the village level. Attrition rates between baseline and endline are reported at the bottom of the table and are balanced across village type.

Table A.3: The Effect of  $VHT_i \times NGO_i$  on Health Services – Logit Estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent Variable: Household sought medical advice from the following health provider in the past year (1=yes)						
	Any CHW (Gov't or NGO)	Gov't CHW	NGO CHW	Traditional healer	Drug store	Gov't hospital/ health center	Private clinic
<b>Mean Dep. Var.</b>	<b>0.457</b>	<b>0.313</b>	<b>0.235</b>	<b>0.014</b>	<b>0.143</b>	<b>0.384</b>	<b>0.337</b>
Gov't	2.096*** (0.300)	2.693*** (0.291)	-0.118 (0.320)	0.350 (0.749)	-0.159 (0.404)	-0.239 (0.256)	0.006 (0.193)
NGO	1.844*** (0.249)	-0.389 (0.309)	2.556*** (0.299)	0.626 (0.745)	-0.188 (0.360)	-0.142 (0.259)	-0.011 (0.201)
Gov't * NGO	-2.464*** (0.354)	-0.906* (0.468)	-0.692* (0.367)	0.033 (0.857)	0.042 (0.411)	-0.098 (0.304)	0.073 (0.273)
Observations	2,747	2,747	2,747	1,869	2,747	2,747	2,747
[1] Mean omitted group: 0 Gov't + 0 NGO	0.099	0.053	0.051	0.004	0.101	0.254	0.305
[2] Predicted Mean: 1 Gov't + 0 NGO	2.195	2.746	-0.067	0.353	-0.058	0.015	0.311
[3] Predicted Mean: 0 Gov't + 1 NGO	1.943	-0.336	2.607	0.629	-0.088	0.112	0.294
[4] Predicted Mean: 1 Gov't + 1 NGO	1.575	1.451	1.797	1.012	-0.205	-0.225	0.373
[4]-[2] p-value: NGO + NGO*Gov't	0.009	0.000	0.000	0.125	0.478	0.124	0.741
[4]-[3] p-value: Gov't + NGO*Gov't	0.123	0.000	0.000	0.497	0.745	0.095	0.727
[4]-[1] p-value: Gov't + NGO + NGO*Gov't	0.000	0.000	0.000	0.194	0.463	0.086	0.785
[2]-[3] p-value: Gov't - NGO	0.267	0.000	0.000	0.602	0.933	0.555	0.917

Notes: Household-level regressions. All regressions are logit regressions and control for branch (area) fixed effects. Standard errors clustered at village level presented in parenthesis. Independent variables: Gov't =1 if village had a Gov't CHW at baseline; NGO =1 if village was assigned to NGO CHW at baseline. Dependent variables: dummy for seeking advice from health provider in the year preceding the endline survey. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1