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ABSTRACT

We document that, in rural Uganda, the entry of foreign aid reduces government provision of similar services because the organization that delivers aid often hires the government worker, thereby reducing state capacity. Access to any public services and population well-being worsen in villages where such "poaching" occurs. In villages with no *ex ante* government presence, foreign aid has no effect on state capacity, increases access to any services and improves population well-being.

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1 Introduction

The efficacy of foreign aid, one of the most important policy tools with which rich countries can transfer resources to help poor ones, is one of the most controversial issues in development economics. During 1960-2013, OECD countries gave $3.5 trillion (2009 USD) of Official Development Assistance (OECD, 2015). Over approximately fifty years, African nations received $568 billion (2003 USD) (e.g., Easterly, 2003). Critics point out that aid has failed in its ultimate goal of achieving sustainable development, and may even have unintentionally *increased* dependence on foreign assistance (e.g., Deaton, 2013; Easterly, 2003; Moyo and Ferguson, 2009). A well-known argument is that the availability of foreign aid may reduce a government's incentive to make the necessary investments in state capacity and institutional quality required for development (e.g., Svensson, 2000). A distinct, but related, criticism is that aid is often allocated based on the strategic objectives of donors rather than the needs of the recipient countries (e.g., Alesina and Dollar, 2000; Kuziemko and Werker, 2006; Nunn and Qian, 2014).[1] Partly in response to these criticisms, the amount of aid from major donors disbursed by non-government organizations (NGOs), which are more independent from donor country objectives (e.g., Faye and Niehaus, 2012; Werker and Ahmed, 2008), have quadrupled in the past twenty years (e.g., Werker and Ahmed, 2008).[2]

NGOs are meant to function as a stopgap until the government can provide similar services in the long run and have become essential in assisting the poor in many countries. Their rising prominence has been accompanied by increasing scrutiny and criticism. Aid workers have noted the lack of coordination between NGOs and recipient governments and that NGOs often compete with the government over scarce resources. A common example is that NGOs poach workers from the public sector by offering much higher wages than the local labor market (Carnahan, Durch, and Gilmore, 2006; Koch and Schulpen, 2018).[3] The public health community has been

[1] Dreher, Klasen, Vreeland, and Werker (2013) finds that politically driven World Bank aid is less effective.

[2] For example, also see Pfeiffer, Johnson, Fort, Shakow, Hagopian, Gloyd, and Gimbel-Sherr (2008).

[3] For example, Koch and Schulpen (2018) surveys foreign NGOs funded by the Dutch bilateral

particularly vocal. Prominent members have called for NGOs to "Limit hiring of public systems", "Limit pay inequity between the public and private sectors" and "Commit to joint planning [with the recipient government]" (Pfeiffer, Johnson, Fort, Shakow, Hagopian, Gloyd, and Gimbel-Sherr, 2008). Farmer (2008) argues that NGOs can reduce state capacity of the recipient country by taking away valuable resources from the government: "The NGOs that fight for the right to health care by serving the African poor directly frequently do so at the expense of the public sector. Their efforts too often create a local brain drain by luring nurses, doctors, and other professionals from the public hospitals to 'NGO land', where salaries are better". In a recent book, Moyo and Ferguson (2009) worry that "A short-term efficacious intervention [...] can unintentionally undermine whatever fragile change for sustainable development may already be in play".[4]

Existing arguments are mostly impressionistic or based on anecdotal evidence because of three main challenges: measurement, data limitations and establishing the causal effect of aid. State capacity is traditionally defined as the ability for a state to raise taxes (e.g., to wage war) (Tilly, 1993), which may be difficult to measure at sub-national levels and less relevant in the very poor countries that receive aid. Establishing the causal impact of foreign aid is often confounded by the endogeneity of aid allocation to local conditions. If foreign aid is allocated to places with low state capacity, then the negative association between aid and state capacity will capture reverse-causal effects. Low state capacity and aid receipts may also be jointly determined by a third factor, such as a history of armed conflict. Moreover, we note that most of the empirical literature on foreign aid relies on country-level data, which may be too crude to capture important heterogeneity such as the ability of the recipient government to provide similar services when aid enters a region.[5]

The primary contribution of this paper is to make progress on understanding how foreign aid affects state capacity with rigorous and novel empirical evidence. Like Besley and Persson (2010), our definition of state capacity expands beyond the

agency and documents that they pay high-skilled (low-skilled) staff five to seven times (two to three times) more than the local labor market. Carnahan, Durch, and Gilmore (2006) show that international organizations and NGOs pay more than 10 times government wages in Sierra Leone, Burundi, Liberia, and the DRC, and pay twice as much in Haiti and Timor-Leste. Another concern is that NGOs can create inefficiencies by replicating government services (e.g., Rahman, 2003; Pfeiffer, Johnson, Fort, Shakow, Hagopian, Gloyd, and Gimbel-Sherr, 2008).

[4]We provide more examples in Section 2.

[5]We discuss the literature at the end of this Section.

original definition of Tilly (1993). A key function of the government in very poor communities is to provide basic local public goods. We measure state capacity as the supply of government health workers and basic health services. Compared to existing studies of aid, our household and village-level data are more detailed and granular. This will help us measure underlying heterogeneity important for understanding the effects of aid and the underlying mechanisms.

To establish causality, we exploit random variation in foreign aid entry across very poor communities in rural Uganda, where the only sources of modern medical care are government and aid workers. As is often the case, aid rollout did not take into account existing public infrastructure.[6] There was a pre-existing government worker in half of the villages prior to aid entry. The foreign NGO that delivers aid has similar aims and provides similar health services as the government: improve basic health care and outcomes, such as infant mortality. Both organizations only hire local agents to work part time. Government workers, like part-time local public goods providers in many other contexts, are unpaid volunteers.[7]

To investigate the effect of foreign aid on state capacity, we estimate the effect of aid entry on the number of health workers and health services from the government. The effects are ambiguous *ex ante*. On the one hand, the concerns we discussed earlier suggest negative effects. On the other hand, entry could stimulate the interests of local villagers to become health workers, for example, by demonstrating the usefulness of the services for improving their neighbors' well-being. Since the effect can differ depending on whether there was already a government worker, we divide our sample into villages with and without a pre-existing government worker.

We find that in villages with a pre-existing government worker, aid entry reduces the number of government workers and the probability that a household receives health care from a government health worker by 25 percentage-points. This is explained by the fact that the NGO hires the government health worker in approximately half of the villages, and provides strong evidence in support of concerns of poaching. In villages without any pre-existing health worker, aid has no effect on the number

[6] See Section 2 for a background discussion.

[7] Volunteer-provided local public services are prevalent in rich and poor countries: e.g., volunteer tax collectors in Pakistan (Khan, Khwaja, and Olken, 2015); election poll workers, police auxiliaries, firefighters, recreation program staff, library aides, and senior citizen center assistants in the United States (Duncombe, 1985); community-based health workers and agriculture extension workers across developing countries (Bhutta, Lassi, Pariyo, and Huicho, 2010; Gilmore and McAuliffe, 2013; Leon, Sanders, Van Damme, Besada, Daviaud, Oliphant, Berzal, Mason, and Doherty, 2015).

of government health workers. These results support the concern that aid reduces state capacity, and provide no support for positive spillover effects of foreign aid on government capacity. Note that like many other contexts where aid is most needed, overall state capacity in Uganda is very low. The government does not have centralized data on the locations of government or aid workers, or the capacity to efficiently redirect resources to locations without foreign aid.[8]

The implications for policy are not straightforward since policy makers need to balance the negative effect of foreign aid on state capacity and future aid dependence with the short-run impact of aid on population well-being. The latter will be positive if aid workers provide better care than government workers. The remainder of the paper addresses this by examining the impact of aid on total service access and health outcomes. These effects depend on whether aid workers offset the reduction in government services by providing higher quantity and/or quality of services, which, in turn, depend on the incentives for aid workers to provide health care.

One advantage of our context is that the NGO we study uses a popular, and thus policy-relevant business model. The aid worker sells commodities during household healthcare visits, which saves distribution costs for the NGO and search costs for useful health products (which are often only available in urban areas) for poor rural households. Profits from sales help fund the free-of-charge health services. This increases financial sustainability while reinforcing one of the main perceived strengths of NGOs over traditional bilateral aid – independence from the strategic objectives and constraints of institutional donors. The so-called "dual-task," "direct selling" or "Avon" model of aid has been applauded by the highest levels of the aid community, the popular press and widely adopted by prominent NGOs across the world.[9]

We find that in villages with no pre-existing government health worker, NGO entry increases total access to health services and improves health outcomes. In villages with a pre-existing government health worker, access declines and health outcomes (e.g., infant mortality) worsen when the NGO hires the government worker. These findings are consistent with the main results on state capacity and the concern that foreign aid can be harmful in places where resources – in our case, skilled workers – are most scarce. Furthermore, they show that aid can reduce well-being if aid

[8]See Background Section 2.2.

[9]The dual-task model is used by the two largest international NGOs and has received positive press coverage and numerous awards. See Section 5 for more discussion.

workers are not given the appropriate incentives for delivering services to the poor.[10] We provide a detailed interpretation and discussion of the results in Section 6.

The estimates are specific to the context of our study. At the same time, we note that the main features of our environment – low overall government capacity, higher pay for aid workers than government workers and the dual-task model – are common where foreign aid is most important, and, thus, relevant.

This study is the first to provide rigorous micro empirical evidence of the effect of foreign aid on state capacity. We add to the large empirical literature on aid efficacy.[11] In examining state capacity, we are related to two recent studies. Young and Padilla (2019) finds that there is no cross-country relationship between aid and state capacity, where the latter is defined as the ability to collect taxes. Emphasizing the importance of state capacity for poor countries, Guariso and Verpoorten (2018) finds that domestic policies to boost coffee production and quality contributed more to recent Rwandese economic growth than external factors such as aid. Empirical studies on aid dependence mostly focus on outcomes such as corruption (e.g., Andersen, Johannesen, and Rijkers, 2020; Svensson, 1999a), democracy (e.g., Kersting and Kilby, 2014; Knack, 2004; Svensson, 1999b) and institutional quality (e.g., Jones and Tarp, 2016; Werker, 2012). We are the first to provide rigorous evidence on the poaching of government workers by aid organizations, the importance of NGO and government coordination and labor market distortions for aid efficacy.[12]

In attempting to improve identification and measurement by using sub-national-level data, we add to several recent studies. Dube and Naidu (2015) finds a positive relationship between U.S. military aid and conflict in Colombia. Crost, Felter, and Johnston (2014) finds that aid increases conflict mortality in the Philippines. Beath, Christia, and Enikolopov (2011) finds that aid has heterogeneous effects on insurgen-

[10] This is consistent with recent observations that commercial activities can crowd out health services in the dual-task model (Reichenbach and Shimul, 2011; Wagnerly, Asiimwe, and Levine, 2020).

[11] The evidence from the voluminous literature is mixed. For well-known studies, see, for example Stern (1974), Bauer (1975), Boone (1996), Collier and Hoeffler (2004), Svensson (1999a), Burnside and Dollar (2000), Easterly (2003), Easterly, Levine, and Roodman (2004), and Sachs (2006). See the literature overviews by Easterly (2009) and Qian (2015) for additional references.

[12] Existing studies have argued for better coordination between donors (e.g., Bigsten and Tengstam, 2015) or between NGOs (Barr and Fafchamps, 2006). The notion that foreign aid can distort local labor markets has been raised in several theoretical studies (e.g., Knack and Rahman, 2004; Koch and Schulpen, 2018), case studies and descriptive studies (e.g., Dollar and Pritchett, 1998; Harris, 2006).

cies depending on the insurgent's location in Afghanistan. Lowes and Montero (2018) finds that a negative colonial legacy reduces the effectiveness of World Bank projects in the D.R.C. Cruzatti, Dreher, and Matzat (2020) finds that regions in Africa that receive Chinese project aid experience increases in infant mortality relative to other regions. In examining the causal effect of aid in the sub-Saharan African context, we add to Nunn and Qian (2014)'s cross-country evidence that U.S. food aid can increase conflict.

We also contribute to the relatively new and rapidly growing literature on the origins of state capacity (e.g., Besley and Persson, 2009, 2010). In using detailed micro data to study a context where capacity is in its infancy and potentially fragile, we add to recent evidence about the origins of rudimentary state formation (Sanchez-de-la-Sierra, 2019), the effect of citizen voice on the willingness to pay taxes (Weigel, 2020) and the influence of historical institutions on contemporary values for state functions (Lowes, Nunn, Robinson, and Weigel, 2017) in the Democratic Republic of Congo.

The paper is organized as follows. Section 2 describes the context. Section 3 describes the data and provides descriptive statistics. Section 4 presents the main results on state capacity. Section 5 presents the results on total service access and health outcomes. Section 6 interprets the results. Section 7 concludes.

2 Background

2.1 Some Examples

Aid workers are often paid much more than local market wages. For example, Koch and Schulpen (2018) examines salaries in the D.R.C. and documents that the entry-level national civil servant salary is approximately $78 USD per month, while lower skilled workers (e.g., janitorial staff) employed by the United Nations in the same location earn $1,164 per month. A financial assistant earns $87 working for the government, $80 to $592 per month working for local NGOs, $583 working for an American NGO and $709 working for a European NGO. Pfeiffer, Johnson, Fort, Shakow, Hagopian, Gloyd, and Gimbel-Sherr (2008) documents that NGO salaries are five to twenty times higher than public-sector salaries for health workers and, in addition, provide more non-wage amenities (e.g., better working conditions, vehicles)

in Mozambique. Dost and Khan (2015) documents that, in Afghanistan, a driver earns $40 per month from the government, $110 from a small local NGO, $500 from a large international NGO and over $800 from the United Nations or other multinational donor agencies. Ammitzbøll and Tychsen (2007) notes that "In Kosovo [...] local UN staff salary levels are about 300% higher than most government salaries".

The pay gap is often the largest in places where the necessary skilled labor is the most scarce. Carnahan, Durch, and Gilmore (2006) documents that pay for similar workers from the United Nations is higher than from the government by approximately twice in Timor-Leste, three times in Kosovo and Haiti, ten times in Sierra Leone, eleven times in Burundi, 25 times in Liberia and forty times in the D.R.C.[13]

Concerns regarding the potential harm of paying aid workers much more than local market wages have been circulating in the aid community for many years. In an article in *The Lancet*, Kassaye (2006) points out that "There is growing recognition of the danger posed by indiscriminate recruitment by foreign agencies of skilled health professionals from the public sector in developing countries. The drop in salaries and attendant demoralization amid an increasingly acquisitive and competitive culture in the towns has made health professionals vulnerable to the financial temptation offered by non-governmental organizations (NGOs). This 'local' brain drain is potentially damaging to the effective delivery of health services in a country, where it constitutes a huge financial loss and could have a negative effect on the economy. It is surprising to see that many agencies, while advocating against international brain drain, are the main perpetrators of the local form".

In Afghanistan, many observe that NGO poaching of government workers can reduce state capacity . A former senior UN staff member stated that "Unfortunately, it seems that (with Afghanistan as an example) there appears to be a brain drain with government employees shifting to NGOs, and from there, shifting to UN or bilateral organizations. Certainly, the salary structure of international organizations prevents the desired effect, which should be that the best and brightest from their national cadres should shift into senior government positions" (Dost and Khan, 2015). The head of a national NGO based in Kabul further notes that "Unfortunately the brain drain damaged the state system. First the skilled men left the country for abroad and

[13]NGOs are aware of this and have tried to address it in initiatives such as Project FAIR (Fairness in Aid Remuneration). See http://project-fair.org for more information.

the remaining skilled employees in the government left jobs for work with international and non-governmental organizations for high salaries. Due to this situation, most of the governmental administration is managed by unskilled persons, bureaucracy and corruption are largely prevailing and badly affect the functioning of the state" (Ammitzbøll and Tychsen, 2007). Ashraf Ghani, the current Afghan president and former finance minister, noted that "within six months of starting my job as finance minister, my best people had been stolen by international aid organizations who could offer them forty to a hundred times the salary we could" (Dost and Khan, 2015). Pfeiffer, Johnson, Fort, Shakow, Hagopian, Gloyd, and Gimbel-Sherr (2008) expresses similar concerns about health workers in Mozambique: "this internal 'brain drain' has had a more severe impact on the local health system than has the more widely recognized international migration of health workers".

2.2 Uganda

Since 2004, Ugandan GDP has grown at 6.2% to 10.8% per year and tax revenues are 14% of total GDP.[14] With this increase in national state capacity, the government has begun to build basic public health services in rural areas, where they have been heretofore absent. Despite this positive development, the levels of income, living standards and state capacity are still very low in Uganda. Average per capita gross income was $560 in 2010.[15] Neonatal, infant and under-5 mortality rates in 2011 were estimated to be 30, 66 and 111 per 1,000 live births, respectively – among the highest in the world (DHS, 2011).

Our study takes place in rural areas, where income, living standards and state capacity will be lower than in urban areas and the national average. Broadly speaking, modern health care was unavailable in rural areas. To address this, the Ugandan government founded the Village Health Team (VHT) program in 2001. However, in many rural areas of Uganda, the government did not have the capacity to implement it until nearly ten years later. In the regions that we study, government workers were hired around mid-2009.[16]

[14] See the World Bank Indicators.

[15] See the World Bank National Accounts Data.

[16] See the "Ugandan Annual Health Sector Performance Report 2008/2009" and the "Village Health Team, Strategy and Operational Guidelines" (Uganda Ministry of Health, 2010). A survey of government workers in Northern Uganda indicates that 87% of them were hired between 2009 and 2010 (Kimbugwe, Mshilla, Oluka, Nalikka, Kyangwa, Zalwango, Kilizza, Turyasiima, Ntambazi,

The main goal of the program is to improve health outcomes and reduce mortality, especially among young children. To accomplish this, health workers make home visits to poor households with expecting mothers or young children, during which they provide the following services: (i) health education (e.g., about the benefits of a hospital delivery), (ii) pre- and post-natal check-ups, (iii) basic medical care and referrals to health clinics that are usually located in more urban areas. The latter includes helping patients decide on the optimal timing of seeking medication attention from clinics and hospitals in urban areas, as well as coordinating with the medical staff of these facilities to ensure that there is staff onsite during the visit (Uganda Ministry of Health, 2011). Government workers also provide basic medicines, such as ACT (artemisinin combination therapy for malaria), ORS (oral rehydration solution), zinc, antibiotics, and deworming tablets free of charge, as well as distribute free bed nets during national malaria campaigns.

Government health workers work part-time and typically maintain other daily occupations such as farming or small shop-keeping. The government recruits local residents to be health workers. Government workers are mostly women, even though men are also eligible. The work is unpaid and recruiters focus on altruistic motivations, which includes personal gains in reputation and feelings of warm glow from helping their community (e.g., Ludwick, Brenner, Kyomuhangi, Wotton, and Kabakyenga, 2013; Wagnerly, Asiimwe, and Levine, 2020). Thus, government workers need to have sufficient income from other activities to allow them to provide part-time volunteer services. According to our interviews with workers and recruiters, the supply of individuals who are willing and able is extremely limited, such that in many communities, recruiters could not find anyone.

The government program was rolled out nationwide and aimed to employ two workers per village. Hired workers are given five days of basic training, a uniform that makes them easily identifiable (e.g., a t-shirt with the official logo), and free medical products to disperse to the community. Training covers key health topics, including diagnosing, treating and recognizing danger signs for referral to urban clinics. Each government worker is affiliated with a nearby health facility: she refills her stock of health products, attends occasional meetings, and reports to the person in charge of the health facility. District-level health officials interviewed by the authors of this paper stated that each health facility is responsible for keeping track of

Walugembe, et al., 2014).

resignations of affiliated community health workers and finding a replacement, but most health facilities are severely under-staffed and neither keep track of community health workers nor replace those that drop out of the program. Moreover, there is no aggregation of district-level records at higher regional or national levels.

The data deficit is consistent with the low overall administrative capacity in Uganda and means that higher levels of the government which make policy do not know which communities have a government health worker. The government similarly does not know where NGOs operate, which means that it does not have the capacity to respond to NGO entry by reallocating resources elsewhere. Similarly, NGOs cannot avoid entering locations with government workers in a centralized or systematic way.[17]

The government lacked the resources for conducting additional recruiting after the initial rollout.

2.3 The NGO

Foreign aid is often delivered by foreign NGOs in Uganda (Barr and Fafchamps, 2006). The one we study is one of the largest in the world. Its aims, services and recruitment strategies are similar to the government program. Aid workers are all women, recruited locally and provide free basic health services to the community. They all work part-time and are easily identifiable from wearing NGO uniforms. Unlike government workers, aid workers also sell household products for which they are paid a piece rate during healthcare home visits. Thus, aid workers earn a much higher income than volunteer government workers. The main results on state capacity focuses on the pay gap. We will return to discuss the pay structure in more details in Section 5.

The NGO and the government provide similar training about health services. Career progression is similarly limited for aid and government workers. We know of no cases or discussions of part-time rural community workers progressing to jobs in

[17]The lack of personnel records is not unique to our context, but also present in many other developing countries (Cain and Thurston, 1998; World Bank, 2000). Cain and Thurston (1998) documents serious discrepancies in Uganda, Ghana and Zimbabwe between the numbers of staff recorded on the nominal rolls (maintained by the ministries) and the numbers of staff actually working. Part of the problem has been attributed to the lack of digital record-keeping in those countries and the difficulty to centralize staff information (which could otherwise be shared with NGOs or other organizations).

urban areas.

In interviews conducted by the authors, NGO recruiters discussed how the NGO attempted to avoid hiring government workers, but could not effectively do so since government workers could easily hide their occupation. Anecdotally, there are also cases where the NGO knows that the applicant works for the government and still hires her because she is the best candidate. Since the NGO looks for individuals with the same skills and follows the same hiring criteria as the government, government workers who apply are typically more competitive than other applicants. In a similar context, Deserranno (2019) finds that 45% of government workers apply to work for the NGO when it enters the village and 60% of these applicants are hired by the NGO. Interestingly, 29% of government worker applicants faced no competition, which is consistent with the belief that the supply of such workers is very limited.

3 Randomization and Data

3.1 NGO Rollout and Survey Timing

The NGO entered our study area of 127 villages in twelve geographical areas of Uganda in June of 2010 by rolling out its program in a random sub-sample of 66 villages, of which 36 already had the government program in place for at least six months.

The main analysis uses survey data collected by the NGO. The baseline survey was collected in May 2010.[18] The endline survey was collected in December 2012, two years and seven months after the NGO rollout. Each wave includes a household-level survey about health services obtained by the household as well as health outcomes. We will discuss the other variables as they become relevant. The household survey is a random sample of 20% of the households that had a child below age of five in 2010. The respondent of the household survey is the female household head, who is presumably the most knowledgeable about the topics of inquiry. We also have access to village-level survey data answered by the village chief that includes information about the presence of health workers.

We supplement the surveys with census data collected before the baseline in 2010.

[18]The data collection and randomization were conducted by one of the authors as part of an internal evaluation of the NGO.

These include information about household size, mortality and occupation for all households in each village. The census data are aggregated at the village level to check the balance of the randomization and provide additional robustness controls.

Finally, we have access to an internal survey conducted by the NGO for its aid workers in January 2012, eighteen months after the NGO rolled out, between the baseline and the endline surveys. Government health workers appear in this survey if they had switched to becoming aid workers.

3.2 Descriptive Statistics

In the baseline survey, one year after the government program had been rolled out, 57% of the villages (73 villages) had a government worker and no village had more than one worker. In the other 54 villages, the government was either unable to recruit or retain a health worker (i.e., the recruited worker had stopped delivering health services by 2010). This is consistent with the perception of the limited labor supply of those who are both qualified and willing to work as volunteer health workers. Data for government workers from similar contexts as ours show that they work on average ten hours per week (Mays, O'Neil, Mworozi, Lough, Tabb, Whitlock, Mutimba, and Talib, 2017).

Note that a health worker can in principle work for both the government and NGO. Our survey is structured so that the village chief should report the presence of a government worker and a NGO worker in this case. We discuss the potential bias caused by measurement error in this variable after we present the main results.

The self-reported survey of aid workers show that they work an average of thirteen hours per week and are paid an average of 19 USD (∼53 thousand UGX) per month.[19] Their income is thus much higher than the one of government workers, who are volunteers. As a benchmark, consider that a rural aid worker earns in 13 hours what the average Ugandan household earns in half a week of working full-time.[20]

In villages with a government worker at baseline, we find that 39% of aid workers used to work for the government. In villages that had a government worker at baseline but lost that worker at endline, 82% of aid workers report previously having worked

[19] See Appendix Table A.1. We use the December 2012 exchange rate: 1 USD = 2,691 UGX (Ugandan Shillings).

[20] 19 USD is 51% of the average weekly household income in Uganda (which includes urban areas that are much richer than the rural communities we study) in 2013.

for the government. These descriptive facts are consistent with the concern that the NGO employs government health workers. The fact that the new aid worker is often the same person as the one who used to work for the government is important to keep in mind for interpreting our results on well-being later in the paper.

Table 1 presents village-level summary statistics and balance checks. Baseline observable characteristics are balanced between villages that are randomly assigned to treatment (NGO entry) and those that are randomly assigned to control. They are balanced both within the entire sample of 127 villages (column 3), the subsample of 73 villages with a government worker in 2010 (column 4) and the subsample of 54 villages without a government worker (column 5). See Data Appendix A for more details on the balance checks.[21]

Government and aid workers are the only source of modern medicine in the villages. Other medical services are provided by traditional healers and drug stores, which dispense basic advice with drug sales. Traditional healers are present in 48% of villages and drug stores are present in 68% of villages. In urban areas, modern medical services are available from government clinics and private clinics.[22] 56% of villages have a government clinic within a ten kilometer radius, and 83.5% of villages have a private clinic within a ten kilometer radius.

On average, 182 households reside in a village, with an average of one infant per every three households. Infant mortality is high. The number of infants who died in the year prior to the survey as a share of birth is 4%.

57% of the households are involved in farming as their main activity. The overall level of education is low, with only 38% of household heads having completed primary education. Households are poor. The average household owns half of the items on a list of "essential" household items (e.g., clothes, pair of shoes, cooking pots). Food availability is unstable. Approximately half of the households live in homes with low-quality construction material.

[21] 26% of households attrit between the baseline and endline. In the Data Appendix A, we show that (i) attrition rates are balanced across groups; (ii) there is no evidence of differential attrition across groups by household baseline characteristics; and (iii) our main results on access to health services hold if we use Lee bounds that account for attrition (Lee, 2009).

[22] Government clinics and private clinics provide the same type of health services (e.g., assist women during a delivery, child vaccination, disease diagnosis and treatment). The former provide these services for free while the latter provide these for pay.

4 Government Health Workers and Services

4.1 Health Workers

Our first measure of state capacity is the number of government health workers. To allow the effects of NGO entry to differ between villages that had a government worker at baseline (i.e., the intensive margin, where the effect can be negative, null or positive) and villages that had no health worker (i.e., the extensive margin, where the effect can be null or positive), we divide the data into two subsamples and estimate the following equation in each:

$$y_i = \alpha + \beta NGO_i + \Gamma X_i + \lambda_a + \varepsilon_i. \quad (1)$$

The number of health workers in village i in 2012, y_i, is a function of: a dummy variable that equals one if the village is randomly assigned to participate in the NGO program in 2010, NGO_i; a vector of village-level variables that may be correlated with the number of health workers and other outcomes we examine in the paper (e.g., mortality), X_i; and area fixed effects, λ_a. The controls in X_i make little difference to the estimates in this section, but will increase the precision of the mortality estimates later in the paper. We include the same baseline controls for consistency.[23] We estimate Huber-White robust standard errors to address heteroskedasticity for village-level regressions.

Since NGO entry is randomly assigned, β can be interpreted as a causal effect. Table 2 Panel A examines villages with a government worker at baseline. Column (1) shows that NGO entry reduces the number of government health workers by approximately one per every other village. The coefficient is -0.430. Column (2) shows that NGO entry increases the number of aid workers by one. Column (3) shows that NGO entry increases the total number of health workers by one per every other village. The estimates are statistically significant at the 1% level.

The results are consistent with the descriptive statistics discussed earlier, which indicate that when the NGO enters a village with a government health worker, the government worker switches to work for the NGO in approximately 40% of cases.

Panel B examines villages with no government health worker at baseline. We find that NGO entry has no effect on the number of government workers (column 4),

[23] Results without the controls are available upon request.

increases the number of NGO health workers by almost one (column 5) and increases the total number of health workers by one (column 6). The estimates in columns (5) and (6) are statistically significant at the 1% level. At the bottom of the table, we also present randomization inference p-values against the null hypothesis. We do not discuss them since they are always consistent with the standard errors presented in the tables.

The estimates show that the NGO is always able to recruit one aid worker in each village it enters, even in those where the government was unable to recruit anyone. However, NGO entry reduces state capacity: entry has a negative effect in villages with a government worker at baseline and no positive spillovers on the supply of government workers in other villages.

The main caveat for interpreting the results is mis-measurement of the number of health workers, which is reported by the village chief. If, for example, he is unaware of a change in employer for a former government worker from the government who moves to the NGO (or that she now works for both), then our estimates understate the negative effect of NGO entry on the number of government workers. If, for example, he under-reports the presence of a government worker because the survey is conducted by the NGO (which increases NGO salience), then our estimates overstate the negative effect of NGO entry. Given the importance and rarity of health workers, and the small size of the communities that we study, we do not believe that measurement error is likely to drive our estimates. Nevertheless, they are addressed in the next section, which examines service access from government and aid workers reported in the household survey.

4.2 Health Services

Our second measure of state capacity is the health services provided by the government. The outcome variable is a dummy variable that equals one if the household answers "yes" to the question on whether it "received medical care" from a government worker in the past year. The question was constructed to elicit a binary response to minimize reporting error (as opposed to a question about the number of visits). As before, we separately estimate the effects in the two sub-samples of villages. The number of observations is much larger than the analysis on the number of health workers because this estimate uses household-level data. We cluster the standard

errors at the village level for this and subsequent household-level regressions.

Table 3 Panel A examines villages with a government worker at baseline. Column (1) shows that NGO entry reduces the probability of obtaining services from the government health worker by 24.1 percentage-points. The estimate is statistically significant at the 1% level.

Column (2) shows that NGO entry increases the probability that a household will obtain services from an aid worker by 31.4 percentage-points. The estimate is statistically significant at the 1% level.

Panel B examines villages with no health worker at baseline. Column (4) shows that NGO entry slightly reduced the probability that a household obtains services from the government by two percentage-points. The estimate is statistically significant at the 10% level.[24] Column (5) shows that NGO entry increased the probability of obtaining health services from an aid worker by 31.2 percentage-points. The estimate is statistically significant at the 1% level.

The estimates for services mirror those for labor supply and show that NGO entry reduced state capacity. In villages with a government worker, NGO entry reduced government services. In villages without a government worker, NGO entry did not have observable positive spillovers on government services.

We will discuss columns (3) and (6) later in the paper.

5 Total Service Access and Population Well-being

In this section, we consider the possibility that aid workers may provide more and/or better care than government workers and improve population well-being, albeit at the cost of a reduction in state capacity. This could occur if the NGO selects higher quality workers, the NGO provides better training or if the positive income increases their capacity to work. The effect will partly depend on the incentive structure of the dual-task model used by the NGO. This so-called "Avon model of aid" is widely acclaimed and used by many of the largest and most well-known NGOs (e.g., BRAC, Grameen) in poor countries such as India, Bangladesh, and many countries in sub-

[24]This estimate reflects the fact that a very small number of households (in villages with no government health worker) will travel to nearby villages to obtain care from a government health worker. Note that this is unlikely to cause spatial contamination of our estimates because our sample villages are far apart and their neighboring villages will not be in our sample.

Saharan Africa and Latin America.[25] The NGO leverages its scale to obtain high quality products at low wholesale prices. Aid workers buy products from the NGO at a price that is slightly above the wholesale price and then sell to households at a retail price that is set by the NGO to be equivalent to or slightly below the market price in that location. The difference between the wholesale price and the buying price for the 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 health worker. The medicines that are distributed free of charge by government workers (oral rehydration salts, pain reliever, zinc, antimalarials, cold capsules, 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.[26]

This dual-task model presents tradeoffs in terms of population well-being. On the one hand, it can benefit the population because the income it offers can increase the amount of free services and the pool of job candidates (i.e., women who are willing but too poor to provide volunteer services; the number of hours an aid worker can deliver health services instead of farming). On the other hand, the commercial incentives can crowd out free health delivery (Wagnerly, Asiimwe, and Levine, 2020). Our estimates

[25]It is used by several of the largest NGOs today, including Living Goods, Grameen, BRAC, and other smaller NGOs such as InVenture, SWAP, VisionSpring, SolarSister, HealthStore Foundation, Accesso Chakipi (a Clinton Foundation Program), Marie Stopes Kenya (a branch of the U.K.'s Women's Health Organization) and HoneyCare Africa. Other NGOs that use this model or similar social marketing approaches include Population Services International, Marie Stopes International, Healthy Entrepreneurs, Réseau Confiance, LifeNet International, One Family Health, BlueStar Healthcare Network, Project Muso, GSN, AMUA, World Health Partners, K-MET Post Abortion Care Network, Partners in Health, Alive and Thrive, Happy Mothers Network, HealthKeepers. See http://healthmarketinnovations.org/ for a more extensive list. It has received positive press coverage and numerous awards. For example, "The 'Avon Ladies' of Africa" published in the New York Times (2012), "How one social enterprise is leading the fight against malaria" published by The Guardian (2013), "East Africa's healthcare 'Avon ladies' help to keep children alive" published by Reuters (2017), "How BRAC, the world's biggest charity, made Bangladesh richer" or "Selling sisters" published in the Economist (2019 and 2012) explain the advantages of the dual-task model as a self-sustainable way to aid the poor. Living Goods, one of the pioneers of this model, has received multiple prizes and awards.

[26]Appendix Figure A.1 documents the retail price (what households pay) and the profit margin for the NGO worker for the products they sell. In Appendix Section C.4, we provide evidence that NGO entry has little effect on the price of treating diseases. In an interview that the authors conducted with one of the NGO directors, she explains that the "Provision of these products which have a less direct impact on health was meant to serve as an [financial] incentive [for the health worker] and also ensure sustainability of the health program operations".

will capture the net effects.

5.1 Access to Health Services

We first examine total access to health services to investigate whether aid workers achieve more coverage than the government workers they replaced. Table 3 column (3) examines the effect of NGO entry for villages with a government worker at baseline. The outcome variable is a dummy variable that equals one if a household receives medical care from any health worker. We find that NGO entry reduces the probability of obtaining services from either the NGO or the government health worker by 11.2 percentage-points. The estimate is statistically significant at the 5% level. Thus, NGO entry reduces the likelihood that a household receives medical care from any health worker. Since the constant is 0.659 (65.9% of households in villages with a government health worker and no NGO worker receive health care on average), the estimate implies that NGO entry reduces total access to care by 17% (.112/.659 = .17).

The negative impact on any health access is consistent with the concern that NGO entry crowds out government health workers and health services. It is also interesting to note that the estimated effect of NGO entry on services from government and aid workers in columns (1) and (2) do not add up to the estimated effect of NGO entry on obtaining services from either health worker in column (3). This is because the aid worker often visits the same households as the government worker in villages with a government and an aid worker. In villages where the NGO hires the government worker such that there is only one worker, some households previously visited by the government are no longer visited by any health worker.[27]

Column (6) shows that in villages with no government worker at baseline, NGO entry increases the probability of obtaining advice from any worker by 28 percentage-points.

5.2 Health Outcomes

Next, we examine infant mortality, the reduction of which is a focal point for both government and NGO workers, as well as international agencies such as the World

[27]Later, in Section 6, we provide descriptive evidence suggesting that the poorest households lose the most access.

Health Organization.[28] Since we find that the effect of NGO entry differs between villages with and without a government health worker at baseline, we continue to allow the effect of NGO entry to differ across these two types of villages. Because mortality is a relatively rare event, we estimate the following interaction specification (equation (2)) with the pooled data to increase statistical power. This is conceptually identical to the earlier estimations of equation (1) for each sub-sample. There is no change to the underlying source of variation for identification or causal inference when we pool the data.

$$y_i = \alpha + \delta Gov_i + \gamma NGO_i + \beta(Gov_i \times NGO_i) + \Gamma X_i + \lambda_a + \varepsilon_i. \tag{2}$$

Variable definitions are the same as before. X_i is the same vector of controls as before, except that we additionally control for their interactions with NGO_i.[29] Analogous to our focus on the NGO coefficient from equation (1) for each sub-sample, the coefficients of interest here are: $\beta + \gamma$, the effect of NGO entry in villages with a pre-existing government worker; and γ, the effect of NGO entry in villages without a pre-existing government worker. The causal interpretation of these two objects in the pooled estimate is unchanged relative to the earlier interpretation of the coefficient for NGO from equation (1). Since we control for interacted controls, the coefficients are evaluated at the sample mean values of the controls.

Table 4 columns (1)-(3) re-state the estimates for access to health services to make clear the comparability between the pooled heterogeneous estimates and earlier estimates.

We focus our discussion on infant mortality. Column (4) examines a dummy variable that equals one if at least one infant died within the household during the two and half years between the two surveys.[30] This is reported in the household

[28] The government and the NGO also aim to reduce in-utero, neonatal and under-age-five mortality. However, we do not have reliable measures of these other outcomes. See the Data Appendix B for a detailed discussion. 46% of the overall under-5 mortality takes place in the first month, 18% in the first 24 hours of life and 15% in the first six hours of life (Baqui, Mitra, Begum, Hurt, Soremekun, Edmond, Kirkwood, Bhandari, Taneja, Mazumder, et al., 2016). The main causes of neonatal mortality in Uganda are birth asphyxia/trauma (28.6%), prematurity (27.9%), sepsis (18.2%), congenital anomalies (11.7%), acute respiratory infections (6.3%) and other causes (6.5%) (World Health Organization, 2012).

[29] These variables, the presence of a clinic within a ten kilometer radius, the number of households in the village and base year morbidity (all measured at baseline, 2010), are correlated with mortality at endline and including them as controls increases the precision of our estimates.

[30] The results are similar when we examine a continuous measure for the number of infants who

survey. The sample comprises of households with at least one infant born since the baseline survey in 2010.[31] We find that the effect of NGO entry on infant mortality in a village with no government worker at baseline is negative, but imprecise. The joint coefficient at the bottom of the table suggests that NGO entry increases infant mortality in villages with a government worker at baseline. The p-value for the joint coefficient is 0.139.

In column (5), we aggregate infant mortality at the village-level and normalize it by the number of births. The coefficients exhibit similar patterns to those in column (4), but are less precise, which is likely due to the reduction in observations and the fact that the aggregation introduces measurement error.[32] Note that the large magnitude of the mortality estimates reflects the fact that rudimentary services can produce high returns in our context where infant mortality is extremely high.[33]

We also examine other health outcomes that the NGO and government programs aim to improve. These are health behaviors (whether children in the household are fully immunized, sleep under bed nets, drink treated water or wash their hands before eating and after using the toilet, and whether the couple regularly uses condoms during sexual intercourse) and the incidences of the diseases that are most prevalent for children in this environment (the percent of children under age five in the household who have experienced cough, diarrhea, worms, tuberculosis or malaria in the past year). For each category, we construct a standardized index measure that is the equally weighted average of z-scores of the component measures. Table 5 presents patterns similar to those for mortality. The uninteracted NGO coefficients in column (4) are all positive and suggest that NGO entry in villages with no government worker at baseline may have had positive effects. But they are statistically imprecise. The joint coefficients in column (12) are all negative and suggest that NGO entry in villages with a government worker at baseline may have had negative effects. But they are also statistically imprecise.

For the reasons discussed earlier, non-random assignment of the government worker at baseline does not affect the casual interpretation of $\beta + \gamma$ and γ, which are the

died in the household, since only 7% of the households experienced more than one infant death. See the Data Appendix Section B for a detailed discussion of our mortality measures.

[31] We discuss sample selection in Appendix Section C.3.

[32] See Appendix Section B.

[33] Bjorkman-Nyqvist, Guariso, Svensson, and Yanagizawa-Drott (2019) studies two NGOs, one of which uses a similar dual-task model, that provide basic health services in rural Uganda and find comparable elasticities.

focus of our paper and the discussion so far. However, it matters for understanding the mechanisms underlying the reduced form interaction coefficient, β, the differential effect of NGO entry in villages with and without a government worker at baseline. Taking the results at face value, one possible explanation is that there was simply more scope for improvement in villages with no health worker at baseline. The non-random placement of government workers at baseline also opens the possibility that villages without a government worker differ from other villages in ways that cause NGO entry to have a stronger effect on health outcomes. This concern is mitigated by the balance checks, which show no difference in observables between the two types of villages at baseline.[34] Given that the interaction coefficient is not the focus of our paper, we do not discuss it further.

5.3 Villages where the NGO Hires the Government Worker

In this section, we examine poaching more explicitly by decomposing villages into those where the NGO hires the government worker versus where it hires a second worker. Since the hiring decision is an outcome, these estimates should be cautiously interpreted as descriptive rather than causal.[35]

We start by examining service provision. We focus our discussion on Table 6 column (3), which examines the probability of receiving any service as the outcome. The uninteracted NGO coefficient shows that in villages with no government health worker at baseline, NGO entry increases the probability of obtaining any service by 31.8 percentage-points. The estimate is statistically significant at the 1% level. The joint coefficients at the bottom of the table show that in villages with a government worker at baseline and where the NGO hires the government worker, the probability of any service declines by 26.6 percentage-points. In villages where the NGO hires a second person to be the aid worker, there is no difference in services relative to a village with no health worker. As before, these estimates are evaluated at the mean values of the interacted control variables. We control for the triple interaction of the control variables, NGO entry and whether it hires the government worker or a new

[34] See Appendix Table A.2 and Appendix Section A. To address the possibility that our sample is not large enough to precisely estimate small, but potentially important differences, we also control for a larger and more comprehensive set of baseline characteristics interacted with NGO entry. The results are very robust. See Appendix Table A.5.

[35] Appendix Table A shows no difference in observables between villages where the NGO hired the government worker and villages where the NGO hired a second person to be the aid worker.

worker.

Columns (4) and (5) examine mortality. The results mirror those for service access. The uninteracted NGO coefficient in column (4) shows that in villages with no government worker, NGO entry reduces the probability that a child died in the household by five percentage-points. The estimate is statistically significant at the 1% level. The joint coefficients at the bottom of the table show that in villages with a government worker at baseline and where the NGO hires the government worker, the probability of at least one death increases by 8.2 percentage-points. The estimate is statistically significant at the 5% level. In villages where the NGO hires a second person to be the aid worker, there is no difference relative to a village with no health worker. The estimates in column (5) for village mortality rates are similar, but slightly less precise due to the smaller number of observations.

Table 7 presents the decomposition for other outcomes. Only the estimates for the standardized index of child health behavior are statistically signifiant. Column (4) shows that NGO entry in villages with no government worker at baseline improves the index measure. The joint coefficients in columns (14) and (16) show that in villages with a government worker at baseline and where the NGO hires the government worker, the index measure worsens by 0.137 (the sample mean is 0.722). The estimate is statistically significant at the 1% level. In villages where the NGO hires a second person to be the aid worker, there is no difference relative to a village with no health worker.

The finding that the adverse effects on any service and health outcomes manifest in villages where the NGO hires the government worker is consistent with the central concern that poaching is a serious problem in contexts where the supply of health workers is especially limited. The results are also consistent with concerns that the dual-task model may cause commercial activities to crowd out service delivery.

6 Interpretation

This section interprets the main results and provides a brief discussion to shed light on some issues prompted by our findings.

The negative effect of aid entry on state capacity only requires the aid-delivering NGO to pay more than the government. This result supports concerns from the aid community that NGOs paying more than local market conditions can impede rather

than help create sustainable development. That these negative effects occur in villages with a government worker supports recent calls for NGOs and the government to coordinate in order to avoid replicating their efforts, or to avoid poaching government workers.

The finding that aid has positive effects in villages with no government worker implies that the NGO successfully fulfills its main mission as a stop gap in places where there is no other source of assistance. Together, the results imply that NGOs, which are critically important in places where the government is not present, should be wary of instances where the government is beginning to develop capacity and where capacity is fragile. Similarly, NGOs should be particularly aware of the limited supply of critical resources, such as the supply of health workers in our case.

The long-run effects can be quite different from the short-run ones that we study. On the one hand, the supply of health workers could grow over time, which should reduce poaching. In addition, if the government started collecting data on the location of government and aid workers, coordination could reduce the replication of services in the same location. Then, aid could complement government services. On the other hand, limited government capacity may mean that it cannot achieve such coordination or conduct another recruiting effort if the NGO departs. In our context, we note that the Ugandan government did not have the resources to conduct a second recruitment drive. The population may therefore be worse off than if the NGO had never entered. This is the scenario hypothesized by Moyo and Ferguson (2009). The long-run effects of NGO-provided aid are ultimately empirical questions and likely to be context specific. As such, much more research is needed.

The negative effect of NGO entry on any service provision and population well-being is a result of the earnings gap, which causes government workers to move to the NGO, and the strong incentives in the dual-task model to sell commodities. These results highlight the pitfalls of the dual-task model in addition to the problem of poaching caused by the pay gap. Data from other similar contexts suggest that the manifestation of the adverse effects in villages where the NGO hires a government worker reflects aid workers allocating time away from providing services and/or a negative selection of aid workers. Reichenbach and Shimul (2011) presents self-reported time use data for 660 workers hired by BRAC in rural Uganda.[36] The data show

[36]See Appendix Table A.6.

that only 21-37% of total time is allocated towards delivering free health services.[37] Taken literally together with the fact that aid workers in our sample work thirteen hours per week, it implies that aid workers in our study spend approximately 2.73 to 4.81 hours per week providing free health services. This is much lower than the ten hours per week of health services provided by government workers reported by Mays, O'Neil, Mworozi, Lough, Tabb, Whitlock, Mutimba, and Talib (2017).[38] Data on government workers from Deserranno (2019), which studies a similar NGO and in a broadly similar context, shows that there may be negative selection of aid workers when the NGO poaches from the government.[39] Relative to government workers who do not apply to work for the NGO, those that apply are fourteen percentage-points more likely to report that "earning money" is the most important feature in a new job, and fourteen percentage-points less likely to say that "earning respect" is the most important feature in a new job. These statistics on time allocation and selection, though from other data, present patterns consistent with our findings.

Interestingly, we find suggestive evidence that aid workers are less likely to visit poor households.[40] Both the NGO and the government programs aim to assist the poorest households, which are unable to afford alternative sources of care such as private clinics (amongst households with young children or expecting mothers). The descriptive evidence raises the concern that NGO workers are less likely to visit households that are unable to afford the commodities sold by aid workers. This highlights a fundamental friction in the incentive structure of the dual-task model in our context – households that benefit the most from the free services are not the households with the highest demand to purchase commodities. The misalignment can be mod-

[37] The range depends on whether we count time attending refresher trainings, which include visits to the branch office to resupply products for selling, as a health or commercial activity.

[38] Consistent with the low level of time allocated by aid workers to provide health services, our data show that the fraction of households that bought a health product from aid workers in the past week (6%) is three times larger than the fraction that obtained medical advice (2%). The household survey data from 2012 show that for villages with an NGO worker, 28% of households purchased commodities (soap, oil, salt) from the NGO, while only 9% purchased any medical products.

[39] Note that one difference between our context and Deserranno (2019) is that the latter focuses on government health workers who are also members of the NGO micro-finance program. In the context of our study, there is no micro-finance program.

[40] Appendix Table A.7 shows that the descriptive patterns in the data support this concern. Column (1) shows that being poor is negatively associated with obtaining any health care in villages with a government health worker at baseline and where the NGO entered. The coefficient is -0.136. In contrast, column (2) shows that the correlation is positive, 0.152, in villages with a government health worker in 2010 and no NGO entry. Both coefficients are statistically significant at the 5% level. The p-value at the bottom of the table for the difference in the two coefficients is 0.001.

erated in other contexts. For example, it is likely that the households that benefit the most from micro-finance programs are also the households which have the highest demands for purchasing high-quality seeds or small farming equipment. This incentive alignment is important for NGOs to take into account when using this business model.

Taken together, the descriptive evidence provides a suggestive and consistent explaination for why health outcomes deteriorate in villages where the government worker becomes an aid worker. The most commercially motivated workers choose to become aid workers, and after switching jobs, allocate less time to providing free health services and visit fewer poor households. These are all part of the crowding out effect of foreign aid on government workers.[41]

To inform the general discussion about aid efficacy, note that we find no effect of NGO entry if we estimate the average effect of entry for the full sample of 127 villages.[42] This is important for future evaluations of foreign aid because it illustrates how focusing on the average effects of aid can obfuscate important underlying heterogeneity and miss both the positive and negative effects of aid.

7 Conclusion

The results of this paper piece together a nuanced picture of how foreign aid can potentially help and hinder economic development. In places where no other assistance is available, aid can fulfill its role as the stopgap between the needs of the poor and the government's ability to provide help. However, in places where the government has begun to develop its own capacity, and where government capacity is particularly fragile and resources scarce, aid can hinder state capacity, which can, in turn, lead to future aid dependence. Interestingly, we show that if one only examines the average effect of aid without taking into account the heterogeneity of pre-existing services, one finds that aid has no effect. In other words, both the positive and negative effects of aid are obfuscated without taking heterogeneity into account.

[41] In Appendix Section C, we consider alternative reasons for why aid workers can increase mortality relative to government workers. Specifically, we consider the possibility that the local population trusts aid workers less than government workers, that aid workers are less likely to coordinate with government hospitals and clinics to facilitate assisted deliveries, that NGO entry increases high risk births or that NGO entry increases the drug prices for treating aliments. We find limited evidence that these mechanisms play important role in driving our results.

[42] See Appendix Section D.

For policy makers, our results provide important, but subtle, insights. They highlight the importance for aid organizations to set wages carefully based on the local labor market. In our case, this means choosing the correct price for labor. In other contexts, such as food aid, this implies choosing the price of food to not undercut local farmers (Janzen, 2015; Levinsohn and McMillan, 2005). Our results also support the call for NGOs, which have become crucial for aid delivery, and governments to coordinate, which is currently not the usual practice.[43] This will become increasingly important as poor countries begin to build domestic capacity for providing public goods, a necessary step towards self-sustainable development. Some of the implied policies for improvement are straightforward. For example, as the government's administrative capacity grows, keeping better records of staff location and sharing these data with NGOs can have high returns.[44]

It is important to note that our study focuses on the short run due to data limitations. For the reasons that we discuss in the previous section, the long-run effects can be similar or quite different. This is an important topic for future research. Another interesting avenue to explore is the effect of the pay gap on labor allocation. Dost and Khan (2015) observes that, in Afghanistan, "it is not uncommon to find highly skilled people with university degrees and several years of experience working in low skill jobs such as administrative assistant, logistics officer or even as drivers or security guards in NGOs, attracted primarily by the higher wages. [...] It is also not uncommon to see people with Medical Doctor's degrees doing administrative or logistical works". In *The Lancet*, Kassaye (2006) points out that "It is usual to see highly educated health professionals employed in jobs unrelated to their expertise by these international NGOs". The potential misallocation of skilled workers is another channel through which the pay gap may lead to unintended consequences.

Our findings highlight the tradeoffs of the dual-task model. On the one hand, it is an innovative way of funding aid activities without large donors.[45] However, our results show that achieving good results requires careful thought, and in particu-

[43] A large body of evidence documents that NGOs often operate in the same place as the government or other NGOs. See Barr and Fafchamps (2006) for detailed discussion on NGOs' location.

[44] Some governments, such as Uganda, are in the process of creating a digital database of government workers. See https://www.intrahealth.org/news/uganda-takes-major-steps-professionalize-community-health-workforce. Other governments, such as Sierra Leone, have recently created a database of all NGOs operating in the country with their location, and the type of services provided. See https://slamohs.org.

[45] Another method has been to fund raise from individuals (Muzinich and Werker, 2008).

lar, providing the correct incentives for aid activities relative to money-making ones. Recently, two well-known NGOs which use the dual-task model, BRAC and Living Goods, have begun to experiment with providing monetary incentives for health services, or spending more on monitoring health workers. Another possible way of aligning incentives is to change the mix of products for sale so that demand for these and core-mission services come from similar households (see the previous Section). These are interesting and important avenues for future research.

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Table 1: Summary Statistics and Balance Checks

Sample of villages:	All		All	Gov Worker in 2010	No Gov Worker in 2010
	Mean	SD	NGO	NGO	NGO
	(1)	(2)	(3)	(4)	(5)
Observations	127		127	73	54
A. Presence of a Health Care Provider in 2010 = {0, 1}					
Gov health worker in the village	0.575	0.496	-0.061	-	-
			(0.088)		
Traditional healer in the village	0.480	0.502	-0.016	0.069	-0.031
			(0.088)	(0.129)	(0.134)
Drug store in the village	0.677	0.469	0.030	0.076	0.000
			(0.039)	(0.071)	(0.000)
Government clinic within 10 km	0.559	0.498	-0.052	-0.022	-0.003
			(0.078)	(0.118)	(0.108)
Private clinic within 10km	0.835	0.373	0.047	0.127	-0.019
			(0.045)	(0.073)	(0.057)
B. Village Size and Infant Mortality in 2010					
# of HHs in the village	182.071	125.452	-13.339	17.600	-77.696
			(22.191)	(18.330)	(44.669)
# of infants per HH	0.291	0.091	-0.004	-0.026	0.009
			(0.014)	(0.022)	(0.019)
# of infants who died in the past year per HH	0.041	0.060	-0.004	-0.005	-0.008
			(0.009)	(0.016)	(0.006)
C. Household (HH) Socio-Economic Background in 2010					
% HHs involved in farming as main activity	0.568	0.383	0.031	0.016	0.059
			(0.023)	(0.036)	(0.036)
% HH heads who completed primary education	0.376	0.260	0.004	0.057	-0.033
			(0.030)	(0.047)	(0.042)
# of assets owned (out of 11)	5.625	1.956	0.032	0.202	0.000
			(0.164)	(0.266)	(0.193)
Average food security (1 to 4)	2.225	0.619	0.032	0.066	0.012
			(0.039)	(0.060)	(0.058)
% HHs with high quality house wall material	0.410	0.411	0.009	0.024	0.000
			(0.028)	(0.025)	(0.058)
% HHs with high quality house floor material	0.424	0.410	0.004	0.034	-0.020
			(0.031)	(0.029)	(0.064)
% HHs with high quality house roof material	0.584	0.406	0.015	0.037	-0.020
			(0.027)	(0.034)	(0.053)
Standardized index of wealth	0.000	0.927	0.027	0.088	-0.015
			(0.053)	(0.063)	(0.099)

Notes: Observations are at the village level. Sample restrictions are stated in the column headings. Each row states the sample mean and standard deviation of a variable, as well as the estimates from three separate regressions, where the variable is regressed on an indicator for NGO entry. All regressions include area fixed effects. In parentheses, we present robust standard errors. In Panel C, the standardized index of wealth is an equally weighted average of z-scores of 5 variables: average number of assets owned by a HH (out of a list of 11 essential household assets), average food security (1="deficit of food the whole year", 2="occasional deficit", 3="neither deficit nor surplus, 4="surplus"), % HHs with high quality wall material, % HHs with high quality floor material, % HHs with high quality roof material.

Table 2: Supply of Health Workers

	Dependent Variable: Presence of Health Workers in the Village in 2012					
	A. Villages with a Gov Health Worker in 2010			B. Villages with no Gov Health Worker in 2010		
	(1)	(2)	(3)	(4)	(5)	(6)
	Gov = {0, 1}	NGO = {0, 1}	Total = {0, 1, 2}	Gov = {0, 1}	NGO = {0, 1}	Total = {0, 1, 2}
Mean Dep.Var.	**0.740**	**0.479**	**1.219**	**0.000**	**0.537**	**0.537**
NGO	-0.430	1.000	0.576	0.000	0.934	0.934
	(0.098)	(0.000)	(0.098)	(0.000)	(0.069)	(0.069)
Constant	0.986	0.040	1.026	0.000	0.052	0.052
	(0.162)	(0.044)	(0.162)	(0.000)	(0.061)	(0.061)
Observations	73	73	73	54	54	54
R-squared	0.432	0.973	0.542	-	0.934	0.934
NGO p-value (RI)	<0.001	<0.001	<0.001	1.000	<0.001	<0.001

Notes: Sample restrictions are stated in the Panel headings. Observations are at the village level. In parentheses, we present robust standard errors. All regressions include area fixed effects and the following controls (measured in 2010): presence of a clinic within 10km of the village, number of households in the village, number of infants who died in the past year. P-values from randomization inference using 500 random permutations are presented at the bottom of the table.

Table 3: Health Services

Dependent Variable: Household Received Medical Care from the Following in the Past Year (2012) = {0, 1}						
	A. Villages with a Gov Health Worker in 2010			B. Villages with no Gov Health Worker in 2010		
	(1)	(2)	(3)	(4)	(5)	(6)
	Gov	NGO	Any (NGO or Gov)	Gov	NGO	Any (NGO or Gov)
Mean Dep.Var.	**0.546**	**0.238**	**0.623**	**0.045**	**0.231**	**0.265**
NGO	-0.241	0.314	-0.112	-0.020	0.312	0.280
	(0.063)	(0.034)	(0.048)	(0.011)	(0.050)	(0.052)
Constant	0.655	0.065	0.659	0.028	0.012	0.053
	(0.084)	(0.061)	(0.068)	(0.034)	(0.103)	(0.083)
Observations	1,473	1,473	1,473	1,274	1,274	1,274
R-squared	0.244	0.173	0.166	0.006	0.233	0.186
NGO p-value (RI)	<0.001	<0.001	0.040	0.078	<0.001	<0.001

Notes: Sample restrictions are stated in the Panel headings. Observations are at the household level. In parentheses, we present standard errors clustered at the village level. All regressions include area fixed effects and the following controls (measured in 2010): presence of a clinic within 10km of the village, number of households in the village, number of infants who died in the past year. P-values from randomization inference using 500 random permutations are presented at the bottom of the table.

Table 4: Health Services and Mortality – Pooled Estimates

	Dependent Variable				
	Household Received Medical Care from the Following in the Past Year (2012) = {0, 1}			Infant Mortality (2010-12)	
	Gov	NGO	Any (NGO or Gov)	≥ 1 died = {0, 1}	Deaths/1,000 births
	(1)	(2)	(3)	(4)	(5)
Sample:	All	All	All	HHs with a birth since 2010	All
Mean Dep.Var.	**0.313**	**0.235**	**0.457**	**0.073**	**65.004**
Gov	0.430***	-0.049	0.396***	-0.051	-54.322
	(0.053)	(0.038)	(0.063)	(0.023)	(24.705)
NGO [1]	-0.022	0.349***	0.310***	-0.033	-37.714
	(0.030)	(0.045)	(0.048)	(0.021)	(22.415)
Gov × NGO [2]	-0.243***	-0.078	-0.458***	0.064	51.653
	(0.074)	(0.059)	(0.078)	(0.032)	(31.767)
Constant	0.154***	0.101***	0.199***	0.103	101.926
	(0.026)	(0.029)	(0.036)	(0.017)	(16.836)
Observations	2,747	2,747	2,747	1,402	127
R-squared	0.422	0.203	0.278	0.033	0.252
Gov × NGO + NGO [1] + [2]	-0.265	0.271	-0.148	0.030	13.939
p-value	<0.001	<0.001	0.003	0.139	0.491
[1] p-value (RI)	0.260	<0.001	<0.001	0.098	0.042
[2] p-value (RI)	<0.001	0.350	<0.001	0.038	0.068

Notes: The sample comprises of all villages. Observations are at the household level in col. (1)-(4) and at the village level in col. (5). In parentheses, we present standard errors clustered at the village level for household-level regressions and robust standard errors for village-level regressions. All regressions include area fixed effects. They also include the following controls (measured in 2010) and their interactions with NGO entry: presence of a clinic within 10km of the village, number of households in the village, number of infants who died in the past year. P-values from randomization inference using 500 random permutations are presented at the bottom of the table.

Table 5: Other Health Outcomes – Pooled Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Mean Dep.	Gov		NGO [1]		Gov × NGO [2]		Constant				Gov × NGO + NGO [1] + [2]		p-values (RI)	
Dependent Variables	**Var.**	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Obs.	R^2	Coef.	p-value	[1]	[2]
A. Child Health Behavior = {0, 1}															
Children are fully immunized	**0.905**	0.028	(0.033)	0.031	(0.023)	-0.047	(0.032)	0.885	(0.022)	2,045	0.238	-0.016	0.367	0.168	0.096
Children sleep under bednet	**0.725**	0.09	(0.031)	0.020	(0.033)	-0.096	(0.048)	0.692	(0.024)	2,747	0.091	-0.076	0.020	0.606	0.076
Children drink treated water	**0.722**	0.045	(0.040)	0.018	(0.028)	-0.024	(0.048)	0.694	(0.024)	2,747	0.213	-0.006	0.887	0.768	0.696
Children wash hands before food & after	**0.878**	0.049	(0.027)	0.016	(0.020)	-0.072	(0.034)	0.862	(0.019)	2,747	0.091	-0.057	0.060	0.698	0.122
Avg. standardized effect of outcomes above	**0.045**	0.131	(0.055)	0.076	(0.043)	-0.143	(0.068)	-0.030	(0.037)	2,045	0.157	-0.067	0.197	0.200	0.080
B. Disease Incidence for Children Under Age of 5 in the Past Year (Data Available for Children Under-5 Only)															
% Children under-5 who had cough	**0.593**	-0.028	(0.048)	0.008	(0.035)	0.015	(0.055)	0.602	(0.032)	1,783	0.205	0.023	0.537	0.786	0.774
% Children under-5 who had diarrhea	**0.284**	-0.026	(0.047)	0.001	(0.036)	0.002	(0.056)	0.296	(0.032)	1,783	0.185	0.002	0.944	0.976	0.982
% Children under-5 who had worms	**0.348**	-0.012	(0.044)	-0.015	(0.039)	-0.001	(0.060)	0.361	(0.031)	1,783	0.277	-0.016	0.659	0.702	0.978
% Children under-5 who had TB	**0.038**	-0.005	(0.036)	0.016	(0.019)	-0.022	(0.039)	0.038	(0.018)	1,783	0.112	-0.006	0.818	0.286	0.414
% Children under-5 who had malaria	**0.471**	-0.025	(0.042)	-0.014	(0.041)	0.023	(0.053)	0.487	(0.033)	1,783	0.123	0.009	0.739	0.714	0.630
Avg. standardized effect of outcomes above	**0.000**	-0.045	(0.086)	0.009	(0.057)	-0.007	(0.098)	0.022	(0.053)	1,783	0.160	0.001	0.982	0.850	0.932
C. Couple Behavior = {0, 1}															
Use of contraceptives	**0.469**	-0.079	(0.054)	-0.030	(0.040)	0.059	(0.066)	0.513	(0.034)	2,510	0.037	0.029	0.545	0.514	0.424

Notes: The sample comprises of all villages. Observations are at the household level. In parentheses, we present standard errors clustered at the village level. All regressions include area fixed effects. They also include the following controls (measured in 2010) and their interactions with NGO entry: presence of a clinic within 10km of the village, number of households in the village, number of infants who died in the past year. P-values from randomization inference using 500 random permutations are presented in col. (14)-(15).

Table 6: Health Services and Mortality – Pooled Estimates, Decomposition by NGO Hiring

	Dependent Variable				
	Household Received Medical Care from the Following in the Past Year (2012) = {0, 1}			Infant Mortality (2010-12)	
	Gov	NGO	Any (NGO or Gov)	≥ 1 died = {0, 1}	Deaths/1,000 births
	(1)	(2)	(3)	(4)	(5)
Sample:	All	All	All	HHs with a birth since 2010	All
Mean Dep.Var.	**0.313**	**0.235**	**0.457**	**0.073**	**65.004**
Gov	0.499	-0.040	0.425	-0.068	-63.305
	(0.054)	(0.036)	(0.065)	(0.024)	(25.464)
NGO [1]	0.001	0.351	0.318	-0.050	-56.473
	(0.027)	(0.045)	(0.049)	(0.020)	(23.676)
Gov × NGO × NGO hired Gov worker [2]	-0.524	-0.119	-0.584	0.132	110.073
	(0.062)	(0.058)	(0.081)	(0.044)	(42.996)
Gov × NGO × NGO hired new worker [3]	-0.020	-0.020	-0.328	0.023	26.667
	(0.091)	(0.067)	(0.087)	(0.030)	(32.670)
Constant	0.107	0.095	0.180	0.114	107.558
	(0.024)	(0.028)	(0.035)	(0.017)	(16.853)
Observations	2,747	2,747	2,747	1,402	127
R-squared	0.469	0.209	0.289	0.047	0.357
Gov × NGO × Hired Gov + NGO [1] + [2]	-0.523	0.232	-0.266	0.082	53.600
p-value	0.000	0.000	0.000	0.022	0.101
Gov × NGO × Hired new + NGO [1] + [3]	-0.019	0.331	-0.009	-0.027	-29.807
p-value	0.805	0.000	0.883	0.215	0.183
[1] p-value (RI)	0.982	<0.001	<0.001	<0.001	<0.001
[2] p-value (RI)	0.354	1.000	<0.001	<0.001	<0.001
[3] p-value (RI)	0.306	1.000	<0.001	0.978	0.974

Notes: The sample comprises of all villages. Observations are at the household level in col. (1)-(4) and at the village level in col. (5). In parentheses, we present standard errors clustered at the village level for household-level regressions and robust standard errors for village-level regressions. All regressions include area fixed effects. They also include the following controls (measured in 2010) and their interactions with NGO entry and with Gov × NGO entry: presence of a clinic within 10km of the village, number of households in the village, number of infants who died in the past year. P-values from randomization inference using 500 random permutations are presented at the bottom of the table.

Table 7: Other Health Outcomes — Pooled Estimates, Decomposition by NGO Hiring

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
		Gov		NGO		Gov × NGO × NGO Hired Gov Worker		Gov × NGO × NGO Hired New Worker		Constant				Gov × NGO × Hired Gov Worker + NGO		Gov × NGO × Hired New Worker + NGO	
Dependent Variables	**Mean Dep. Var.**	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Obs.	R^2	Coef.	p-value	Coef.	p-value
A. Child Health Behavior = {0, 1}																	
Children are fully immunized	**0.905**	0.032	(0.034)	0.032	(0.023)	-0.064	(0.036)	-0.033	(0.031)	0.882	(0.022)	2,045	0.238	-0.032	0.156	-0.001	0.955
Children sleep under bednet	**0.725**	0.087	(0.032)	0.030	(0.031)	-0.101	(0.058)	-0.098	(0.050)	0.695	(0.024)	2,747	0.093	-0.071	0.116	-0.068	0.099
Children drink treated water	**0.722**	0.039	(0.043)	0.004	(0.028)	0.004	(0.055)	-0.011	(0.063)	0.698	(0.026)	2,747	0.215	0.008	0.864	-0.007	0.894
Children wash hands before food & after toilet	**0.878**	0.059	(0.027)	0.017	(0.020)	-0.125	(0.040)	0.001	(0.043)	0.855	(0.020)	2,747	0.104	-0.108	0.002	0.018	0.642
Avg. standardized effect of outcomes above	**0.045**	0.147	(0.057)	0.070	(0.043)	-0.207	(0.082)	-0.039	(0.076)	-0.041	(0.039)	2,045	0.165	-0.137	0.038	0.030	0.631
B. Disease Incidence for Children Under Age of 5 in the Past Year (Data Available for Children Under-5 Only)																	
% Children under-5 who had cough	**0.593**	-0.016	(0.048)	0.009	(0.036)	-0.026	(0.060)	0.047	(0.061)	0.594	(0.033)	1,783	0.208	-0.017	0.685	0.055	0.259
% Children under-5 who had diarrhea	**0.284**	-0.022	(0.048)	0.004	(0.036)	-0.013	(0.064)	-0.003	(0.058)	0.293	(0.033)	1,783	0.186	-0.009	0.844	0.001	0.975
% Children under-5 who had worms	**0.348**	-0.004	(0.047)	-0.025	(0.039)	-0.018	(0.062)	0.026	(0.076)	0.356	(0.033)	1,783	0.278	-0.043	0.266	0.000	0.994
% Children under-5 who had TB	**0.038**	0.006	(0.038)	0.015	(0.019)	-0.060	(0.045)	0.013	(0.037)	0.031	(0.019)	1,783	0.119	-0.046	0.163	0.027	0.297
% Children under-5 who had malaria	**0.471**	-0.020	(0.042)	-0.027	(0.044)	0.026	(0.057)	0.019	(0.058)	0.484	(0.033)	1,783	0.126	-0.001	0.964	-0.008	0.813
Avg. standardized effect of outcomes above	**0.000**	-0.021	(0.090)	-0.001	(0.059)	-0.079	(0.106)	0.052	(0.107)	0.005	(0.055)	1,783	0.166	-0.080	0.247	0.051	0.526
C. Couple Behavior = {0, 1}																	
Use of contraceptives	**0.469**	-0.079	(0.055)	-0.020	(0.040)	0.047	(0.083)	0.067	(0.071)	0.513	(0.035)	2,510	0.039	0.027	0.682	0.048	0.391

Notes: The sample comprises of all villages. Observations are at the household level. In parentheses, we present standard errors clustered at the village level. All regressions include area fixed effects. They also include the following controls (measured in 2010) and their interactions with NGO entry: presence of a clinic within 10km of the village, number of households in the village, number of infants who died in the past year.

Online Appendix – Not for Publication

A Balance

Table 1 column (3) in the paper compares the subsamples of villages with and without NGO entry. To do so, we regress each base year village characteristic of Table 1 on a dummy for NGO entry, with area fixed effects and robust standard errors. The coefficient of the NGO dummy captures the difference across the two subsamples. Consistent with randomization, none of the differences are statistically different from zero. Since the randomization was not stratified on the presence of a government health worker, we examine the balance of the randomization of NGO within the subsample of villages with a pre-existing government worker (column 4) and the subsample of villages without a pre-existing government worker (column 5). We find that the characteristics are balanced in each subsample. For villages with a pre-existing government worker, only the "presence of a private clinic within 10km" is statistically significant at the 10% level. Villages with NGOs are more likely to have a clinic nearby. For villages without a government health worker at baseline, only the coefficient for the number of households is statistically significant at the 10% level. It shows that villages with NGO entry are on average smaller. We add both variables as controls throughout our results.

Appendix Table A.2 Column (3) shows that villages with and without a government health worker at baseline do not differ systematically, even though this variable was not randomly assigned. Column (4) shows that, among villages with the NGO entry and with a pre-existing government worker, those where the NGO hired the government worker are similar to villages where they did not.

Appendix Table A.3 reports household-level summary statistics and balance checks using the base year household survey. Note that we do not have reliable information on household-level infant mortality at the base year. Also note that 26% of households attrit between the baseline and endline. Reassuringly, the attrition rate is balanced across groups (Panel D). Moreover, there is no evidence of systematic differential attrition by household baseline characteristics (Appendix Table A.4).[46] As a result,

[46]Table A.4 tests for differential attrition by regressing the likelihood that a household attrit on

differences between treatment and control households are comparable when estimated in the full sample of households (attrit or not attrit) or when estimated in the sample that did not attrit. In Appendix Table A.8, we bound the effect of NGO entry on access to health services using the trimming procedure proposed by Lee (2009). As shown in the table, the lower bound of the effect of NGO on access to care from NGO worker, government worker or any worker is positive and significant.[47]

B Mortality

Household-level data on mortality are collected in the 2012 endline survey. For each household, we know the total number of children born between the two waves of surveys – i.e., between baseline (May 2010) and endline (December 2012) – but we do not know their birth dates. For each of these children, we also know whether they died or not before endline. If they died, we know the age at which they died *in years* (i.e., died at 0, 1, or 2 years old). We do not observe the age of death in years and not in months. Thus, we cannot calculate under-one-month (infant) mortality or under-five mortality.

We calculate the village-level infant mortality ratio as the number of children in the village who were born *and* who died below age one between the two waves of surveys divided by the number of children who were born between the two waves of surveys times 1,000. Any child born *before* endline (2012) and dead before the age of one *after* endline (2012) increases the infant mortality ratio denominator by one without increasing the numerator, thus causing us to underestimate infant mortality. Bjorkman-Nyqvist, Guariso, Svensson, and Yanagizawa-Drott (2019) addresses this by measuring age in months, which we do not observe.[48]

treatment assignment interacted with household baseline characteristics.

[47]The procedure trims observations from above (below) in the group with lower attrition, to equalize the number of observations across groups. It then re-estimates the effect of NGO entry in the trimmed sample to deliver the lower (upper) bounds for the true treatment effect.

[48]For example, Bjorkman-Nyqvist, Guariso, Svensson, and Yanagizawa-Drott (2019) calculates that a child who is three months old in 2012 is exposed 1/4 [3/4] of a year while a child born after 2010 and who is more than one in 2012 is exposed a full year.

C Mortality

We consider several reasons that aid workers will be less effective in reducing infant mortality than government workers. These are complementary, but distinct, from the crowding out channels discussed in the main paper.

C.1 Trust

Motivated by recent studies that document a connection between trust and health service demand (Alsan, 2015; Lowes and Montero, 2018; Martinez-Bravo and Stegmann, 2018), we consider the possibility that aid workers are less effective in reducing mortality than government workers because of distrust from the local population. In the sub-Saharan African context, Lowes and Montero (2018) document the negative effects of Colonial medical practices on trust in foreign organizations. One may be concerned that rural Ugandans, who were formerly colonized by the British Empire, are more trustful of health services provided by the Ugandan government than a foreign NGO. This could lead to an increase in mortality when the NGO enters and the government workers switches to the NGO. Being aware of the importance of trust and local ties, the NGO recruits only local women to be health workers. Most importantly, the result on service decline is driven by places where the health worker is generally the same person as before. Thus, trust is unlikely to play an important role in our context.

C.2 Coordination with Government Clinics

Another reason for why aid workers may be less effective in reducing mortality than government workers is the possibility that they coordinate less with government clinics and hospitals in urban area. Staff absenteeism is high in such facilities and assisted deliveries can significantly reduce risk.[49] Lower coordination between aid workers and

[49] 31% of the households in our study report staff absenteeism in public health facilities as a major constraint to the access of health services. The Uganda National Health Organization documents a 48% average rate of staff absenteeism in Ugandan public health facilities, with more highly trained workers (doctors, clinical officers) being more likely absent than less trained workers (Nyamweya, Yekka, Mubutu, Kasozi, and Muhindo, 2017; Mukasa, Sensoy Bahar, Ssewamala, KirkBride, Kivumbi, Namuwonge, and Damulira, 2019). This creates excessively long lines, which, for pregnant women, increases the risk of having to deliver in the health facilities without assistance from a health professional. Existing studies show that health services improve and mortality declines when there is someone in the community who is in close contact with the doctor/nurse of the urban

government medical staff may be because aid workers are less motivated to exert effort to coordinate, or because coordination costs are lower for two public-sector workers than between a public-sector worker and a foreign aid worker. This can be viewed as another way in which the lack of coordination between the government and NGO can reduce health outcomes in villages where the government worker is "poached" by the NGO.

We investigate this possibility by examining the effect of NGO entry on whether a woman delivers in a clinic and whether the delivery is assisted by the clinic staff. These variables are only available for households which have given birth within one year of the 2012 survey, for whom such care is most salient. Thus, the sample size is much smaller than for the main analysis shown earlier. Appendix Table A.9 column (1) shows that NGO entry has no effect on the probability of delivering in a clinic (versus at home) in villages with no government health workers. In villages with a government health worker, NGO entry reduces the probability of delivering in a clinic, but the estimate is only significant at the 20% level. Column (2) shows that the estimates for assisted delivery are more precise. In villages with no government health worker, NGO entry increases assisted delivery by 20.1 percentage-points. In villages with a government worker, NGO entry reduces the probability of an assisted delivery by 10.4 percentage-points. The estimates are statistically significant at the 10% level. These results are consistent with concerns of absenteeism in government clinics and reduced coordination between aid workers and the clinic staff.

In column (3), we examine the probability of a post-natal visit soon after birth, which along with assisted hospital delivery, is one of the services promoted by the World Health Organization and UNICEF as key to reducing infant mortality (e.g., UNICEF, 2009; World Health Organization, 2014). We find that NGO entry in villages with no government health worker increases the probability of a post-natal visit within the first two months of birth by 19.4 percentage-points. In villages with a government worker, NGO entry reduces the probability of a visit by 21.6 percentage-points. The estimates are statistically significant at the 1% level. These results are interesting because post-natal visits require effort on the part of the health worker,

health facility and who can coordinate patient visits with them (Mogensen, 2005; Sodemann, Biai, Jakobsen, and Aaby, 2006). Absenteeism is not unique to either the contexts of Uganda or the health sector. For example, Duflo, Hanna, and Ryan (2012) document high levels of absenteeism in teachers in India.

but little coordination with government clinics.[50]

Taken together, the results in Appendix Table A.9 are consistent with less coordination between NGO workers and the government clinic as a cause of increased infant mortality after the NGO enters. They also emphasize the importance of reduced worker effort for explaining mortality. Note that the limited sample size prevents our decomposing these results according to whether the NGO hired the government worker.

C.3 Selection into Fertility

Increased mortality may also result from a change in fertility patterns, for example, if NGO entry in villages with a former government worker increased higher-risk births. This is related to worker effort since, in principle, the health worker can help to prevent high-risk births by providing better prenatal care and family planning advice. We investigate this by examining the effect of NGO entry on fertility and the types of households giving birth (i.e., triple interaction of NGO entry, the presence of a government health worker, and household or village baseline characteristics). Appendix Table A.10 shows that NGO entry reduces (has no effect on) the probability of giving birth between the baseline and endline surveys by 4.3 percentage-points in villages with (without) a government health worker. However, NGO entry in villages with a government health worker does not cause differential fertility across a number of proxies for health risk (e.g., mother's age and education) or access to health care (e.g., household wealth, distance to a clinic, baseline mortality rates). This goes against selection into fertility driving the increase in mortality. Note that we can further decompose the estimates according to whether the NGO hired a government worker (i.e., estimate quadruple interaction effects). Appendix Table A.10 shows that they are similarly unsuggestive of differential fertility patterns.

C.4 Drug Prices

Since government health workers give out drugs for free, while aid workers sell the same drugs at a low price, the crowding out of the government worker can increase

[50] In principle, post-natal visits can be provided by clinic staff as well as the community health workers that we study. In practice, they are provided by the latter in our context. We do not have data on prenatal visits.

the price of medical treatments. This can, in turn, cause the shift of workers from the government to the NGO to increase mortality. We investigate this by examining the cost of treatment (drug prices, the cost of transportation to obtain treatment, and the cost of diagnostic medical tests) for the three most relevant diseases in our contexts (malaria, diarrhea and pneumonia). Using these measures as dependent variables in our baseline (equation 2), we find no evidence that this alternative mechanism plays a major role. See Appendix Table A.11.

D Average Effect of NGO Entry

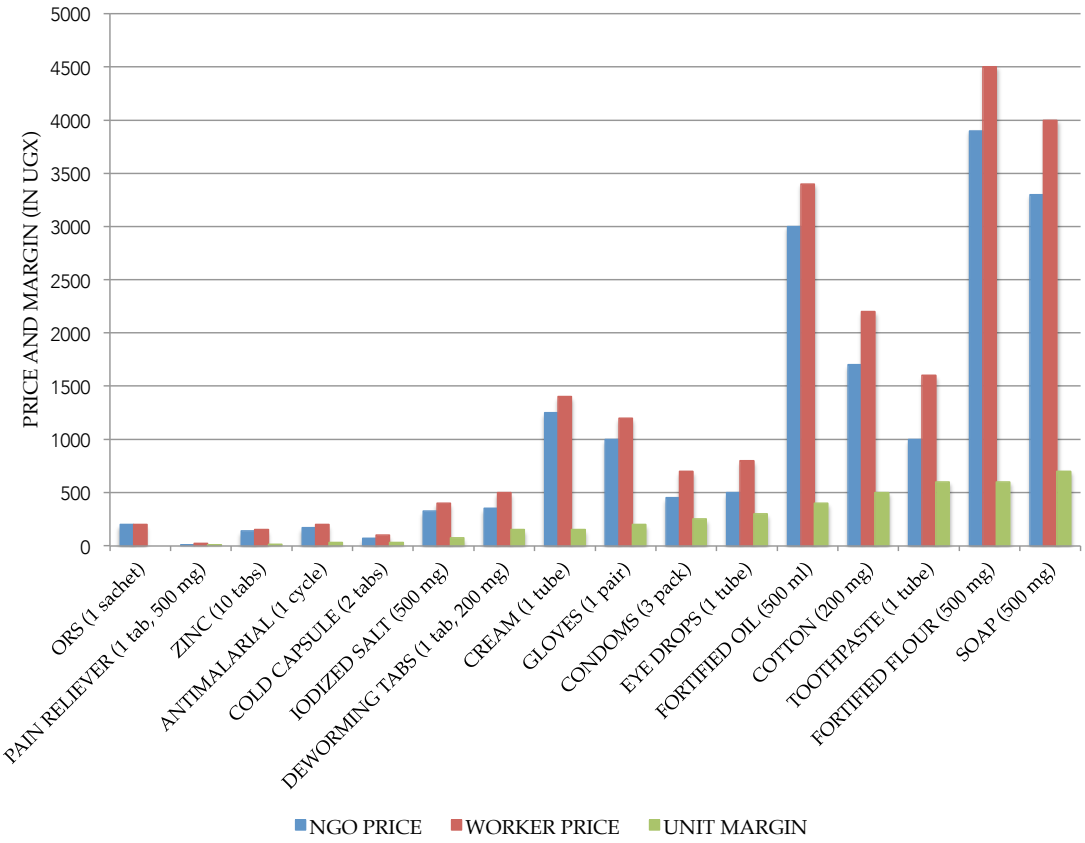
Appendix Table A.12 presents the average effects of NGO entry, where we regress the main outcomes of interest on the uninteracted NGO dummy variable, controlling for area fixed effects, for the full sample of villages (those with and without a pre-existing government health worker). NGO entry increases medical care from NGO health workers by 31.5 percentage-points (column 1) and reduces medical care from government health workers by 17.2 percentage-points (column 2). Both estimates are statistically significant at the 1% level. NGO entry has no effect on total health care. The estimate in column (3) is small in magnitude and statistically imprecise. Columns (4) and (5) show that NGO entry has, on average, no effect on mortality: the estimates are small in magnitude and statistically imprecise.

A comparison of the estimates of the average impact of NGO entry with the main results presented earlier highlights the importance of allowing for heterogeneity, which reveals both the positive and negative effects of NGO entry.

E Non-Linear Estimation

The main results are estimated with a Linear Probability Model. We can alternatively estimate non-linear Logistic regressions for the binary outcomes of whether a household received medical care from the NGO or government worker and for mortality (measured as a dummy variable that equals one if at least one infant died in the household). The estimates, shown in Appendix Table A.13, are consistent with those from the main regressions.

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



Notes: This figure presents the list of products sold by the NGO workers, ranked from lowest to highest unit margin. The unit margin equals the price at which the health worker sells the products in her community ("worker price") minus the price at which she buys the products from the NGO ("NGO price"). Prices are expressed in Ugandan Shillings (1$=3,691 UGX in December 2012).

Table A.1: NGO Workers Characteristics

	Mean (1)	SD (2)
Observations (# NGO workers)	66	
Age	33.545	10.218
Completed primary education = {0, 1}	0.652	0.480
Completed secondary education = {0, 1}	0.258	0.441
Was working as Gov health worker = {0, 1}	0.212	0.412
..among villages with Gov health worker in 2010	0.389	0.494
..among villages with Gov health worker in 2010 and none in 2012	0.824	0.393
# of working hours as a health worker in the past week	13.106	8.891
Health worker earnings in the past month (in thousand UGX)	52.335	66.986

Notes: Observations are at the NGO worker level.

Table A.2: Summary Statistics and Balance Checks (Part 2)

Sample of villages:	All		All	NGO Entry and Gov Worker in 2010
	Mean	SD	Gov	NGO Hired Gov
	(1)	(2)	(3)	(4)
Observations	127		127	36
A. Presence of a Health Care Provider in 2010 = {0, 1}				
Traditional healer in the village	0.480	0.502	-0.027	-0.187
			(0.125)	(0.206)
Drug store in the village	0.677	0.469	-0.023	0.203
			(0.044)	(0.116)
Government clinic within 10 km	0.559	0.498	-0.054	-0.312
			(0.108)	(0.261)
Private clinic within 10km	0.835	0.373	0.006	0.120
			(0.047)	(0.095)
B. Village Size and Infant Mortality in 2010				
# of HHs in the village	182.071	125.452	-45.290	-76.953
			(29.111)	(31.802)
# of infants per HH	0.291	0.091	-0.024	-0.001
			(0.019)	(0.043)
# of infants who died in the past year per HH	0.041	0.060	-0.007	-0.037
			(0.006)	(0.024)
C. Household (HH) Socio-Economic Background in 2010				
% HHs involved in farming as main activity	0.568	0.383	0.025	0.018
			(0.027)	(0.049)
% HH heads who completed primary education	0.376	0.260	-0.016	0.050
			(0.035)	(0.104)
# of assets owned (out of 11)	5.625	1.956	0.133	0.608
			(0.177)	(0.677)
Average food security (1 to 4)	2.225	0.619	0.024	-0.077
			(0.041)	(0.137)
% HHs with high quality house wall material	0.410	0.411	-0.027	0.053
			(0.044)	(0.050)
% HHs with high quality house floor material	0.424	0.410	-0.028	0.057
			(0.045)	(0.063)
% HHs with high quality house roof material	0.584	0.406	-0.001	0.046
			(0.031)	(0.057)
Standardized index of wealth	0.000	0.927	-0.006	0.113
			(0.070)	(0.156)

Notes: Observations are at the village level. Sample restrictions are stated in the column headings. Each row states the sample mean and standard deviation of a variable, as well as the estimates from two separate regressions, where the variable is regressed on an indicator for presence of a gov health worker in 2010 (col. 3), and an indicator for whether the NGO hired the gov health worker after its arrival (col. 4). All regressions include area fixed effects. In parentheses, we present robust standard errors.

Table A.3: Summary Statistics and Balance Checks (Part 3)

Sample of Villages:	All		All		Gov Worker in 2010		No Gov Worker in 2010	
	Mean (1)	SD (2)	NGO (3)	Obs. (4)	NGO (5)	Obs. (6)	NGO (7)	Obs. (8)
A. Household Received Medical Care from […] in the Past Year (2010) = {0, 1}								
Gov health worker	0.037	0.189	-0.008	3,727	-0.015	2,119	0.001	1,608
			(0.006)		(0.010)		(0.008)	
Traditional healer	0.024	0.154	-0.002	3,727	-0.001	2,119	0.004	1,608
			(0.005)		(0.008)		(0.006)	
Drug store	0.151	0.358	-0.002	3,727	-0.016	2,119	0.003	1,608
			(0.019)		(0.016)		(0.037)	
Government clinic	0.251	0.434	-0.016	3,727	-0.034	2,119	0.022	1,608
			(0.021)		(0.033)		(0.029)	
Private clinic	0.391	0.488	-0.013	3,727	-0.023	2,119	0.010	1,608
			(0.020)		(0.024)		(0.030)	
B. Socio-Economic Background in 2010								
# of infants	0.283	0.485	0.023	3,745	0.017	2,131	0.047	1,614
			(0.018)		(0.028)		(0.022)	
Involved in farming as main activity = {0, 1}	0.519	0.500	-0.034	3,745	-0.056	2,131	-0.008	1,614
			(0.018)		(0.031)		(0.022)	
Mother's age	31.22	10.167	-0.098	3,537	-0.223	2,004	-0.128	1,533
			(0.395)		(0.620)		(0.431)	
Mother completed primary education = {0, 1}	0.383	0.486	-0.005	3,745	0.037	2,131	-0.048	1,614
			(0.024)		(0.033)		(0.037)	
# of assets owned (out of 11)	5.600	2.838	-0.022	3,745	0.098	2,131	-0.007	1,614
			(0.125)		(0.201)		(0.155)	
Food security (1 to 4)	2.223	0.876	0.029	3,727	0.031	2,119	0.026	1,608
			(0.028)		(0.037)		(0.050)	
High quality house wall material = {0, 1}	0.413	0.492	-0.005	3,745	0.018	2,131	-0.035	1,614
			(0.025)		(0.021)		(0.051)	
High quality house floor material = {0, 1}	0.427	0.495	-0.007	3,745	0.024	2,131	-0.044	1,614
			(0.027)		(0.021)		(0.056)	
High quality house roof material = {0, 1}	0.593	0.491	-0.003	3,745	0.019	2,131	-0.056	1,614
			(0.024)		(0.029)		(0.046)	
Standardized index of wealth	0.000	0.802	-0.001	3,745	0.039	2,131	-0.049	1,614
			(0.035)		(0.035)		(0.069)	
C. Health Outcomes and Behavior in 2010								
Children sleep under bednet = {0, 1}	0.687	0.464	-0.020	3,745	-0.023	2,131	-0.017	1,614
			(0.022)		(0.032)		(0.033)	
Children drink treated water = {0, 1}	0.684	0.465	-0.003	3,745	-0.008	2,131	-0.003	1,614
			(0.023)		(0.037)		(0.036)	
Children wash hands before food & after toilet = {0, 1}	0.928	0.259	-0.005	3,745	-0.015	2,131	-0.003	1,614
			(0.011)		(0.017)		(0.014)	
% Children under-5 who had cough in past year	0.533	0.456	0.008	3,650	0.016	2,064	-0.012	1,586
			(0.019)		(0.024)		(0.032)	
% Children under-5 who had diarrhea in past year	0.325	0.429	0.002	3,650	0.006	2,064	0.012	1,586
			(0.016)		(0.026)		(0.023)	
% Children under-5 who had worms in past year	0.297	0.431	0.001	3,650	-0.028	2,064	0.043	1,586
			(0.018)		(0.024)		(0.028)	
% Children under-5 who had TB in past year	0.015	0.107	-0.003	3,650	-0.004	2,064	-0.002	1,586
			(0.004)		(0.005)		(0.005)	
% Children under-5 who had malaria in past year	0.620	0.437	0.014	3,650	-0.022	2,064	0.054	1,586
			(0.014)		(0.021)		(0.016)	
Use of contraceptives = {0, 1}	0.332	0.471	-0.004	3,549	0.005	2,017	-0.009	1,532
			(0.019)		(0.027)		(0.030)	
D. Attrition								
Attrition (HH not interviewed at Endline) = {0, 1}	0.266	0.442	0.019	3,745	0.051	2,131	-0.048	1,614
			(0.023)		(0.036)		(0.032)	

Notes: Observations are at the household level. Sample restrictions are stated in the column headings. Each row states the sample mean and standard deviation of a variable, as well as the estimates from three separate regressions, where the variable is regressed on an indicator for NGO entry. All regressions include area fixed effects. In parentheses, we present standard errors clustered at the village level. In Panel B, the standardized index of wealth is an equally weighted average of z-scores of 5 variables: number of assets owned by a HH (out of a list of 11 essential household assets), food security (1="deficit of food the whole year", 2="occasional deficit", 3="neither deficit nor surplus, 4="surplus"), high quality wall material, high quality floor material, high quality roof material. In Panel D, attrition is a dummy variable that take value 1 if the household was interviewed at baseline but not at endline.

Table A.4: Attrition

Sample of Villages:	Dependent Variable: Attrition = {0, 1}							
	All				Gov Worker in 2010			
	NGO	**X***	NGO × **X***	Obs.	NGO	**X***	NGO × **X***	Obs.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
List of **X***:								
Household Received Medical Care from […] in the Past Year (2010) = {0, 1}								
Gov health worker	0.017	-0.066	0.062	3,727	0.048	-0.058	0.058	2,119
	(0.023)	(0.095)	(0.120)		(0.034)	(0.114)	(0.143)	
Traditional healer	0.019	-0.046	0.002	3,727	0.054	0.006	-0.088	2,119
	(0.023)	(0.052)	(0.085)		(0.035)	(0.068)	(0.104)	
Drug store	0.024	0.006	-0.036	3,727	0.052	-0.014	-0.013	2,119
	(0.024)	(0.034)	(0.056)		(0.037)	(0.033)	(0.065)	
Government clinic	0.011	-0.054	0.030	3,727	0.030	-0.092	0.089	2,119
	(0.023)	(0.022)	(0.042)		(0.036)	(0.030)	(0.050)	
Private clinic	0.037	0.024	-0.044	3,727	0.054	0.011	-0.006	2,119
	(0.026)	(0.026)	(0.036)		(0.040)	(0.034)	(0.048)	
Socio-Economic Background in 2010								
# of infants	0.007	-0.051	0.044	3,745	0.041	-0.032	0.036	2,131
	(0.026)	(0.019)	(0.029)		(0.039)	(0.026)	(0.043)	
Involved in farming as main activity = {0, 1}	-0.018	-0.086	0.068	3,745	0.010	-0.087	0.051	2,131
	(0.026)	(0.031)	(0.039)		(0.053)	(0.046)	(0.059)	
Mother's age	-0.019	-0.019	-0.005	3,537	0.011	-0.006	0.001	2,004
	(0.055)	(0.055)	(0.001)		(0.078)	(0.001)	(0.002)	
Mother completed primary education = {0, 1}	0.028	0.049	-0.024	3,745	0.051	0.025	-0.003	2,131
	(0.029)	(0.025)	(0.035)		(0.042)	(0.034)	(0.051)	
# of assets owned (out of 11)	0.009	-0.002	0.002	3,745	0.028	-0.003	0.005	2,131
	(0.046)	(0.004)	(0.006)		(0.056)	(0.006)	(0.008)	
Food security (1 to 4)	0.014	-0.010	0.002	3,727	0.029	-0.008	0.011	2,119
	(0.055)	(0.014)	(0.020)		(0.069)	(0.021)	(0.028)	
High quality house wall material = {0, 1}	0.037	-0.000	-0.042	3,745	0.043	-0.031	0.034	2,131
	(0.033)	(0.029)	(0.040)		(0.042)	(0.039)	(0.054)	
High quality house floor material = {0, 1}	0.035	0.027	-0.038	3,745	0.046	-0.001	0.018	2,131
	(0.034)	(0.028)	(0.040)		(0.042)	(0.037)	(0.055)	
High quality house roof material = {0, 1}	0.044	0.078	-0.041	3,745	0.064	0.063	-0.031	2,131
	(0.039)	(0.038)	(0.042)		(0.048)	(0.041)	(0.053)	
Standardized index of wealth	0.019	0.010	-0.016	3,745	0.054	0.006	0.011	2,131
	(0.023)	(0.020)	(0.025)		(0.034)	(0.025)	(0.032)	
Health Outcomes and Behavior in 2010								
Children sleep under bednet = {0, 1}	0.016	-0.018	0.004	3,745	0.069	-0.009	-0.028	2,131
	(0.032)	(0.018)	(0.031)		(0.047)	(0.025)	(0.039)	
Children drink treated water = {0, 1}	0.042	0.054	-0.032	3,745	0.075	0.052	-0.038	2,131
	(0.044)	(0.039)	(0.045)		(0.050)	(0.047)	(0.055)	
Children wash hands before food & after toilet = {0, 1}	0.091	0.087	-0.077	3,745	0.166	0.114	-0.124	2,131
	(0.051)	(0.035)	(0.048)		(0.061)	(0.037)	(0.061)	
% Children under-5 who had cough in past year	0.032	0.015	-0.016	3,650	0.071	0.038	-0.023	2,064
	(0.033)	(0.027)	(0.038)		(0.046)	(0.036)	(0.058)	
% Children under-5 who had diarrhea in past year	0.014	0.001	0.033	3,650	0.050	0.009	0.030	2,064
	(0.025)	(0.026)	(0.038)		(0.038)	(0.040)	(0.059)	
% Children under-5 who had worms in past year	0.019	0.019	0.015	3,650	0.042	-0.013	0.064	2,064
	(0.026)	(0.028)	(0.038)		(0.039)	(0.041)	(0.058)	
% Children under-5 who had TB in past year	0.022	-0.083	0.118	3,650	0.059	-0.087	0.027	2,064
	(0.023)	(0.086)	(0.160)		(0.035)	(0.104)	(0.161)	
% Children under-5 who had malaria in past year	0.033	0.016	-0.016	3,650	0.059	0.049	0.003	2,064
	(0.027)	(0.025)	(0.035)		(0.040)	(0.034)	(0.055)	

Notes: Observations are at the household level. Sample restrictions are stated in the column headings. Each row presents the estimates from a regression of attrition onto NGO entry, X*, NGO entry × X*, where X* is a household characteristics mesured at baseline. All regressions include area fixed effects. In parentheses, we present standard errors clustered at the village level.

Table A.5: Health Services and Mortality – More Controls

	Dependent Variable				
	Household Received Medical Care from the Following in the Past Year (2012) = {0, 1}			Infant Mortality (2010-12)	
	NGO	Gov	Any (NGO or Gov)	≥ 1 died = {0, 1}	Deaths/1,000 births
	(1)	(2)	(3)	(4)	(5)
Sample:	All	All	All	HHs with a birth since 2010	All
Mean Dep.Var.	**0.235**	**0.313**	**0.457**	**0.073**	**65.004**
Gov	-0.031	0.394	0.387	-0.054	-63.993
	(0.041)	(0.060)	(0.072)	(0.025)	(26.888)
NGO [1]	0.371	-0.051	0.311	-0.034	-46.037
	(0.045)	(0.038)	(0.049)	(0.024)	(27.031)
Gov × NGO [2]	-0.108	-0.201	-0.449	0.062	56.218
	(0.061)	(0.084)	(0.087)	(0.035)	(37.130)
Constant	0.085	0.177	0.201	0.108	110.227
	(0.030)	(0.034)	(0.043)	(0.019)	(20.115)
Observations	2,747	2,747	2,747	1,402	127
R-squared	0.216	0.437	0.288	0.039	0.315
Gov × NGO + NGO [1] + [2]	0.264	-0.252	-0.138	0.028	10.181
p-value	<0.001	<0.001	0.010	0.197	0.627

Notes: The sample comprises of all villages. Observations are at the household level in col. (1)-(4) and at the village level in col. (5). In parentheses, we present standard errors clustered at the village level for household-level regressions and robust standard errors for village-level regressions. All regressions include area fixed effects. They also include the following controls (measured in 2010) and their interactions with NGO entry: access to health providers (government clinic within 10km, private clinic within 10km, drug store in the village, traditional healer in the village), village size (number of households in the village, number of infants per household), infant mortality (number of infants who died), household characteristics (farming is the main HH occupation, completed primary education, standardized index of wealth).

Table A.6: NGO Time Allocation Across Tasks (Reichenbach and Shimul, 2011).

	Self-reported Activity for the Past Month				
	(1) % health workers who provided this activity	(2) Time (minutes) per activity	(3) # of activities provided	(4) Total time per activity = (2) x (3)	(5) Total time per activity as % of total time = (4)/2920 x 100
Pregnancy identification	98%	25	7	175	6%
Attending delivery and providing newborn care	97%	28	7	196	7%
Referral to hospitals or clinics	88%	21	11	231	8%
Attending refresher training	94%	231	2	462	16%
Selling medicines	99%	23	46	1058	36%
Selling health commodities	97%	21	38	798	27%
Total per worker across activities		349	111	2920	100%

Notes : The sample comprises of 660 NGO community health workers interviewed by the NGO throughout Uganda in 2009. Workers were asked (a) which activities they performed as a health worker in the last month, (b) how much time was dedicated to each of these activities. Refresher trainings are organized on a monthly basis in the NGO branch office and are aimed to "refresh" workers' health knowledge and to allow workers to replenish their stock of health products.

Table A.7: Targeting

	Dependent Variable: Household Received Medical Care from the NGO or Gov Health Worker in the Past Year (2012) = {0, 1}	
	(1)	(2)
Sample of villages:	NGO	No NGO
Mean Dep.Var.	**0.573**	**0.668**
Poor household	-0.136	0.152
	(0.055)	(0.066)
Constant	0.615	0.625
	(0.034)	(0.028)
Observations	694	779
R-squared	0.187	0.203
NGO = No NGO p-value	0.001	

Notes: The sample comprises of villages with a gov health worker in 2010.
Additional restrictions are stated in column headings. Observations are at the household level. In parentheses, we present standard errors clustered at the village level. All regressions include area fixed effects. "Poor household" is an indicator for whether the household standardized index of wealth is in the bottom quartile of the within-village distribution. The p-value "NGO=No NGO" is the p-value of the coefficient Poor × NGO in a regression where the dependent variable is regressed on NGO, Poor, Poor × NGO, area fixed effects, area fixed effects × NGO and standard errors clustered at the village level.

Table A.8: Health Services with Lee Bounds

	Dependent Variable: Household Received Medical Care from the Following Health Worker in the Past Year (2012) = {0, 1}		
	(1)	(2)	(3)
	Gov	NGO	Any (NGO or Gov)
Mean Dep.Var.	**0.546**	**0.238**	**0.623**
NGO - Lower Bound	-0.261	0.296	-0.154
	(0.028)	(0.024)	(0.037)
NGO - Upper Bound	-0.172	0.385	-0.064
	(0.034)	(0.031)	(0.029)
Observations	2,132	2,132	2,132

Notes: This table presents Lee Bounds (2009). Observations are at the household level. In parentheses, we present bootstrapped standard errors.

Table A.9: Natal and Post-Natal Services

	Dependent variable		
	(1)	(2)	(3)
	Delivery in a clinic = {0, 1}	Delivery assisted by a health professional = {0, 1}	Post-natal visit within two months of birth = {0, 1}
Sample:	HHs with a birth in the past year		
Mean Dep.Var.	**0.744**	**0.533**	**0.265**
Gov	-0.006	0.392	0.379
	(0.076)	(0.106)	(0.081)
NGO [1]	0.051	0.201	0.194
	(0.070)	(0.104)	(0.060)
Gov × NGO [2]	-0.135	-0.304	-0.410
	(0.095)	(0.119)	(0.088)
Constant	0.783	0.260	0.060
	(0.072)	(0.096)	(0.059)
Observations	407	407	407
R-squared	0.164	0.118	0.243
Gov × NGO + NGO [1] + [2]	-0.084	-0.104	-0.216
p-value	0.200	0.094	0.001
[1] p-value (RI)	0.390	0.058	0.000
[2] p-value (RI)	0.114	0.018	0.000

Notes: The sample comprises of all villages. Observations are at the household level. In parentheses, we present standard errors clustered at the village level. All regressions include area fixed effects. They also include the following controls (measured in 2010) and their interactions with NGO entry: presence of a clinic within 10km of the village, number of households in the village, number of infants who died in the past year. P-values from randomization inference using 500 random permutations are presented at the bottom of the table.

Table A.10: Fertility

	Dependent Variable: Birth since 2010 = {0, 1}													
	NGO × Gov × X*		NGO × X*		Gov × NGO		NGO				Gov × NGO + NGO		Gov × NGO × X* + NGO × X*	
X* of triple interaction below:	Coef.	Std Err.	Coef.	Std Err.	Coef.	Std Err.	Coef.	Std Err.	Obs.	R-sq.	Coef.	p-val	Coef.	p-val
						A. Baseline								
					-0.100	(0.049)	0.057	(0.035)	2,747	0.080	-0.043	0.107		
						B. Household-Level Characteristics								
Mother's age	-0.001	(0.004)	-0.001	(0.003)	-0.043	(0.136)	0.065	(0.099)	2,598	0.118	0.022	0.790	-0.002	0.467
Mother completed primary education = {0, 1}	0.116	(0.082)	-0.098	(0.056)	-0.151	(0.059)	0.105	(0.046)	2,747	0.081	-0.046	0.124	0.017	0.772
Standardized index of HH wealth	0.082	(0.070)	-0.085	(0.065)	-0.117	(0.061)	0.083	(0.054)	2,747	0.084	-0.035	0.228	-0.003	0.923
Standardized index of child health behavior	0.120	(0.083)	-0.045	(0.064)	-0.180	(0.081)	0.087	(0.064)	2,747	0.084	-0.041	0.113	0.075	0.150
Standardized index of disease incidence for children under-5	0.030	(0.089)	-0.072	(0.065)	-0.129	(0.088)	0.116	(0.072)	2,747	0.080	-0.046	0.084	-0.042	0.470
Use contraceptives = {0, 1}	0.038	(0.078)	-0.062	(0.056)	-0.112	(0.057)	0.080	(0.043)	2,613	0.087	-0.031	0.299	-0.024	0.658
Farming as main activity = {0, 1}	0.061	(0.103)	0.047	(0.078)	-0.152	(0.069)	0.042	(0.040)	2,747	0.082	-0.111	0.033	0.108	0.103
						C. Village-Level Characteristics								
Clinic within 10 km = {0, 1}	0.175	(0.206)	-0.027	(0.197)	-0.253	(0.200)	0.082	(0.193)	2,747	0.081	-0.170	0.005	0.147	0.022
Traditional healer in the village = {0, 1}	0.079	(0.082)	-0.066	(0.055)	-0.133	(0.064)	0.083	(0.046)	2,747	0.080	-0.050	0.192	0.013	0.816
Drug store in the village = {0, 1}	0.198	(0.204)	-0.226	(0.206)	-0.273	(0.197)	0.253	(0.199)	2,747	0.081	-0.020	0.639	-0.028	0.604
# of HHs in the village	-0.000	(0.000)	-0.000	(0.000)	-0.098	(0.090)	0.121	(0.066)	2,747	0.081	0.023	0.703	0.000	0.308
# of infants per HH	-0.473	(0.423)	-0.156	(0.363)	0.021	(0.124)	0.107	(0.115)	2,747	0.082	0.129	0.081	-0.629	0.021
# of infants who died in the past year per HH	1.992	(0.866)	-2.137	(0.800)	-0.146	(0.054)	0.098	(0.037)	2,747	0.082	-0.048	0.141	-0.145	0.727

Notes: The sample comprises of all villages. Observations are at the household level and standard errors are clustered at the village level. Each row is one regression. X* is defined in the row headings and is measured at baseline. All regressions include all lower order terms and area fixed effects. They also include the following controls (measured in 2010) and their interactions with NGO entry: presence of a clinic within 10km of the village, number of households in the village, number of infants who died in the past year.

Table A.11: Prices

	Dependent Variable: Price of Treatment (Medication and Tests)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Malaria	Diarrhea	Pneumonia	Malaria	Diarrhea	Pneumonia
Mean Dep.Var.	**5.643**	**3.418**	**3.357**	**5.643**	**3.418**	**3.357**
Gov	-1.299	-0.588	-0.877	-1.534	-0.609	-0.924
	(1.173)	(0.976)	(0.857)	(1.210)	(0.984)	(0.871)
NGO [1]	0.332	-0.464	-0.149	-0.411	0.018	0.119
	(1.160)	(1.214)	(0.960)	(1.007)	(1.337)	(0.987)
Gov × NGO [2]	0.561	-0.319	0.092			
	(1.530)	(1.304)	(1.106)			
Gov × NGO × NGO hired Gov worker [3]				1.880	-0.272	0.253
				(1.596)	(1.398)	(1.118)
Gov × NGO × NGO hired new worker [4]				1.454	-1.560	-0.579
				(1.537)	(1.592)	(1.277)
Constant	6.148	4.143	3.822	6.274	4.144	3.84
	(0.884)	(0.714)	(0.646)	(0.899)	(0.729)	(0.653)
Observations	2,236	1,977	1,819	2,236	1,977	1,819
R-squared	0.112	0.091	0.111	0.115	0.093	0.111
Gov × NGO + NGO [1] + [2]	0.893	-0.783	-0.057			
p-value	0.352	0.161	0.902			
Gov × NGO × Hired Gov + NGO [1] + [3]				1.469	-0.254	0.372
p-value				0.172	0.693	0.480
Gov × NGO × Hired new + NGO [1] + [4]				1.043	-1.542	-0.460
p-value				0.359	0.023	0.480

Notes: The sample comprises of all villages. Observations are at the household level and standard errors are clustered at village level. Prices are measured in 1,000 Ugandan Shillings. All regressions include area fixed effects. They also include the following controls (measured in 2010) and their interactions with NGO entry: presence of a clinic within 10km of the village, number of households in the village, number of infants who died in the past year. Col. (4)-(6) additionally include the controls interacted with Gov × NGO.

Table A.12: Average Effect of NGO Entry

	Dependent Variable				
	Household Received Medical Care from the Following Health Worker in the Past Year (2012) = {0, 1}			Infant Mortality (2010-2012)	
	(1)	(2)	(3)	(4)	(5)
	NGO	Gov	Any (NGO or Gov)	≥ 1 died = {0, 1}	Deaths /1,000 births
NGO	0.315	-0.172	0.054	0.001	-6.777
	(0.027)	(0.040)	(0.037)	(0.014)	(13.797)
Constant	0.074	0.401	0.429	0.073	68.526
	(0.015)	(0.028)	(0.028)	(0.009)	(9.435)
Observations	2,747	2,747	2,747	1,402	127
R-squared	0.185	0.345	0.220	0.028	0.206

Notes: The sample comprises of all villages. Observations are at the household level in col. (1)-(4) and at the village level in col. (5). In the parentheses, we present standard errors clustered at the village level in household-level regressions and standard errors in village-level regressions. All regressions include area fixed effects.

Table A.13: Logit Estimation for Health Services and Mortality

	Dependent Variable			
	Household Received Medical Care from the Following Health Worker in the Past Year (2012) = {0, 1}			Mortality = {0, 1}
	(1)	(2)	(3)	(4)
	NGO	Gov	Any (NGO or Gov)	≥ 1 died
Mean Dep.Var.	**0.235**	**0.313**	**0.457**	**0.073**
Gov	0.072	2.744	2.187	-0.706
	(0.385)	(0.357)	(0.323)	(0.330)
NGO [1]	2.631	-0.446	1.838	-0.464
	(0.359)	(0.369)	(0.269)	(0.337)
Gov × NGO [2]	-0.859	-0.926	-2.509	0.856
	(0.437)	(0.559)	(0.392)	(0.443)
Observations	2,747	2,747	2,747	2,747
Gov × NGO + NGO [1] + [2]	1.771	-1.372	-0.671	0.393
p-value	<0.001	<0.001	0.006	0.160

Notes: This table presents coefficients from a logistical regression. The sample comprises of all villages. Observations are at the household level. In parentheses, we present standard errors clustered at the village level. All regressions include area fixed effects. They also include the following controls (measured in 2010) and their interactions with NGO entry: presence of a clinic within 10km of the village, number of households in the village, number of infants who died in the past year.