

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

(Preliminary and Incomplete)

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Abstract

We document that in poor rural communities where government workers provide basic health services, the entry of an NGO that aims to provide similar services reduces the supply of government workers and total services. This is consistent with the NGO providing the combination of higher pay and strong incentives for commercial activities. The decline in health services is driven by villages where the government worker moves to work for the NGO, and is accompanied by an increase in infant mortality. In villages without any health worker beforehand, NGO entry unambiguously increases health services and reduces infant mortality.

Keywords: Foreign Aid, Aid Effectiveness.

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1 Introduction

The efficacy of foreign aid is a central and one of the most controversial questions for researchers and policy makers today. Well-known arguments have been made both for and against the effectiveness of traditional aid (e.g., [Burnside and Dollar, 2000](#); [East-erly, 2006](#)). In response to the criticisms, particularly those regarding aid being tied to the strategic objectives of donor countries (e.g., [Alesina and Dollar, 2000](#); [Kuziemko and Werker, 2006](#)), aid policy makers have given increasing support to non-government organizations (NGOs) (e.g., [Buthe et al., 2012](#); [Dreher et al., 2007](#); [Nancy and Yontcheva, 2006](#)).¹ For example, [Faye and Niehaus \(2012\)](#) documents that donors use bilateral aid to influence elections in developing countries, but that this strategic behavior is not present for aid administered by NGOs. In the past twenty years, the number of NGOs and overall aid from major donors such as USAID and the European bilateral agencies channeled through NGOs have more than quadrupled ([Pfeiffer et al., 2008](#); [Werker and Ahmed, 2008](#); [Aldashev and Navarra, 2018](#)).² To reduce reliance on large donors, several of the largest NGOs have also created innovative methods of generating revenues that we discuss later.

The ultimate goal of foreign aid is to create self-sustainable development in countries that are otherwise poor. One of the key challenges for many poor developing nations that NGOs can help address is the deficit in public services relative to what the population needs. NGOs fill this gap as the aid-recipient government builds capacity to provide these services in the long-run. However, critics point out that NGOs are largely unreg-

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

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ulated and, for the most part, do not coordinate with each other or recipient-country governments.³ This could create inefficiencies by replicating services and even harming the development of public service delivery by competing with the recipient government for resources and reduce the government’s capacity to provide services which could, in turn, *increase* the country’s future reliance on aid. A second concern is NGOs often pay workers much more than what they would earn working for native private entities or the public sector, which can lead to what some critics have called a “local brain drain.”⁴ Finally, we note that one of the mostly widely acclaimed business models used by some of the world’s largest NGOs (e.g., Living Goods, Grameen, BRAC, and other smaller NGOs such as SWAP, VisionSpring, SolarSister, HealthStore Foundation, HoneyCare Africa, Population Services International, Marie Stopes International, Healthy Entrepreneurs, Réseau Confiance, LifeNet International, One Family Health, BlueStar Healthcare Network, Project Muso, Gold Star Network Kenya, AMUA, World Health Partners) to achieve financial independence is the parallel-task model, where NGO field workers deliver free services to the needy while selling commodities to the same households for a profit.⁵ This business model has the advantage of generating revenues for the NGO independent of donors, and the disadvantage that monetarily incentivized activities can crowd out service delivery.⁶

In the context of health services, concerns over the efficacy of NGOs have been

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

⁴In the Democratic Republic of Congo, (?) shows that high-skilled workers (such as technicians or doctors) are paid seven to eight times more when working for an international NGO than for the government. ([Hjort et al., 2019](#)) documents that the pay gap is partially driven by the fact that international organizations (among which, international NGOs) tend to compress employee wages across countries.

⁵Living Goods, which is one of the pioneers of this new model, has received various prizes and awards, among which the Glaxo Smith Kline–Save the Children Healthcare Innovation Award, the Duke University Center for the Advancement of Social Entrepreneurship Enterprising Social Innovation Award, the BNP Paribas Prize Special Jury Prize for Individual Philanthropy, the Schwab Foundation Social Entrepreneur of the Year Award.

⁶We provide a more detailed discussion in the Background Section.

articulated by medical doctors and public health experts, who call 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 et al., 2008). Farmer (2008) stated that “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.” NGOs are aware of the potential challenges. For example, in discussing its parallel-task model, BRAC, the world’s largest NGO, states: “Clearly there is a potential programmatic trade-off here between increasing her sales and monthly income, while still ensuring that the preventative and health education aspects of the program are being sufficiently addressed” (Reichenbach and Shimul, 2011).⁷

Given the vital role of NGOs in providing aid and the increasing popularity of the parallel-task model, understanding their effects on the development of public services in poor countries is a question of first-order importance. The central aim of this paper is to make progress on this agenda. Specifically, we investigate the effect of NGO entry on the supply of public-sector workers and service delivery in a context that is very relevant to the expressed concerns by policy makers and aid workers: where the NGO offers higher pay than the infant public sector and implements the parallel task model.

We focus on basic health services in rural Uganda, where the population is poor, where access to modern medical care is limited, and where infant mortality rates are amongst the highest in the world.⁸ This is also a context where the government has been attempting to expand public provision of basic health services, and where an NGO with similar aims entered soon after the government program was rolled out. These

⁷Another example of NGO awareness can be seen in Project FAIR’s (Fairness in Aid Remuneration) joint effort with 25 NGOs to reduce the pay gap with native firms (<http://project-fair.org>).

⁸Infant mortality in our sample is 69 per 1,000 live births. In the 2011 Ugandan Demographic and Health Survey (DHS), it is 66 per 1,000.

features make it an ideal context for our research question.

Like many local public-sector workers, government community health workers were volunteers.⁹ Approximately one year after the government introduced its program, a large NGO randomly rolled. At this time, nearly half of the villages that was assigned an NGO worker had a pre-existing government worker. NGO workers provide similar services as the government and also free of charge. In addition, NGO workers sell products to households. These include the medicines that government workers give for free, as well as other household products such as soap, oil or gloves. The profits from sales partly go towards paying NGO village health workers, and partly towards funding the NGO at large.

The main analysis investigates the effect of NGO entry on government health workers (labor) and government-provided services. In principle, NGOs can crowd in, as well as crowd out government-provided services. For example, NGOs can educate the local population about the benefits of health interventions, which can increase the supply of willing health workers as well as the demand of health services. Our empirical estimates will capture the net of the two opposing forces.

Our analysis uses two empirical strategies. To assess the effect of NGO entry on the number of government health workers and the delivery of government-provided health services, we restrict our attention to the subsample of villages with a pre-existing government program and simply estimate the uninteracted effect of randomly assigned NGO entry.¹⁰ To evaluate the effect of NGO entry on mortality and other health out-

⁹In both poor and rich countries, local public services are often delivered by volunteers. For example, Khan et al. (2015) studies volunteer tax collectors in Pakistan. In the United States, election poll workers, police auxiliary, firefighters, recreation program staff, library aides, and senior citizen center assistants are often volunteers (Duncombe, 1985). Most of the community-based health worker, village health committees, traditional birth attendants, community-based distributing agents, or agriculture extension programs in developing countries lack explicit monetary incentives (Bhutta et al., 2010; Gilmore and McAuliffe, 2013; Leon et al., 2015).

¹⁰The effect of NGO entry on government workers/services in villages without a pre-existing government program is mechanically zero.

comes, we estimate the interaction effect of the pre-existence of a government worker and the entry of the NGO. Since NGO entry is randomly assigned, the two variables are independent and the interaction can be interpreted as causal. We prefer the interaction specification because the larger pooled sample of villages provides more statistical precision, and because observing the heterogeneous effects of NGOs in villages with and without pre-existing workers provides a richer picture of the NGO's overall performance. We discuss this in more detail later in the paper.

The results for labor show that the arrival of the NGO in villages with a government worker reduces the number of government workers on average by one health worker in every other village. In half of the villages, the NGO entry pushes the government health worker to drop out and this is often because the NGO recruits the government worker, increasing the total number of health workers in the village by zero. In the other half of the villages, the NGO is able to recruit a new person, increasing the total number of health workers in the village by one. The findings are consistent with NGO entry crowding out the infant public sector, and the conventional wisdom that higher pay from the NGO induces volunteer government workers to switch to working for the NGO.

The results on service delivery show that households in villages that have pre-existing government workers and then receive the NGO are approximately 25 percentage-points *less* likely to see a *government* health worker and 12 percentage-points *less* likely to see *any* health worker. The former shows that NGO entry crowds out government-provided services and is consistent with the shift in labor from the government to the NGO. The latter shows that NGO entry reduces total service delivery. This is consistent with time allocation data, which show that NGO workers spend most of their time on commercial activities and very little time providing health services.¹¹

¹¹See the Background Section for a discussion about time allocation.

The main caveat for our identification strategy is the concern of external validity – the presence of a pre-existing government worker, which is non-random, could be correlated with factors that cause her to prefer to work for the NGO. We address this by carefully controlling for a large number of potentially important base year characteristics (e.g., proxies for village-level or household-level socio-economic status, access to other medical assistance, mortality). Our results are very robust. We also explore and rule out some obvious alternative mechanisms (e.g., changes in the prices of drugs, relative demand for health care and household products). See the paper for details.

The estimated causal effects support the concern that NGO entry crowds out government-provided health services, and shows that the labor supply of health workers is an important channel. It is natural to ask whether the reduction in health services affects health outcomes, such as infant mortality, the reduction of which is amongst the main objectives of both organizations. We find that in villages with a pre-existing government worker, NGO entry increases infant mortality: the effect is large but insignificant. However, when we decompose the villages into those where the NGO did not recruit a new worker (i.e., the government worker shifted to work for the NGO, the total number of workers was unchanged) and those where the NGO recruited a new person (i.e., the total number of workers increased from one to two), we find that the average decline in total health services is driven by the former. Moreover, mortality experienced a statistically significant *increase* in the former group of villages and an imprecisely estimated *reduction* in the latter group. The descriptive decomposition suggests that the average causal effect on mortality masks heterogeneity which depends on whether the NGO is able to recruit an additional worker.

While our paper focuses on government-crowd out – i.e., the effect of NGO entry on villages with a government program, we also examine the effect of NGO entry in

villages without any health workers. In these communities, we find that NGO entry has unambiguously positive effects on service provision and mortality reduction.

It is beyond the scope of our paper to be conclusive about welfare. We provided a detailed discussion in the conclusion, where we also discuss policy implications.

Our study contributes to the large literature on foreign aid. Several recent studies have provided rigorous empirical evidence on the heterogeneous effect of aid across contexts (e.g., [Crost et al., 2014](#); [Nunn and Qian, 2014](#)).¹² In focusing on NGOs, we add to the recent study of [Faye and Niehaus \(2012\)](#), which is referenced earlier. Our results complement this earlier work by pointing to coordination with recipient governments as an important dimension for improving NGO-administered aid. Studies that argue for better coordination typically focus on donor coordination (e.g., [Bigsten and Tengstam, 2015](#)) or on coordination between NGOs.¹³ Recent studies have also provided theoretical evidence that higher wages from foreign aid can distort local labor markets. (e.g., [Knack and Rahman, 2004](#); [Koch and Schulpen, 2018](#)) Various case studies have documented that NGO entry can distort the local labor market, but these remain vastly suggestive and correlational.¹⁴

In documenting how private spending can crowd out government spending in a poor country, we contribute to the public economics literature, which has mainly focused on developed countries and on how government spending crowds out private spending (e.g., [Gruber and Hungerman, 2007](#); [Kingma, 1989](#); [Payne, 1998](#)).¹⁵ The labor sup-

¹²See [Easterly \(2009\)](#) and [Qian \(2015\)](#) for literature overviews.

¹³? study the allocative efficiency of the Ugandan NGO sector and find evidence that NGOs too often operate in the same location, even in the absence of complementarities between NGOs, and that this results in duplication of effort.

¹⁴See [Dollar and Pritchett \(1998\)](#) for a case study in Kenya, [Thakur et al. \(2007\)](#) for a case study in Kosovo and Afghanistan, [Harris \(2006\)](#) for a case study in Sri Lanka.

¹⁵In two well-known earlier studies, [Kingma \(1989\)](#) finds that U.S. government contributions to National Public Radio crowds out private donations, while [Payne \(1998\)](#) finds little evidence that government spending crowds out private donations to U.S. homeless shelters. More recently, [Gruber and Hungerman \(2007\)](#) finds that U.S. government spending crowded out church spending on social services during the Great Depression.

ply mechanism we study supports the recent paper by [Wagnerly et al. \(2019\)](#), which finds that community health workers in Uganda who are randomly instructed to sell health products (rather than distribute them free of charge) provide health services to fewer households. We are also closely connected to a study by [Baldwin et al. \(2019\)](#) which finds that a participatory development program launched by an NGO caused improvements in leadership by pre-existing institutions, but decreased investments in local public goods through these institutions. A large number of studies have produced mixed findings when evaluating the effect of NGO-provided community health services on mortality.¹⁶ The heterogeneous effects we estimate – that NGOs reduce mortality in villages with no government worker complements this literature.

The paper is organized as follows. Section 2 describes the context. Section 3 describes the data and descriptive statistics. Section 4 presents the main results on labor supply and health service delivery. Section 5 presents the results on mortality. Section 6 concludes.

2 Background

2.1 Government Health Service Provision

Rural Uganda is one of the poorest regions in the world, where average per capita gross income was \$560 in 2010 (World Bank National Accounts Data) and where neonatal,

¹⁶[Bjorkman-Nyqvist et al. \(Forthcoming\)](#) find that the entry of an NGO similar to ours (with a similar parallel task model) reduces child mortality (under 5 years) by 27%, infant mortality (under 1 year) by 33%, and neonatal mortality (under 1 month) by 28%. Similarly, [Kumar et al. \(2008\)](#) and [Baqui et al. \(2008\)](#) document large reductions in neonatal mortality (34%-50%) following the introduction of a new NGO program providing home health care in poor rural areas. In contrast, [Darmstadt et al. \(2010\)](#) and [Shandra et al. \(2010\)](#) document smaller effects (below 15%), which in the latter paper were only found in democratic and not repressive nations. [Sloan et al. \(2008\)](#) finds that teaching child care to expectant and postpartum women has no significant impact on neonatal and infant mortality, and [More et al. \(2012\)](#) finds that the introduction of women’s groups that aim to improve local perinatal health in urban slums has no neonatal mortality.

infant and under-5 mortality rates were estimated in 2011 at 30, 66 and 111 per 1,000 live births, respectively – among the highest in the world ([DHS, 2011](#)). 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 6 hours of life ([Baqui et al., 2016](#)).¹⁷

To respond to the scarcity of public health services and the shortage of health workers, the Ugandan government founded the Village Health Team (VHT) program which hires community health workers to provide health services to their own community. While the program was founded in 2001, it was not implemented for many years and in many areas in Uganda because of the lack of funding. In the North and Central Ugandan regions that we study, government workers were hired around mid-2009.¹⁸

Government health workers are part-time employees who typically maintain other daily occupations such as farming or small shopkeeping. Their main job as a government health worker is to provide the following health services during home visits to members of their community: (i) health education (e.g., benefits of a hospital delivery, methods of disease prevention), (ii) post-natal check-ups, (iii) basic medical advice and referrals to health clinics that are usually located in more urban areas. The latter include helping patients decide when it is useful to travel to urban areas for medical attention, as well as coordinating the visit to ensure that professional medical staff is on-site during the visit.¹⁹ The latter is important because of the high level of absenteeism in Ugandan public health facilities. For example, the Uganda National Health

¹⁷The 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%) ([WHO, 2012](#)).

¹⁸See 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 150 government workers in Northern Uganda indicates that 87% of them were hired between 2009 and 2010 ([Kimbugwe et al., 2014](#)).

¹⁹The Ugandan Ministry of Health states that “VHTs (government community health workers) are responsible for serving the first link between the community and formal health providers” [Uganda Ministry of Health \(2011\)](#). Within Uganda’s tiered national health system, the VHT workers holds the position of Health Centre I, followed by Health Centres II-IV, which are local clinics, each with sequentially higher levels of capacity and larger catchment areas ([Mays et al., 2017](#)).

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 (Mukasa et al., 2019; Nyamweya et al., 2017)). 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.

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.

The government recruits workers locally. To be eligible for the community health worker position, a person must be an adult and satisfy two conditions: village residence and be able to read and write. Among the eligible candidates, the government prioritizes those who are good community mobilizers and communicators, trustworthy and willing to work for the community, and who have experience in the health sector (Turinawe et al., 2015).²⁰ Once hired, government 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. They are not paid or given any incentives and are therefore generally considered to be motivated by altruism, along with the reputational value they benefit from and the appreciation they get from the local community (e.g., Ludwick et al., 2013; Kasteng et al., 2015; Ormel et al., 2019; Wagnerly et al., 2019).

The government program was rolled out in all villages. It aimed to employ two workers per village. However, in our study area, only 57% of the villages (73 villages)

²⁰The exact selection procedure varies from one village to another. In some villages, the worker is appointed by a government official. In some others, the worker is appointed by the community members, either by the village chief (LC1) or through a popular votes (Turinawe et al., 2015; Kimbugwe et al., 2014). In Northern Uganda, 78% of the hired government workers had prior experience working as a volunteer in the health sector as a Community Drug Distributor or a Condom Distributor (Kimbugwe et al., 2014).

had a government worker in 2010, one year after the government program was rolled out; 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). To understand the recruitment and staffing of government workers, we conducted in-depth interviews with government workers in our study areas at all levels of the bureaucracy. The presence of a government worker in 2010 is not random. According to higher-level government officials as well as community health workers, the key limitation is the labor supply of those who are both qualified and willing to work as volunteer workers.

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” at the health facility. District-level health officials that we interviewed stated that each health facility is responsible for keeping track of resignations of affiliated community health workers and finding a replacement, but are severely under-staffed, and in practice, neither keep track of community health workers nor replace those that drop out of the program. In other words, there is no accurate record of government workers at a given point in time. Note that the lack of personnel records is not only specific to our context but is present in many other developing countries (Cain and Thurston, 1997; Bank, 2000; Cain, 2001; Ngulube and Tafor, 2006; Asogwa, 2012; Mampe and Kalusopa, 2012).²¹ Such lack of records is very problematic for NGOs when the latter attempts to avoid hiring government workers. We discuss this more in the next section.

²¹Cain and Thurston (1997) 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).

2.2 The NGO

The NGO we study has the same aims and provides the same services as the government program. It entered our study area of 127 villages in June of 2010 by rolling out its program in a random sub-sample of 66 villages, of which 36 had already the government program in place for at least six months.²²

NGO workers, like government ones, are recruited locally and tasked to provide similar free basic health services to the community. Like government workers, they work part-time and are easily identifiable from wearing their NGO uniforms. They mainly differ from government ones in that they also sell household products from which they receive piece-rate (whereas government workers earn no income). As we discussed in the introduction, the motivation of the “parallel-task” model is to provide financial sustainability for the NGO and increase its independence from donors. This model is used by several of the largest NGOs today, including Living Goods, Grameen, BRAC, and other smaller organizations such as SWAP, VisionSpring, SolarSister, HealthStore Foundation, HoneyCare Africa.²³

For the NGO of our study, the parallel-task model works as follows: NGO 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 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 NGO and government programs differ in two other ways. First, the govern-

²²Our study focuses on 127 villages that can be divided in 4 types based on NGO entry and the presence of a government worker in 2010: 36 villages have both the NGO and the government, 37 have the NGO only, 30 have the government only, and 24 have neither.

²³See <https://healthmarketinnovations.org/> for a more extensive list of NGOs using the parallel-task model.

ment workers distribute drugs for free, while the NGO workers sell similar drugs for a small fee. Past studies have noted that NGOs may provide higher quality products (Bjorkman-Nyqvist et al., 2016, [Forthcoming](#)). Second, the NGO provides more training than the government: NGO workers receive twelve days of initial training (vs. five for the government). The content of the NGO and government trainings are similar — they covers key health topics, including diagnosing, treating and recognizing danger signs for referral – with the difference that NGO workers are also trained on best practice sales skills, counseling, and communication. Moreover, NGO workers attend a monthly one-day refresher training session, where they receive further training, discuss the gaps in coverage and the quality of care and are allowed to restock health products. This could ostensibly result in the NGO providing higher quality care than the government.

In our study area, the NGO was able to successfully recruit in all the villages it entered, whereas the government was only able to do so in half of the villages. Since the NGO looks for individuals with the same skills and follows the same hiring criteria as the government, government workers who apply to work for the NGO are typically more competitive than other applicants. Based on the interviews that we conducted with NGO recruiters, the NGO attempts to avoid hiring government workers. But this is difficult to implement because of the lack of information on government workers and the incentives for applicants to hide their role as government workers when hired. There are also some cases where the NGO knows that the applicant works for the government but still hires her because she is the only able and willing candidate.

2.3 Products sold by NGO vs. Government workers

Figure [1](#) documents the retail price (what households pay) and the profit margin for the NGO worker for the products they sell. The medicines that 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. This suggests that the increase in the price of drugs is likely to play a small role in understanding the tradeoffs of government and NGO workers.

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. In an interview with one of the NGO directors, she says that the “Provision of these products which have a less direct impact on health was meant to serve as an incentive and also ensure sustainability of the health program operations”. This means that the NGO worker is mostly monetarily incentivized to sell products that have less of a direct impact on health than those provided by the government worker.

2.4 Time Allocation of Government vs. NGO workers

Government workers work on average ten hours per week delivering health services, including the dispersal of free drugs (Mays et al., 2017). To the best of our knowledge, there are no disaggregated time allocation data for government health workers.

For NGO workers, we have such data from two sources. First, Deserranno (2019) finds that NGO workers work approximately fourteen hours a week, half of which is devoted to health services. This roughly implies that NGO workers provide 30% fewer hours of health services than government workers. The second source is Reichenbach and Shimul (2011), who interviewed 660 NGO workers. Table 1 shows that over one month, NGO workers supply a total of 49 hours, where 37% is spent on providing health services (which includes attending refresher training) and 63% is spent on selling medicines or health commodities. Because the time allocated for refresher training includes visits to the branch office to resupply the products they sell, 37% is the upper

bound of health-related activities. The lower bound can be obtained if we attribute the time attending refresher training to market activities. When we do this, we find that NGO workers spend 21% of their total effort on health-related activities and 79% of their time on market activities. For the purposes of comparability with government health workers, for whom we do not have detailed time allocation data but for whom we assume that dispensing free medicines is a health service, we can attribute half of selling medicines as health services for NGO workers. In this case, the amount of time allocated to health-related activities will be 39% to 57%.

The time allocation data should be interpreted as merely suggestive and can under- or over-state the true time spent providing health services. On the one hand, we assume that the time spent by the NGO worker selling similar drugs and other products is not a part of health care provision, whereas, for government workers, we assume that distributing drugs is part of health services provision.²⁴ On the other hand, the self-reported NGO allocation of time to health services is probably an upper bound of actual service delivery because patient visits are also used to sell products and monthly training visits are also used to refill stocks.

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

²⁴We make this assumption because we lack disaggregated data for time allocation for government health workers.

from a government health worker as well as the NGO.

On the other hand, the NGO can crowd out health care delivery in several ways. The NGO distorts the local labor market by providing the monetarily incentivized activity of selling goods to health workers, which can crowd out more altruistically motivated health service provision. NGOs are aware of this problem. For example, BRAC, the world’s largest NGO, which uses the parallel-task model said in an evaluation of the community health program in 2011, “There is a perception among the NGO staff that women are more commercial-minded and very much motivated by financial incentives as opposed to non-financial incentives” ([Reichenbach and Shimul, 2011](#)).

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

The discussion so far focuses on time allocation that is unadjusted for quality. For example, the NGO worker may be more efficient at identifying and examining patients, such that she can provide more services within a given time frame than the government worker. Similarly, if the drugs sold by the NGO (and are given for free by the government) are higher quality, the effect of the increase in prices on health may be offset by the increase in quality. We will return to this when we present the results.

2.5 Selection of Government Workers who Switch to NGO

We study which type of government health worker applies for the NGO position by leveraging data from [Deserranno \(2019\)](#). The data contain information on 241 govern-

ment health workers eligible for the NGO position in rural Western Uganda (no overlap with the sample of villages in this study).²⁵ For each government health worker, we know their socio-economic background, their education level, their occupation, proxies of their wealth, the number of months of experience as a government health worker and measures of their prosocial motivation. Importantly, we also know whether they applied for the NGO job upon NGO arrival and whether they were ultimately hired.

The data indicate that 45% of the government workers applied for the job. Of these 60% were hired. Conditional on applying for the NGO position, a government health worker has thus high chances of being appointed. Interestingly, 29% of the appointed government health workers had no competition (no other applicant in the village) while 71% of the appointed candidates had competitors, presumably less-qualified.

To understand whether the government workers who switch to the NGO are positively or negatively selected, one needs to assess which type of government worker applies for the job (application stage) and which type is appointed by the NGO (hiring stage). Table A.1, columns (1)-(5), shows that government workers who applied for the job have 1.36 extra years of education relative to workers who did not apply, while they have similar wealth, similar age and the same number of children. They have an extra 8 months of experience as a health worker and are 14 percentage-points more (less) likely to report that “earning money” (“earning respect”) is the most (least) important characteristic in a new job. Overall this suggests that the type of government worker interested in switching to the NGO is more educated, has more experience and is less prosocially motivated. Among the government health workers who apply for the job, the NGO appoints those with more months of experience and the pro-social ones. Indeed, the difference in the number of years of experience (pro-social motivation) is

²⁵In her context, a government health worker is eligible for the position only if she is a member of the NGO microfinance program. “Being part of the microfinance program” is not an eligibility criteria in our context. The characteristics of the underlying pool of eligible government workers may thus differ in our context from hers.

larger (smaller) for workers who were hired vs. not hired than for workers who applied vs. did not apply. Ultimately, this means that the government workers who switch to the NGO are positively selected: they have 1.16 more years of education and 15 (60%) more months of experience as a health worker (see Table A.1, columns 6-10).

3 Data

3.1 Data Sources

The data collection and randomization used in this study were conducted by one of the authors of this paper as part of an internal evaluation of the NGO.²⁶ The main analysis uses survey data that cover 127 rural villages in twelve geographical areas of Uganda.²⁷ Data on mortality and access to health services were collected in May 2010, approximately six months to a year after the government program was rolled out and one month before the NGO program rolled out. Data were collected again in December 2012. The paper will sometimes refer to 2010 as the base year and 2012 as the end year. In each wave, there is a village and a household-level survey. The former is answered by the village head. The latter is answered by 10% of the households, chosen randomly within the sample of households that had a child below age of five in 2010. The survey respondent is the female household head, who is presumably the most knowledgeable about the topics of inquiry. The survey questions change slightly over time. We will discuss this when relevant. We supplement the survey data with census data collected from February to April 2010. These include variables such as household size, mortality, and occupation for all households in each village.²⁸ We also have access to an internal survey conducted by the NGO for its community health workers in January 2012,

²⁶We are extremely grateful to the NGO for sharing their data.

²⁷We do not reveal the names of the 127 village to preserve the anonymity of the NGO.

²⁸These census data were used by the NGO for sampling in the household-level survey.

eighteen months after the NGO rolled out.²⁹

3.2 Descriptive Statistics

3.2.1 NGO Personnel

Several interesting facts emerge from the self-reported data from health workers that we present in Appendix Table A.2. First, NGO workers report earning 14.2 USD per week, or 38% of the average weekly income in Uganda in 2013, which is a considerable income for a part-time job.

Second, 21% of all NGO workers report that they used to work for the government as health workers. In contrast, in villages with pre-existing government workers, 40% had switched from the government to the NGO. Even more strikingly, if we examine villages with a government worker in 2010, but no government worker in 2012, 82% of the pre-existing government workers switched to the NGO after the latter entered the community. This is consistent with the concern that NGOs compete with the government for labor and workers are likely to move to the NGO that pays a higher income.

Finally, the NGO health workers report that the fraction of households who bought a health product from them in the past week is three times larger than the fraction of households to whom they gave medical advice (6 versus 2%). Household survey data collected in 2012 for villages with the NGO indicate that the fraction of households that have purchased commodities (soap, oil, salt) from the NGO at end year, 28%, is higher than that which have purchased medical products (antimalarials, oral rehydration salt) from the NGO worker (9% and 3%, respectively).

NGO workers recruited in villages with a pre-existing government worker have sim-

²⁹The survey includes NGO workers in 2012 and does not include any government workers in 2012. It will include government workers from 2010 only if they switched to work for the NGO.

ilar age, education, marital status, earnings than those recruited in villages without a pre-existing government workers (A.2, column 7). Unsurprisingly, they are substantially more likely to have worked as a government health worker in the past and, consistent with that, they have better knowledge about how to treat malaria and diarrhea.

3.2.2 Household Well-being, Access to Health Services and Balance

Table 2 reports the summary statistics for the main variables that capture access to health care, and the well-being of the household. Panel A column (1) shows that in 2010, government health workers are present in 57.5% of villages, traditional healers are present in 48% of villages, drug stores are present in 69% of villages, 56% of villages have a government clinic within a ten kilometer radius, and 84% of villages have a private clinic within a ten kilometer radius.³⁰ Panel B aggregates the census data at the village level and shows that on average, a village contains 182 households, with an average of 0.3 infants per household. 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 and only 32% of the household heads have completed primary education. Households are poor. The average household owns half of a list of “essential” household items (e.g., clothes, pair of shoes, cooking pots). Average food security is two, measured on a scale from one to four. Approximately half of the households live in homes with low-quality construction material.

Columns (3)-(6) compares the subsample of villages with and without NGO entry. To do so, we regress each base year village characteristic of Table 2 on a dummy for NGO entry, with area fixed effect and Newey-West robust standard errors. The coefficient of the NGO dummy captures the difference across the two subsamples. Consistent with

³⁰Government 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.

randomization, none of the differences is statistically different from zero (column 3).

In columns (8)-(11), we focus on the subsample of villages with a pre-existing government worker, and again show that the difference in means between villages with and without NGO entry (captured by the NGO dummy coefficient) is not statistically different from zero and is small in magnitude, with the exception of “presence of a private clinic within 10km” which is significant at the 10% level. The fact that villages with vs. without NGO entry are comparable even in the subsample of villages with a pre-existing government worker is important for our study because the randomization was not stratified at the level of the government workers and the small sample could have led to differences across the villages without and without NGO entry to be non-zero. We show this is not the case.

Table A.3 reports household-level summary statistics and balance checks using the base year household survey. The fraction of households who have received medical advice from a government health worker, a traditional healer, a drug store, a government clinic or a private clinic in the past year is 3%, 2%, 15%, 25% and 39% respectively.³¹ “Receiving medical advice” from a health provider takes value one if a household received any type of medical advice regardless of whether they sought for the advice themselves or received without seeking it. Consistent with our sample being rural and poor, 76% of the households surveyed in 2010 report that medical services are too expensive and 51% report that health facilities are too far. Interestingly, 31% of households report staff absenteeism in public health facilities as another constraint to the access of health services. These variables are comparable in villages with vs. without NGO entry, whether we consider the entire sample of 127 villages or the subsample of 73 villages

³¹The share of households who report having received advice from a government health worker in the year preceding the base year (2010) is similar in villages with vs. without a government worker in 2010. This is in line with the government community health program having only recently started in the region by the time of the base year survey collection.

with a pre-existing government worker.³²

4 Main Results

4.1 Labor Supply

To investigate how NGO entry affects the labor supply of government health workers, we restrict our attention to the 73 villages that had a government worker when the NGO entered in 2010 and estimate the following specification:

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

The number of health workers in village i in 2012, y_i , is a function of: a dummy variable that takes a value of 1 if it is designated to participate in the NGO program in 2010, NGO_i ; the uninteracted dummy variables; and area fixed effects, λ_a (stratification variable). We estimate Newey-West robust standard errors.

Since NGO entry is randomly assigned, β can be interpreted as a causal effect.³³ Table 3 Panel A presents the results for labor supply. Column (1) examines the number of NGO health workers and it shows that NGO entry unsurprisingly increases the number of NGO health workers by one. Column (2) shows that NGO entry reduces the number of government health workers by approximately one per every other village. The coefficient is -0.430 and statistically significant at the 1% level. These estimates are consistent with the descriptive statistics discussed earlier, which indicate that when the NGO enters a village with a government health worker, in approximately 40% of cases, the government worker switches to working for the NGO. Column (3) examines the

³²We do not report household-level summary statistics on infant mortality because we do not have reliable information on household-level infant mortality at base year.

³³Recall that we demonstrate balance between treatment and control villages in the subsample with a government worker in 2010.

number of all government health workers (government or NGO). This variable can take the values of zero, one or two. We find that NGO entry increases total health workers by around one per every two villages. The coefficient is 0.570 and it is statistically significant at the 1% level. This finding is unsurprising given the results in columns (1) and (2).

In columns (4) and (5), we examine the presence of a traditional healer and drug store as outcomes. Traditional healers are a source of health care, but unlike NGO and government health workers, they do not provide modern health services. Drug stores do not provide health services like the NGO and government health workers. However, they do sell drugs and household products, and often dispense advice along with the products. It is unlikely that a traditional healer or a worker at the drug store would be a good candidate to work for the NGO. Thus, it is not surprising that we that NGO entry has no effect on the number of traditional healers and drug stores.

In columns (6) and (7), we examine the presence of a government clinic or a private clinic within a 10km radius as placebo outcomes since these facilities are in urban areas and are unlikely to respond to changes in the supply or demand for health services in one of the many nearby rural communities. We find that NGO entry has no effect.

4.2 Health Services

Recall from the earlier discussion that the self-reported time allocation data suggests that NGO workers are likely to spend fewer hours in total delivering health services than government workers. Nevertheless, the supply of services need not decline if NGO workers are more efficient than government workers. Table 3 Panel B examines this using a question in the household survey about whether a household has “received medical advice” from a community health worker in the past year and the identity of the service provider. The number of observations is much larger than the earlier

analysis since this analysis uses household-level data. To address the possibility that the error terms are correlated with villages, we cluster the standard errors at the village level for all household-level regressions.

Column (1) shows that NGO entry increases the probability that a household will obtain services from an NGO worker by 31.5 percentage-points. In contrast, column (2) shows that it reduces the probability of obtaining services from the government health worker by 25.1 percentage-points. More importantly, column (3) shows that NGO entry reduces total services – i.e., the probability of obtaining services from either the NGO or the government health worker – by 11.6 percentage-points. All estimates are statistically significant at the 5% or higher level.

We find that the probability of obtaining medical advice from a traditional healer or a drug store is unaffected by NGO entry (columns 4 and 5). NGO entry reduces the probability that a household will obtain services from a government clinic by 5.7 percentage-points. This is most likely because government workers are better able to coordinate with medical professionals at government clinics. All community health workers are asked to coordinate with clinics ([Uganda Ministry of Health, 2010](#)). In order to improve the coordination of assisted deliveries in clinics, government health workers in rural areas are given the contact information (e.g., mobile phone numbers) for the clinic staff and the staff are instructed to be responsive to the calls of government health workers ([Asbroek et al., 2018](#)) We will return to discuss this more later when we present the results on assisted deliveries. Unsurprisingly, NGO entry has no effect on obtaining health services with private clinics, which do not explicitly coordinate with either NGO or government health workers.

4.3 Targeting

In addition to a change in overall service delivery, NGO entry can also affect the targeting of services. The main targets for the basic health services for both NGO and government health workers are pregnant women or women who have recently delivered, and poor households. Table 4 examines whether NGO and government workers target differently along these two dimensions. We divide the sample of villages that had a government worker in 2010 into those where the NGO entered and those where the NGO did not enter in columns (1) and (2). We then regress whether a household received medical advice from any health worker during the year prior to the endline survey on whether there is a woman in the household who was either pregnant or delivered in the past year. Column (1) shows that in villages with a government health worker in 2010 and NGO entry, the correlation between having such a women in the household and obtaining services is -0.023. Column (2) shows that the correlation in villages with a government health worker in 2010 and no NGO entry is 0.047. However, neither estimates are precisely estimated. The bottom of the table shows that the p-value for the difference between the two coefficients is 0.345. The imprecision is most likely due to the fact that there are relatively few households that with someone who was pregnant or delivered in the past year.

Columns (3) and (4) examine poor households in similarly divided samples. The estimates are more precise, most likely because there is more variation in the measure of poverty. We define poor to take a value of one if the household wealth index is in the bottom quartile of the within-village distribution. Column (3) shows that in villages with a government health worker in 2010 and NGO entry, being poor is negatively associated with obtaining health advice. The coefficient is -0.136. In contrast, column (4) shows that the correlation in villages with a government health worker in 2010 and no NGO entry is positive, 0.152. 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 0.081.

Consistent with the fact that the NGO workers are strongly incentivized to sell products relative to government health workers, the results suggest that NGO workers are less likely to give advice to households with pregnant or recently delivered women and poor households.

4.4 Decomposition by the Labor Supply of Health Workers in 2012

Recall our earlier finding that NGO entry increases number of NGO workers by one in all villages, and the total health workers by around one per every two villages. This implies that in half of the villages where the NGO enters, there is one NGO workers in 2012, and in the other half, there are two health workers (one government worker and one NGO worker). Also recall from the descriptive statistics that in villages that start with one government health worker in 2010 and only has one NGO worker by 2012, 82% of the NGO workers are former government workers.

This raises the question of whether our findings for services differ between villages with one and two health workers in 2012. Table 5 examines this by decomposing the effects according to the number of workers in 2012. Note that since the number of workers in 2012 is an outcome variable, these estimates are not causal.³⁴ Column (1) shows that there is one NGO worker in both types of villages. Column (2) shows that in villages with alone health worker in 2012, NGO entry is associated with almost one less government workers. The coefficient is -0.920 and it is statistically significant at the 1% level. This is consistent with the descriptive statistics that in such villages, the

³⁴Appendix Table A.4 presents the summary statistics for villages with one vs. two health workers in 2012. We find little evidence of difference in observables between the two types of villages.

NGO workers is the former government worker. It also shows that in villages with two workers in 2012, NGO entry is associated with no change in the number of government workers. The coefficient is only -0.066 and is not statistically significant.

Column (3) examines the total number of health workers and unsurprisingly shows that NGO entry is associated with little change in the number of workers in villages where there is only one in 2012, while it is associated with an additional worker in villages with two health workers in 2012.

Columns (4)-(6) examine services as an outcome. Column (1) shows that NGO entry is associated with similar increases in health advice from NGO workers regardless of whether there is one or two health workers in 2012. Column (2) shows that in villages with one worker in 2012, NGO entry is associated with a 53.1 percentage-point reduction in the probability of getting advice from the government health worker. The estimate is significant at the 1% level. NGO entry is not associated with any change in obtaining services from government health workers in villages where there are two health workers in 2012. The coefficient in the latter case is 0.021 and statistically insignificant.

Column (6) examines total services. It shows that in villages with one worker in 2012, NGO entry is associated with a 24.2 percentage-point reduction in the probability of getting advice from any health worker. The estimate is significant at the 1% level. In contrast, NGO entry is not associated with any change in obtaining services in villages where there are two health workers in 2012. The coefficient in the latter case is 0.006 and statistically insignificant.

These results together show that the reduction in services occurs in villages where the government health worker moves to work for the NGO. In villages where the NGO hires an additional worker, NGO entry is not associated with any change in the probability of obtaining any health advice. This is consistent with the belief from workers

in the field that in villages with both types of health workers, NGO workers visit the same households as the government worker. This could partly be due to the fact that the government health worker already services all of the households targeted by the program.

Note that our dependent variable measures the extensive margin of whether a household obtains any health advice. It could be that in villages with both types of workers, there is a change on the intensive margin in the quantity and quality of services, for which our survey does not measure. Later, we will address this by examining health outcomes.

4.5 NGOs in Villages without a Government Worker in 2010

4.5.1 Treatment Effect in Villages with an NGO worker

Thus far, to understand the interplay between NGO entry and infant public services provided by the government, we have focused on the effect of NGO entry in villages where there was a government health worker in 2010. In this section, we investigate the effect of NGO entry in villages without a government health worker for comparison. This is interesting because the effect of NGO entry on services can be heterogeneous – i.e., moving from no health worker to an NGO health worker may be very different from moving from a government health worker to an NGO health worker or to two health workers. To fully understand the role that NGO health workers play in our context, it is important to examine both scenarios.

Table 6 Panel A estimates equation (1) for the subsample of villages with no government workers in 2010. Columns (1)-(3) show that NGO entry increased the number of NGO workers by one, had no effect on government health workers, and increased the total number of workers by one. Columns (4)-(5) show that NGO entry increased

services from the NGO by 31.5 percentage-points, slightly reduces services from the government by 1.9 percentage-points,³⁵ and increased services from either the government or the NGO by 28.6 percentage-points. Thus, NGO entry had a positive effect on labor supply and health services in villages with no government worker to begin with.

4.5.2 Heterogeneous Treatment Effects

Panel B compares the estimates of NGO entry in villages with and without a government worker in 2010. This is essentially the second difference in the coefficients from Table 3 and Table 6 Panel A. We do this by estimating a second difference equation.

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

The number of health workers or the probability of obtain services in village i in 2012, y_i , is a function of: the interaction of a dummy that takes a value of 1 if the village has a government health worker in 2010, Gov_i , and a dummy that takes a value of 1 if it is designated to participate in the NGO program, NGO_i ; the uninteracted dummy variables; and area fixed effects, λ_a . β is the differential effect of NGO entry in the two types of villages. $\beta + \gamma$ is the effect of NGO entry in villages with a pre-existing government worker and analogous to the NGO coefficient shown in Table 3 for villages with a government worker. γ is the effect of NGO entry in villages without a government worker and analogous to the estimates presented in Table 6 Panel A.

The interaction coefficients in 6 Panel B show that NGO entry has similar effects on the number of NGO workers and services from NGO workers (columns 1 and 4) in the two types of villages. However, it reduces the number of government and total health workers, and government and total services in villages with a government health worker

³⁵NGO entry reduces the likelihood that a household seeks health services from a government health worker in another village.

relative to those without. The interaction coefficients are negative and statistically significant at the 1% level in columns (2)-(3) and (5)-(6).

4.5.3 Additional Controls

Since the presence of a government worker is not randomly assigned, a natural question to ask is whether the differential effect of NGO entry between villages with and without a government worker is due to other factors that are correlated with the presence of a government worker, and which may influence the effect of NGO entry on services, or a government worker’s decision to move to the NGO. We can investigate this concern by comparing the characteristics of villages with and without a government health worker. Table 2 columns (13)-(17) presents the summary statistics as well as the p-value for the difference in means across the two sub-samples. We focus on access to other health care providers, which can influence the demand for health services; and the health and economic well-being of households in 2010, which can influence the demand for health services, the demand for the household products sold by the NGO, as well as the supply of willing and able women to work as a health worker. Column (17) shows that all of these variables are statistically similar between the two subsamples.

Nevertheless, to be cautious, we include additional controls that can potentially influence the effect of NGO entry. We categorize the additional controls into four groups. The first group comprises of variables that can influence the demand for a community health worker: distance to the nearest government clinic, distance to the nearest government clinic, distance to the nearest private clinic, the presence of a drug store and the presence of a traditional healer. Second, we consider demographic variables: the number of households and the number of infants in the community. These variables could affect the labor supply of and demand for health services relative to household products sold by the NGO. For example, the demand for services may be larger in more

populous villages or villages with more young children. Third, we consider base year morbidity: the number of infants who died in the past year. The variables could be correlated to the demand for health services, and reflect underlying well-being (e.g., income) of the population. For example, a village with a higher mortality rate may be poorer, where there is a lower supply of community health workers or where government workers are more motivated to work for higher pay with the NGO. Finally, we consider household-level demographic variables: the age of the female household head and the percent of households involved in farming as the main activity, the share of household heads who completed primary education, and a standardized index of household wealth. These factors may affect the availability of health workers for the government and the NGO.

All control variables are measured in the base year of 2010. We include them in equation (2) both on their own but also interacted with NGO entry. The numerous interaction terms make the uninteracted NGO term difficult to interpret. Thus, we present the NGO coefficient evaluated at the mean of all the controls. The results, which are presented in Table 6 Panel C, are found to be robust to the inclusion of these additional controls.

Note that another advantage for the second difference estimates is that it allows us to pool the data for more statistical power. This will be especially useful as we examine relatively rare-event outcomes such as mortality. Henceforth, we will present the second difference specification.

4.6 Drug Stores

Another way to investigate whether our main estimates reflects the NGO crowding out government health workers and health services in villages where there was a government health worker prior to NGO entry, or if they reflect higher demand for household

products sold by the NGO (relative to health services) in such villages is to exploit the variation in the presence of drug stores. Drug stores sell many of the same products as the NGO. Thus, if the main results are driven by differential demand for goods, then we should find a smaller effect in villages that had a drug store. We examine the total number of health workers and total health care delivery as outcome variables and estimate the second difference specification for villages with and without a drug store in 2010. The estimates are similar and go against differential demand as a main driver of our results.³⁶

5 Mortality

5.1 Natal and Post-Natal Services

To understand whether the crowding-out has real-world consequences, we examine infant (under one year of age) mortality, the reduction of which is a focal point for both government workers and the NGO workers.³⁷

Before examining mortality, we examine the services which are focal points of organizations such as the WHO and UNICEF for reducing infant mortality: assisted hospital delivery and whether a mother received a visit soon after the delivery (Jones et al., 2003).³⁸ The data on post-natal care are only available for households which have given birth during the year preceding the 2012 survey, for whom such care is most relevant. Since giving birth is potentially an outcome of the provision of NGO and

³⁶See Appendix Table A.5.

³⁷Our focus on infant mortality is motivated by the policy objectives of the government and NGO. These two organizations also focus on reducing neonatal and under-age-five mortality. However, we are unable to examine neonatal mortality because we only observe the age of the child and the age of the child's death in years (and not months). We are also unable to examine under-five mortality because we only have precise information about mortality for children born in-between the two surveys and these children have not reached age 5 by the second survey (i.e., they may still die under the age of 5 even though they are not reported as having died by the second wave of data).

³⁸See World Health Organization (2014, 2016); UNICEF et al. (2009).

government health workers, we first need to establish that fertility is not endogenous to the presence of government and/or NGO workers. Table 7 column (1) examines the presence in the household of a woman who delivered in the past year as the outcome variable. We find no relationship between this proxy for fertility and our main right-hand-side variables. Therefore, in columns (2)-(4), we restrict our sample to households with at least one woman who delivered in the past year. This results in the sample size decreasing from 2,747 to 407 households.³⁹⁴⁰

To maximize statistical power, we present the second difference specification with a short list of additional controls that strongly predict access to an assisted hospital delivery and infant mortality (the two main outcome variables of this section) — namely, presence of a clinic within ten kilometer radius, number of infants in the villages and number of infants who died in the past year. The results with the the full list of controls are presented in Table A.7.⁴¹ As before, we present the estimate evaluated at the mean value of the controls.

In column (2), we find no effect on having a delivery in a health clinic. This may partly be that most women have deliveries in clinics in our context. Much less common are assisted deliveries in health clinics. We find that the presence of a government health worker increases the probability of an assisted hospital delivery by 37.5 percentage-points in villages where the NGO never enters (although this estimate is not causal), the presence of an NGO worker increases the probability of a delivery assisted by a health professional (i.e., a doctor or a nurse) by 19.1 percentage-points in villages with no government health worker. The joint coefficient at the bottom of the table shows

³⁹In 0.2% of the households, more than one woman delivered in the past year in which case we collapse woman-level data at the household level.

⁴⁰One may be concerned that for the examination of post-natal care in Table 7, we restrict the sample based on a potential outcome (whether a household has given birth during the year preceding the 2012 survey). We can alternatively estimate a multinomial logit model with the full sample of households. See Appendix Table A.8. The results are similar.

⁴¹Excluding all the controls has little effect on the coefficients, but reduces the statistical power. The estimates are available upon control.

that NGO entry in villages with a government worker reduces the probability of a health delivery by 29 percentage-points. The estimate is statistically significant at the 1%. This result is consistent with concerns of absenteeism in such facilities and the fact that NGO workers do not coordinate with clinic staff as well as government workers.⁴²

In column (4), we examine the probability of receiving a post-natal visit within two months of delivery (which is typically provided by the community health worker herself). The presence of an NGO worker increases the probability of a post-natal visit by 16 percentage-points in villages with no government health worker. The joint coefficient at the bottom of the table shows that NGO entry in villages with a government worker reduces the probability of a post-natal visit by 33.9 percentage-points.⁴³

To connect the results on services and mortality, we also examine the correlation between receiving medical advice from health workers, delivering in a clinic, delivering assisted by a health professional, and receiving a post-natal visit within two months of birth and infant mortality. Since the health advice question refers to the past year, this analysis is restricted to households with at least one delivery in the past year. Appendix Table A.6 Panel A measures infant mortality as a dummy variable if at least one infant died. Panel B measures infant mortality as the number of infants who died as a share of live births. (More information on how these measures of mortality are constructed in the next section). Each row is one regression. The estimates from Panels A and B present a similar pattern. So we will focus our discussion on Panel A for brevity. Receiving advice from a health worker is associated with 10.2 percentage-

⁴²There is evidence that, in local communities, access to health facilities and mortality are lower whenever someone in the community is in close contact with the doctor/nurse of the health facility and can coordinate patient visits with them (Mogensen, 2005; Sodemann et al., 2006; Meinert and Etyang, 2014).

⁴³The means of the outcome variables are in line with data from rural areas in the 2011 Uganda DHS. The fraction of women who deliver in a hospital is 74% in our study and 68% in the DHS. The fraction of women who receive a post-natal check-up within 2 months of birth is 26% in our study and 31% in the DHS. The fraction of women who were assisted by a health professional during the delivery is 53% in our data and vs. 50% in the DHS.

point lower infant mortality. Delivering in a clinic or delivering assisted by a health professional are not statistically significantly associated with mortality, probably due to an obvious selection effect (women who deliver in a clinic are likely more at risk of birth complications). Receiving a post-natal visit is associated with 7.7 percentage-points reduction in infant mortality.⁴⁴

The negative correlation between obtaining medical advice and services from a health worker and the findings that NGO entry reduces the probability of obtaining services from any health worker in villages with a government health worker before NGO entry suggests that, in such cases, infant mortality may increase.

5.2 Infant Mortality

In Table 7 columns (5)-(7), we examine infant mortality using different measures. Column (5) uses the household-level survey to examine a dummy that equals one if at least one infant died within the household since 2010. The results shows that the introduction of the NGO in a village with no government worker reduces mortality by 3.5 percentage-points. In contrast, the introduction of the NGO in a village with a government worker has much less benefit for mortality than NGO entry in a village with the government. The interaction coefficient is 0.052 and statistically significant at the 1% level. The sum of the uninteracted NGO coefficient and the interaction coefficient shown at the bottom of the table is 1.6 percentage-points, which suggests that NGO entry into a village with a government worker and control variables with the values of the sample means experience a 1.6 percentage-point increase in infant mortality. However, the estimate is not statistically significant at conventional levels (the p-value is

⁴⁴Similarly, in the Ugandan 2011 DHS data, delivering in a clinic or delivering assisted by a health professional are not statistically significantly associated with infant mortality. The correlation between receiving a postnatal visit and infant mortality in the DHS is also negative and significant but the correlation is twice as small (2.9 percentage points).

0.126).⁴⁵

We observe a similar pattern in columns (4) and (5), when we normalize the outcome variable by the number of births. In column (4), we calculate the household-level infant mortality ratio as the number of children who were born between the two waves of surveys *and* who died below age of one during this period divided by the number of children who were born during this period.⁴⁶ In column (5), we follow a similar approach as column (4) but aggregate all numbers at the village level rather than at the household level and then multiply the denominator by 1,000.⁴⁷ We find similar patterns as in column (5), but the joint coefficients are statistically insignificant.

We note that the magnitude of the estimated effect on mortality is large. In villages without a pre-existing government worker, NGO entry reduces the the number infants who died as share of births by 2.8 percentage-points (significant at the 10% level), while it reduces the number of infants who die per 1,000 live births by 27 deaths (not statistically significant).

⁴⁵The presence of government workers in a village with no NGO is associated with a reduction in infant mortality by 4.2 percentage-points, relative to villages with no health worker of any type. The estimated reduction in mortality is large in magnitude and in line with [Brenner et al. \(2011\)](#) which document a 53.2% decline in mortality as a result of the same government program in an experiment that takes place in 116 villages of Southwest Uganda.

⁴⁶The latter is measured as the sum of (a) the number of children who were born during this period and who died below age of one during this period, and (b) the number of children who were born during this period and who did *not* die during the trial period.

⁴⁷One caveat of the approach in columns (4) and (5) is that any child born *before* 2012 but who dies before the age of one *after* 2012 increases the infant mortality ratio denominator by one without increasing the nominator, thus causing us to underestimate infant mortality. [Bjorkman-Nyqvist et al. \(Forthcoming\)](#) addresses this by expressing the infant-mortality ratio in terms of the “infant-years of exposure to the risk of dying under the age of one” (e.g., 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 year old in 2012 is exposed a full year). We are unable to replicate this approach because we do not observe a child’s age in months. An alternative approach is to exclude from the analysis any child who is less than one year old in 2012, in addition to any child who would have been less than one in 2012 had he/she not died. This further reduces the sample size and exacerbates the sample selection problem. But our main results are unaltered. The results are available upon request.

5.3 Decomposition by the Labor Supply of Health Workers in 2012

Given our earlier finding that the reduction in health services caused by the NGO is concentrated in villages where there was a government health worker in 2010 and had only one health worker in 2012 after NGO entry, we conduct a similar descriptive decomposition with mortality. Table 8 estimates the triple interaction effect of NGO entry, the presence of a government worker before it entered, and whether there is one or two workers in 2012. As with the earlier decomposition, the number of workers in 2012 is an outcome and the triple interaction should not be interpreted as causal. Table 8 examine the same three measures of mortality as before, with the same short list of controls as in 7 interacted with NGO entry and with the interaction of the presence of a government health worker and NGO entry.⁴⁸ Because of the interacted controls, we evaluate all coefficients at the mean of the control variables.

For brevity, focus on the joint estimates at the bottom of Table 8. They are very similar to the baseline shown earlier. We present the joint coefficients for the effect of NGO entry in villages with a government worker in 2010 for the two types of villages at the bottom of the table together with its p-value. The pattern of the results are similar for all three mortality measures. We find that NGO entry is associated with *increased* infant mortality in villages where there was already a government worker and in which there is only one worker in 2012 (i.e., the government worker switched to the NGO). In villages where the NGO was able to recruit a second worker, NGO entry has no effect.

To assess the magnitude, consider, for example, the probability that at least one child died in column (1). In villages where there was a government health worker in 2010, NGO entry, and one health worker in 2012, 4.4percentage-points *more* households

⁴⁸Recall that the short list of controls includes: presence of a government/private clinic within ten kilometer radius, number of infants in the villages and number of infants who died in the past year. The results are very similar when we control for the full list of controls instead. See A.9.

experienced at least one infant death during this period. This increase is xx% of the baseline share of seven percent (see the estimate for the constant).

5.4 Other Health Outcomes

In our investigation of the possible health outcomes of the crowding out of labor and health services, we focus on infant mortality, which is the focal point of both the NGO and government programs. However, health workers also provide advice and medicines for many other health conditions (e.g., malaria, basic hygiene, etc.). We investigate whether NGO workers in villages with the government program improved these other outcomes. We examine a large number of variables that capture better preventive health behavior (e.g., children washing their hands, sleeping under bednets, couples using contraceptives) and disease incidence (cough, diarrhea, worms, tuberculosis, malaria) as the outcome in our baseline specification. Appendix Table A.10 shows that we find no average effect.

Following the main analysis, we also conduct a decomposition for communities where there was a government worker in 2010, the NGO entered, and there is one versus two health workers in 2012. Interestingly, we find that in villages where there there is was a government worker in 2010, the NGO entered, and there is only one worker in 2012, there is a statistically significant reduction in the probability that children wash their hands before eating and after using the toilet. See Appendix Table A.10. Recall that the decomposition is a descriptive exercise. Another caveat is that the self-reported behavioral measures are likely to be measured with more error than self-reported mortality, which is a less frequent and more traumatic event that is less likely to be mistaken by survey respondents.

5.5 Drug Prices

The results so far indicate that in villages with a government health worker, NGO entry reduced total health services, which increased mortality, especially in villages where the government worker shifted to the NGO. Since the government community health worker gives out the drugs for free, while the NGO sells the same drugs at a low price, the crowding out of the government worker can also increase drug prices. This could be an additional channel through which the shift of workers away from the government towards the NGO can increase mortality.

Our data allow us to examine the cost of disease treatment (drug prices, the cost of transportation to obtain treatment, and the cost of diagnostic medical tests) for the most relevant diseases for our contexts. Using these measures as dependent variables in our baseline, we find no evidence that this alternative mechanism plays a major role (see Appendix Table [A.11](#)).

5.6 Non-Linear Estimation

The main results are estimated with a Linear Probability Model. We can alternatively use a Logistic Model for the dummy variable outcomes of the whether a household received medical advice from the NGO or government worker, for post-natal care and for mortality (measured as a dummy for at least one infant died in the household). The estimates are shown in Appendix Tables [A.12](#). Similarly, one may be concerned that for the examination of post-natal care in Table [7](#), we restrict the sample based on a potential outcome. Although we document that this is not the case, we also alternatively use a Multinomial Logit Model. See Appendix Table [A.8](#). All of the non-linear estimates are consistent with those from the main regressions.

6 Conclusion

This paper presents novel empirical evidence that NGOs can crowd out government-provided community health services and reduce total health services. When the NGO arrives to villages with volunteer government health workers, government workers shift to work for the NGO in half of the cases. In the other half of the cases, the NGO is able to recruit a new person. In the former group of villages, the supply of health services declines and infant mortality increases. In the latter group, there is little change in the supply of health services or mortality.

These results piece together a nuanced picture of heterogeneous effects: NGO entry provides benefits in places with no government-provided services, but can hinder its own goals in places where the government services have already begun to be established and where the labor supply of altruistic health workers may be particularly constrained.

The implications for welfare are ambiguous. It would depend on factors such as the importance of having a health worker be employed by the government instead of the NGO for the long-run development of government capacity, and the value of additional income for rural health workers and household products to the community provided by NGOs.

The empirical estimates should be cautiously interpreted as specific to the context of this study. The two key features that are particularly important to keep in mind are the novelty of the government program and the limited supply of able and willing health workers. One could imagine that the entry of the NGO into a location with a mature program may attract fewer workers from the government because there is more worker loyalty. Time may also allow the government to build up the supply of potential health workers (e.g., because there is a better understanding of the importance of the job, and more people have knowledge about good health practices).

For extrapolating our findings to other contexts, note that in our context, there are

two forces at play. The first is the compensation gap between the government and the NGO, which induces some workers to shift to working for the NGO. For understanding the magnitude of the findings, it is important to keep in mind that government workers are all volunteers and do not receive any pay. It is very likely that if the income gap between government and NGO workers is smaller, the magnitude of crowding out would also be smaller. At the same time, note that the context that we study is very relevant for policy makers. Hindering the development of public services in their infancy can impede the process towards sustainable development and the practice of using volunteers to provide local public services is common to developing (and developed) countries (e.g., [Cowley and Smith, 2014](#); [Finan et al., 2015](#); [Banuri and Keefer, 2016](#); [Deserranno, 2019](#); [Ashraf et al., 2018](#)). The second is the parallel task model which we incentivizes workers to allocate time away from health services towards commercial activities. The dual-task model is not by any means universally used, though it is growing in popularity. It is mostly used in the context of community-based agents: e.g., community health workers provide health services and sell health products, or agricultural extension workers train farmers and sell fertilizer and seeds. The NGO incentivizes sales and not services because the former is easier to monitor. As we discussed in the Introduction, this business model provides revenues that help reduce the reliance of NGOs on large donors. Our findings illustrate the challenges this business model poses for the NGO.

For policymakers, our results validate the concerns of public health workers that NGOs can hinder the development of infant public services. Our results also support the call for aid-recipient governments and NGOs to coordinate their efforts. Towards this end, improving record-keeping of the location of government workers could have high returns ([Asogwa, 2012](#); [Bank, 2000](#); [Mampe and Kalusopa, 2012](#)). It is important to recognize that the randomization in this study was intentionally designed for the

purposes of evaluation. NGOs do not usually target their programs randomly. Thus, our results may be useful in highlighting the presence of government workers and local labor market constraints as important features to take into account when deciding on the location of operations. The NGOs should experiment with alternative compensation schemes to minimize the crowding out of altruistic activities by money-making activities. We note that some NGOs which use the parallel-task model, such as BRAC or Living Goods, have already begun to provide monetary incentives for health services.

This study suggests several avenues for future research. First, the results emphasize the importance of heterogeneous effects for understanding the effect of foreign aid and NGO effectiveness. Specifically, our findings suggest that understanding the presence of other similar service providers and the determinants of local labor supply are important questions for future study. Second, the problems highlighted by our results are directly related to tradeoffs illustrated in the seminal model of multi-tasking by [Holmstrom and Milgrom \(1991\)](#). Our findings suggest that NGO-delivered aid is a natural context to test this model. Finally, future studies should explore whether aid crowds out or crowd in the development of native capacity in other contexts. For example, policymakers and aid workers have expressed much concern that food aid, if not thoughtfully targeted, can reduce farmgate food prices and negatively affect farmers in recipient countries ([Janzen, 2015](#); [Levinsohn and McMillan, 2005](#)).

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Table 1: NGO Time Allocation Across Tasks (Reichenbach et al. 2011)

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

Notes: Sample = 660 NGO community health workers interviewed by the NGO 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 and are aimed to "refresh" workers' health knowledge and to allow workers to replenish their stock of health products.

Table 2: Summary Statistics and Balance Checks

Sample of villages:		Government Health Worker Present in 2010												All			
		All				NGO				Constant							
		Mean	SD	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
A. Presence of a Health Care Provider in 2010 = {0, 1}																	
Assigned to NGO	0.520	0.502	1.000	(0.000)	0.000	(0.000)	127	1.000	(0.000)	0.000	(0.000)	73	-0.062	(0.090)	0.556***	(0.068)	127
Government health worker in the village	0.575	0.496	-0.061	(0.088)	0.607***	(0.063)	127	0.000	(0.000)	1.000	(0.000)	73	1.000	(0.000)	0.000	(0.000)	127
Traditional healer in the village	0.480	0.502	-0.016	(0.088)	0.489***	(0.063)	127	0.069	(0.129)	0.527***	(0.086)	73	-0.027	(0.125)	0.496***	(0.078)	127
Drug store in the village	0.677	0.469	0.030	(0.039)	0.662***	(0.025)	127	0.076	(0.071)	0.524***	(0.037)	73	-0.023	(0.044)	0.690***	(0.022)	127
Government clinic within 10 km	0.559	0.498	-0.052	(0.078)	0.586***	(0.056)	127	-0.022	(0.118)	0.545***	(0.081)	73	-0.054	(0.108)	0.590***	(0.065)	127
Private clinic within 10km	0.835	0.373	0.047	(0.045)	0.810***	(0.026)	127	0.127*	(0.073)	0.746***	(0.045)	73	0.006	(0.047)	0.831***	(0.039)	127
B. Village Size and Infant Mortality in 2010																	
Number of HHs in the village	182.071	125.452	-13.339	(22.191)	189.003***	(17.623)	127	17.600	(18.330)	138.293***	(12.446)	73	-45.290	(29.111)	208.104***	(19.131)	127
Average number of infants per HH	0.291	0.091	-0.004	(0.014)	0.294***	(0.008)	127	-0.026	(0.022)	0.294***	(0.013)	73	-0.024	(0.019)	0.305***	(0.012)	127
Number infants who died in past year per HH	0.041	0.060	-0.004	(0.009)	0.044***	(0.007)	127	-0.005	(0.016)	0.062***	(0.013)	73	-0.007	(0.006)	0.046***	(0.006)	127
C. Household (HH) Socio-Economic Background in 2010																	
% HHs involved in farming as main activity	0.568	0.383	0.031	(0.023)	0.552***	(0.018)	127	0.016	(0.036)	0.717***	(0.027)	73	0.025	(0.027)	0.554***	(0.019)	127
% HH heads who completed primary education	0.376	0.260	0.004	(0.030)	0.374***	(0.020)	127	0.057	(0.047)	0.264***	(0.026)	73	-0.016	(0.035)	0.385***	(0.024)	127
Average number of assets owned (out of 11)	5.625	1.956	0.032	(0.164)	5.608***	(0.097)	127	0.202	(0.266)	4.997***	(0.151)	73	0.133	(0.177)	5.548***	(0.128)	127
Average food security (1 to 4)	2.225	0.619	0.032	(0.039)	2.209***	(0.027)	127	0.066	(0.060)	1.983***	(0.040)	73	0.024	(0.041)	2.211***	(0.030)	127
% HHs with high quality house wall material	0.410	0.411	0.009	(0.028)	0.406***	(0.016)	127	0.024	(0.025)	0.234***	(0.014)	73	-0.027	(0.044)	0.426***	(0.029)	127
% HHs with high quality house floor material	0.424	0.410	0.004	(0.031)	0.422***	(0.018)	127	0.034	(0.029)	0.237***	(0.016)	73	-0.028	(0.045)	0.440***	(0.031)	127
% HHs with high quality house roof material	0.584	0.406	0.015	(0.027)	0.576***	(0.014)	127	0.037	(0.034)	0.439***	(0.022)	73	-0.001	(0.031)	0.585***	(0.026)	127
Standardized index of wealth	0.000	0.927	0.027	(0.053)	-0.014	(0.027)	127	0.088	(0.063)	-0.391***	(0.030)	73	-0.006	(0.070)	0.003	(0.049)	127

Notes: Observations are at the village level. Sample restrictions are stated in the column headings. Each row contains three separate regressions in which each variable is regressed on an indicator for NGO entry in Col.3-7 and on an indicator for presence of a government health worker in 2010 in Col.8-12, with area fixed effects as controls and with robust Newey-West standard errors. The standardized index of wealth is an equally weighted average of z-scores of 5 variables: average number of assets owned by a HH, average food security, %HHs with high quality wall material, %HHs with high quality floor material, %HHs with high quality roof material. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Main Results on Labor Supply and Health Services

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>A. Dependent Variable: Presence of Health Providers in the Village in 2012</i>							
	NGO health worker = {0, 1}	Government health worker = {0, 1}	Total # of health workers (NGO or Government) = {0, 1, 2}	Traditional healer = {0, 1}	Drug store = {0, 1}	Government clinic within 10 km = {0, 1}	Private clinic within 10 km = {0, 1}
Mean Dep. Var.	0.479	0.740	1.219	0.205	0.356	0.260	0.630
NGO	1.000*** (0.000)	-0.430*** (0.098)	0.570*** (0.098)	-0.074 (0.103)	-0.016 (0.072)	0.109 (0.093)	0.082 (0.087)
Constant	-0.014 (0.011)	0.952*** (0.041)	0.938*** (0.042)	0.242*** (0.069)	0.364*** (0.050)	0.206*** (0.058)	0.590*** (0.055)
Observations (villages)	73	73	73	73	73	73	73
R-squared	0.973	0.432	0.542	0.272	0.637	0.485	0.541
<i>B. Dependent Variable: Household Received Medical Care from the Following in the Past Year (2012) = {0, 1}</i>							
	NGO health worker	Government health worker	Any health worker (NGO or Government)	Traditional healer	Drug store	Government clinic	Private clinic
Mean Dep. Var.	0.238	0.546	0.623	0.022	0.192	0.180	0.367
NGO	0.315*** (0.033)	-0.251*** (0.064)	-0.116** (0.049)	0.015 (0.010)	-0.017 (0.028)	-0.057** (0.024)	0.009 (0.038)
Constant	0.090*** (0.018)	0.664*** (0.026)	0.678*** (0.025)	0.015*** (0.005)	0.200*** (0.021)	0.207*** (0.016)	0.363*** (0.018)
Observations (HHs)	1,473	1,473	1,473	1,473	1,473	1,473	1,473
R-squared	0.173	0.235	0.165	0.030	0.108	0.094	0.185

Notes: Sample comprises of villages with a government health worker in 2010. Observations are at the village level in Panel A and at the household level in Panel B. In parenthesis, we present Newey-West standard errors in Panel A and standard errors clustered at the village level in Panel B. All regressions include area fixed effects. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Results on Targeting

Dependent Variable: Household Received Medical Care from the NGO or Government Health Worker in the Past Year (2012) = {0, 1}				
Sample of villages:	(1)	(2)	(3)	(4)
	NGO	No NGO	NGO	No NGO
	X = Pregnant Dummy		X = Poor Dummy	
Mean Dep. Var.	0.573	0.668	0.573	0.668
Explanatory Var X	-0.023 (0.037)	0.047 (0.034)	-0.136** (0.055)	0.152** (0.066)
Constant	0.583*** (0.030)	0.649*** (0.021)	0.615*** (0.034)	0.625*** (0.028)
Observations	694	779	694	779
R-squared	0.181	0.197	0.187	0.203
p-value NGO=No NGO (SUR)		0.168		0.001

Notes: Sample comprises of villages with a government health worker in 2010 and with (without) NGO entry in odd (even) columns. Observations are at the household level and standard errors are clustered at the village level. All regressions include area fixed effects. "Pregnant dummy" takes value 1 if the household comprises a woman who is pregnant or who delivered in the past year. "Poor dummy" takes value 1 if the household wealth index is in the bottom quartile of the within-village distribution. The wealth index is an equally weighted average of z-scores of 5 variables: average food security, average number of assets owned by a HH, %HHs with high quality roof/floor/wall material. The p-value "NGO=No NGO" is the p-value of the coefficient X*NGO in a regression where the dependent variable is regressed on NGO, X, X*NGO, area fixed effects, area fixed effects*NGO and standard errors clustered at the village level. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Results on Labor Supply and Health Services — Decomposition by the Number of Health Workers in 2012

Dependent Variable: Household Received Medical Care from the Following in the Past Year (2012) = {0, 1}			
	(1)	(2)	(3)
	NGO health worker	Government health worker	Any health worker (NGO or government)
Mean Dep. Var.	0.238	0.546	0.623
[1] NGO × NGO hired Gov worker	0.274*** (0.029)	-0.526*** (0.053)	-0.229*** (0.055)
[2] NGO × NGO did not hire Gov worker	0.343*** (0.047)	-0.066 (0.069)	-0.040 (0.056)
Constant	0.090*** (0.018)	0.664*** (0.026)	0.678*** (0.026)
Observations	1,473	1,473	1,473
R-squared	0.175	0.302	0.177
[1] = [2] p-value	0.174	0.000	0.006

Notes: Sample comprises of villages with a government health worker in 2010. Observations are at the household level and standard errors are clustered at the village level. All regressions include area fixed effects. *** p<0.01, ** p<0.05, * p<0.1

Table 6: Results on Labor Supply and Health Services – Difference-in-Difference

	Dependent Variable					
	Presence of Health Workers in the Village in 2012			Household Received Medical Care from the Following in the Past Year (2012)		
	(1)	(2)	(3)	(4)	(5)	(6)
	NGO health worker = {0, 1}	Government health worker = {0, 1}	Total # of health workers (NGO or Government) = {0, 1, 2}	NGO health worker = {0, 1}	Government health worker = {0, 1}	Any health worker (NGO or government) = {0, 1}
<i>A. Villages with No Government Health Worker in 2010</i>						
Mean Dep.Var.	0.504	0.425	0.929	0.231	0.045	0.265
NGO	0.948*** (0.053)	0.000 (0.000)	0.948*** (0.053)	0.315*** (0.046)	-0.019* (0.011)	0.286*** (0.046)
Constant	0.010 (0.014)	0.000 (0.000)	0.010 (0.014)	0.056** (0.028)	0.055*** (0.008)	0.106*** (0.028)
Observations	54	54	54	1,274	1,274	1,274
R-squared	0.934	-	0.934	0.233	0.006	0.185
<i>B. All Villages</i>						
Mean Dep.Var.	0.504	0.425	0.929	0.235	0.313	0.457
Gov	-0.070 (0.050)	0.791*** (0.074)	0.720*** (0.095)	-0.093** (0.038)	0.428*** (0.049)	0.361*** (0.057)
NGO	0.939*** (0.050)	-0.020 (0.027)	0.919*** (0.059)	0.315*** (0.043)	-0.019 (0.020)	0.288*** (0.046)
Gov × NGO	0.038 (0.056)	-0.446*** (0.099)	-0.409*** (0.114)	-0.016 (0.055)	-0.240*** (0.065)	-0.415*** (0.069)
Constant	0.046 (0.034)	0.107*** (0.040)	0.153*** (0.058)	0.128*** (0.028)	0.154*** (0.023)	0.221*** (0.034)
Observations	127	127	127	2,747	2,747	2,747
R-squared	0.948	0.709	0.760	0.193	0.418	0.270
[1] Gov × NGO + NGO coef	0.976	-0.466	0.510	0.299	-0.259	-0.127
[2] Gov × NGO + NGO p-value	<0.001	<0.001	<0.001	<0.001	<0.001	0.007
<i>C. All Villages – Additional Controls</i>						
Mean Dep.Var.	0.504	0.425	0.929	0.235	0.313	0.457
Gov	-0.051 (0.038)	0.717*** (0.111)	0.666*** (0.125)	-0.031 (0.041)	0.394*** (0.060)	0.387*** (0.072)
NGO	0.966*** (0.044)	-0.093 (0.068)	0.874*** (0.085)	0.371*** (0.045)	-0.051 (0.038)	0.311*** (0.049)
Gov × NGO	-0.007 (0.070)	-0.375** (0.143)	-0.382** (0.167)	-0.108* (0.061)	-0.201** (0.084)	-0.449*** (0.087)
Constant	0.029 (0.025)	0.171*** (0.064)	0.200*** (0.074)	0.085*** (0.030)	0.177*** (0.034)	0.201*** (0.043)
Observations	127	127	127	2,747	2,747	2,747
R-squared	0.954	0.755	0.797	0.216	0.437	0.288
[1] Gov × NGO + NGO coef	0.959	-0.468	0.491	0.264	-0.252	-0.138
[2] Gov × NGO + NGO p-value	<0.001	<0.001	<0.001	<0.001	<0.001	0.010

Notes: Sample comprises of villages without a government health worker in 2010 in Panel A and comprises of all villages (with and without a government health worker) in Panels B-C. Observations are at the village level in Col.1-3 and at the household level in Col.4-6. In parenthesis, we present Newey-West standard errors in village-level regressions and standard errors clustered at the village level in household-level regressions. All regressions include area fixed effects. Regressions in Panel C also include the following controls, all 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 (standardized index of wealth, education, occupation). *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Main Results on Post-Natal Services and Infant Mortality

		Dependent Variable				
Fertility		Delivery and Post-Natal Care			Infant Mortality (2010-2012)	
Sample:	All HHs	HHs with a birth in the past year (2012)	HHs with a birth since 2010	HHs with a birth since 2010	All villages	All villages
	Birth in the past year (2012) = {0, 1}	Delivery in a clinic = {0, 1}	Delivery assisted by a health professional = {0, 1}	Post-natal visit within two months of birth = {0, 1}	An infant died = {0, 1}	Number of infants who died
	(1)	(2)	(3)	(4)	(5)	(6)
	(1)	(2)	(3)	(4)	(5)	(6)
	(1)	(2)	(3)	(4)	(5)	(7)
Mean Dep.Var.	0.148	0.744	0.533	0.265	0.073	0.082
Gov	0.029 (0.027)	-0.006 (0.076)	0.392*** (0.106)	0.379*** (0.081)	-0.051** (0.023)	-0.047 (0.029)
NGO	0.012 (0.020)	0.051 (0.070)	0.201* (0.104)	0.194*** (0.060)	-0.033 (0.021)	-0.041 (0.026)
Gov x NGO	-0.052 (0.037)	-0.135 (0.095)	-0.304** (0.119)	-0.410*** (0.088)	0.064** (0.032)	0.065* (0.037)
Constant	0.140*** (0.017)	0.783*** (0.072)	0.260*** (0.096)	0.006 (0.059)	0.103*** (0.017)	0.112*** (0.019)
Observations	2,747	407	407	407	1,402	1,402
R-squared	0.100	0.164	0.118	0.243	0.033	0.028
[1] Gov x NGO + NGO coef	-0.039	-0.084	-0.104	-0.216	0.030	0.024
[2] Gov x NGO + NGO p-value	0.187	0.200	0.094	0.001	0.139	0.317
						0.491

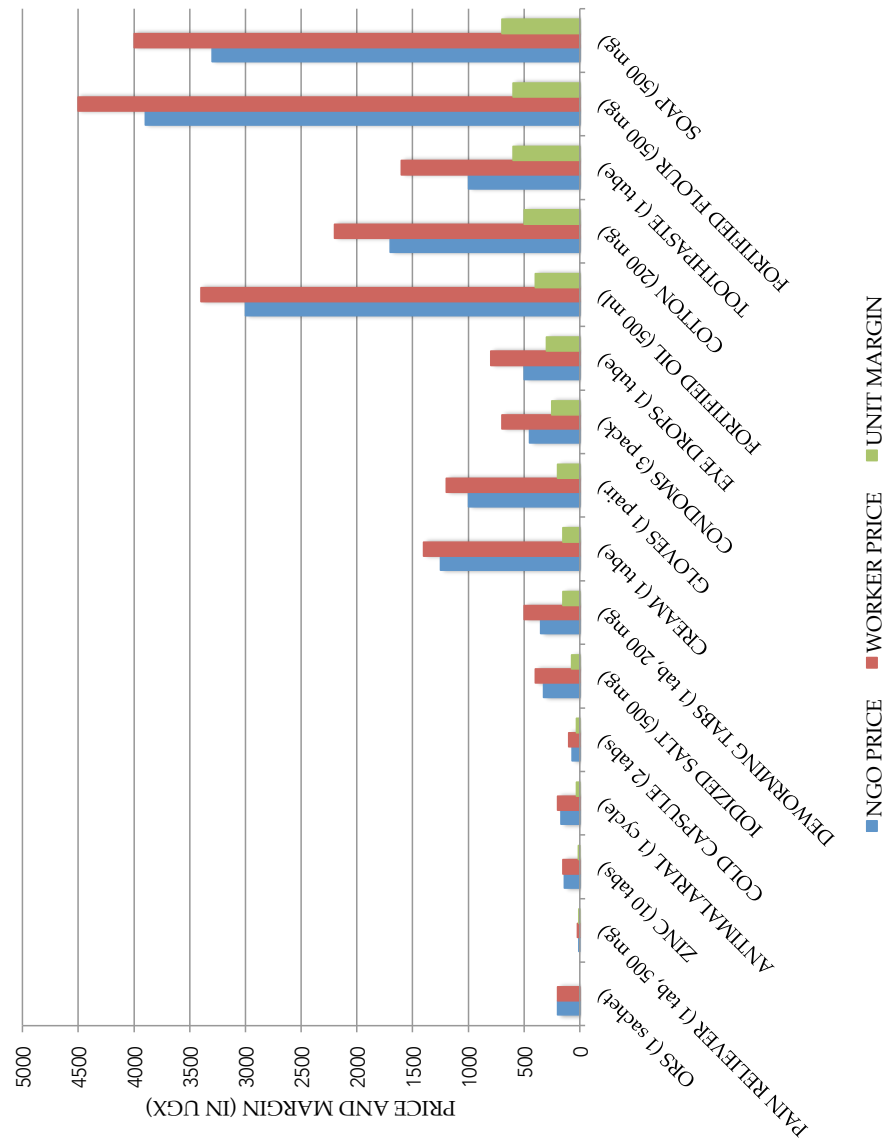
Notes: Sample comprises of all villages (with and without a government health worker in 2010). Observations are at the household level in Col.1-6 and at the village level in Col.7. In parenthesis, we present standard errors clustered at the village level in household-level regressions and Newey-West standard errors in village-level regressions. All regressions control for area fixed effects and the following controls, all 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<0.01, ** p<0.05, * p<0.1.

Table 8: Results on Post-Natal Services and Infant Mortality — Decomposition by the Number of Health Workers in 2012

	Dependent Variable: Infant Mortality (2010-2012)		
	An infant died = {0, 1} (1)	Number of infants who died (2)	Number infants who died per 1,000 births (3)
Mean Dep. Var.	0.073	0.082	65.004
Gov	-0.068*** (0.024)	-0.066** (0.029)	-63.305** (25.464)
NGO	-0.050** (0.020)	-0.065** (0.029)	-56.473** (23.676)
Gov × NGO × NGO hired Gov worker	0.132*** (0.044)	0.146*** (0.053)	110.073** (42.996)
Gov × NGO × NGO did not hire Gov worker	0.023 (0.030)	0.024 (0.038)	26.667 (32.670)
Constant	0.114*** (0.017)	0.125*** (0.019)	107.558*** (16.853)
Observations	1,402	1,402	127
R-squared	0.047	0.041	0.357
[1] Gov × NGO × Hired Gov + NGO	coef	0.082	53.600
[2] Gov × NGO × Hired Gov + NGO	p-value	0.022	0.101
[3] Gov × NGO × Not hired Gov + NGO	coef	-0.027	-29.807
[4] Gov × NGO × Not hired Gov + NGO	p-value	0.215	0.183

Notes: Sample comprises of all villages (with and without a government health worker in 2010). Observations are at the household level in Col.1-2 and at the village level in Col.3. In parenthesis, we present standard errors clustered at the village level in household-level regressions and NewWest-West standard errors in village-level regressions. All regressions control for area fixed effects and the following controls, all measured in 2010, and their interactions with NGO entry and NGO*Gov: 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<0.01, ** p<0.05, * p<0.1.

Figure 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\$=3,713 UGX).

Table A.1: Selection into the NGO position (Deserranno et al. 2019)

Sample of Government Health Workers who ...	Applied for NGO position		Did not apply for NGO position		<i>p-value</i> (1)=(3)	Were hired for NGO position		Were not hired for NGO position		<i>p-value</i> (6)=(8)
	Mean (1)	SD (2)	Mean (3)	SD (4)		Mean (6)	SD (7)	Mean (8)	SD (9)	
Observations	109		132		241	65		176		241
A. Socio-economic background										
Age	37.31	8.49	37.36	7.78	0.96	38.05	7.73	37.07	8.23	0.41
Married	0.75	0.43	0.71	0.46	0.46	0.77	0.42	0.71	0.45	0.40
Years of schooling	8.42	2.69	7.05	3.31	0.00	8.54	2.62	7.35	3.23	0.01
Number of children	5.11	2.60	4.82	2.35	0.36	5.20	2.52	4.86	2.45	0.34
Has electricity at home	0.14	0.34	0.11	0.32	0.60	0.13	0.34	0.12	0.33	0.79
Number of rooms in the house	3.63	1.95	3.64	1.81	0.98	3.80	2.18	3.58	1.75	0.43
Own house	0.76	0.43	0.76	0.43	0.94	0.76	0.43	0.76	0.43	0.96
B. Experience										
Number of months as a health worker	34.28	38.59	26.45	32.92	0.10	41.46	44.39	25.92	31.28	0.00
C. Pro-social motivation										
Money is the most important job characteristic	0.40	0.49	0.26	0.44	0.02	0.37	0.49	0.30	0.46	0.33
Respect is the most important job characteristic	0.24	0.43	0.38	0.49	0.02	0.29	0.46	0.33	0.47	0.62
Helping community is the most important job characteristic	0.36	0.48	0.36	0.48	0.96	0.34	0.48	0.37	0.48	0.63

Notes: Sample comprises of 241 government health workers. In Col.1-5, we compare characteristics of government health workers who applied for the NGO position (regardless of whether they were hired or not) to those who did not apply. In Col.6-10, we compare characteristics of government health workers who were hired for the position to those who were not hired (regardless of whether they applied or not).

Table A.2: NGO Workers Characteristics

Sample of villages:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All						Obs.
	Mean	SD	Presence of Gov worker in 2010		Constant		
			Coef.	Std.Err.	Coef.	Std.Err.	
A. Socio-economic characteristics (self-reported by NGO worker)							
Age	33.545	10.218	-4.055	(2.910)	35.788***	(1.925)	66
Completed primary education (1=yes)	0.652	0.480	0.150	(0.160)	0.585***	(0.110)	66
Completed secondary education (1=yes)	0.258	0.441	0.161	(0.172)	0.155	(0.112)	66
Married (1=yes)	0.833	0.376	0.119	(0.128)	0.768***	(0.091)	66
B. Experience and motivation (self-reported by NGO worker)							
Was working as Gov health worker (1=yes)	0.212	0.412	0.716***	(0.118)	-0.178***	(0.056)	66
..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	-	-	-	-	-
Main reason for doing the health worker job is money (vs help community)	0.167	0.376	-0.092	(0.110)	0.202**	(0.085)	66
Knows how to treat malaria (knows the exact doses of ACT)	0.682	0.469	0.299**	(0.141)	0.534***	(0.107)	66
Knows how to treat diarrhea (ORS+Zinc)	0.758	0.432	0.237*	(0.134)	0.659***	(0.097)	66
C. Earnings, hours and activities (self-reported by NGO worker)							
Number of working hours as a health worker in the past week	13.106	8.891	-1.304	(2.429)	13.817***	(1.547)	66
Health worker earnings in the past month (in thousand UGX)	52.335	66.986	-13.975	(9.920)	59.352***	(7.261)	64
Number of pregnant women identified by the health worker in the last month	4.136	3.620	1.927	(1.162)	3.085***	(0.688)	66
%HHs who received medical care from the health worker in the past week	0.023	0.036	0.031	(0.056)	0.047*	(0.025)	66
%HHs who bought health products from the health worker in the past week	0.064	0.095	0.009	(0.015)	0.018**	(0.007)	66
D. Health products purchases (from 2012 household survey [information available only for NGO villages])							
% HHs who have ever purchased anti-malarials from NGO	0.085	0.214	-0.129	(0.164)	0.165	(0.125)	34
% HHs who have ever purchased ORS/zinc from NGO	0.032	0.093	-0.045	(0.043)	0.059*	(0.030)	34
% HHs who have ever purchased soap / salt / oil from NGO	0.278	0.346	-0.090	(0.146)	0.334***	(0.100)	34

Notes: Observations are at the NGO health worker level. Sample restrictions are stated in the column headings. Each row contains a separate regressions, in which each variable is regressed on an indicator for presence of a government health worker in 2010 in Col.3-7, with area fixed effects as controls and with robust Newey-West standard errors. Panels A-C focus on health worker characteristics as the dependent variable. These variables are measured in 2012 and are self-reported by the NGO health workers. Panel D focuses instead on the fraction of households who self-report ever purchasing health products from the NGO at end year (2012). These data were collected only for households in the NGO villages.

Table A.3: Household-level Summary Statistics

Sample of villages:																	
All			NGO			All			Government Health Worker			All					
									Present in 2010								
									NGO			Gov					
Mean	SD		Coef.	Std.Err.	Coef.	Std.Err.	Obs.	Coef.	Std.Err.	Coef.	Std.Err.	Obs.	Coef.	Std.Err.	Coef.	Std.Err.	Obs.
(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
A. Household Received Medical Care from [...] in the past year = {0, 1}																	
Government health worker	0.032	0.176	-0.006	(0.006)	0.035***	(0.005)	2,735	-0.011	(0.011)	0.051***	(0.008)	1,467	-0.004	(0.005)	0.034***	(0.004)	2,735
Traditional healer	0.023	0.149	-0.001	(0.005)	0.023***	(0.004)	2,735	0.003	(0.008)	0.028***	(0.006)	1,467	0.003	(0.005)	0.021***	(0.004)	2,735
Drug store	0.148	0.355	-0.008	(0.022)	0.152***	(0.015)	2,735	-0.013	(0.020)	0.131***	(0.017)	1,467	-0.005	(0.030)	0.150***	(0.018)	2,735
Government clinic	0.249	0.433	-0.028	(0.023)	0.264***	(0.018)	2,735	-0.050	(0.035)	0.267***	(0.026)	1,467	0.018	(0.033)	0.240***	(0.020)	2,735
Private clinic	0.387	0.487	-0.001	(0.022)	0.387***	(0.012)	2,735	-0.006	(0.026)	0.343***	(0.018)	1,467	-0.019	(0.036)	0.397***	(0.019)	2,735
B. Self-reported reason for limited access to health service = {0, 1}																	
Health facility is too distant	0.510	0.500	-0.019	(0.025)	0.520***	(0.016)	2,747	-0.043	(0.034)	0.606***	(0.022)	1,473	-0.007	(0.033)	0.514***	(0.020)	2,747
Cannot afford costs of treatments	0.757	0.429	-0.035*	(0.019)	0.775***	(0.011)	2,747	-0.041	(0.031)	0.801***	(0.017)	1,473	-0.012	(0.028)	0.763***	(0.015)	2,747
Absence of health provider at the health facility	0.314	0.464	-0.030	(0.026)	0.329***	(0.020)	2,747	-0.026	(0.028)	0.339***	(0.016)	1,473	-0.003	(0.033)	0.315***	(0.021)	2,747
C. Household (HH) Socio-Economic Background in 2010																	
% HH heads who completed primary education	0.391	0.259	-0.008	(0.026)	0.395***	(0.018)	2,747	0.043	(0.037)	0.272***	(0.021)	1,473	-0.025	(0.033)	0.405***	(0.021)	2,747
Average number of assets owned (out of 11)	5.873	1.918	-0.031	(0.131)	5.889***	(0.076)	2,747	0.125	(0.195)	5.259***	(0.110)	1,473	0.136	(0.162)	5.800***	(0.102)	2,747
Average food security (1 to 4)	2.316	0.612	0.028	(0.033)	2.302***	(0.023)	2,747	0.047	(0.047)	2.062***	(0.030)	1,473	-0.001	(0.038)	2.317***	(0.026)	2,747
% HHs with high quality house wall material	0.473	0.410	0.000	(0.028)	0.472***	(0.018)	2,747	0.020	(0.023)	0.287***	(0.015)	1,473	-0.024	(0.043)	0.485***	(0.026)	2,747
% HHs with high quality house floor material	0.481	0.411	-0.007	(0.030)	0.485***	(0.020)	2,747	0.028	(0.026)	0.283***	(0.017)	1,473	-0.024	(0.044)	0.494***	(0.027)	2,747
% HHs with high quality house roof material	0.642	0.398	0.006	(0.021)	0.639***	(0.011)	2,747	0.035	(0.025)	0.486***	(0.018)	1,473	-0.001	(0.019)	0.642***	(0.017)	2,747
D. Attrition																	
	0.266	0.442	0.019	(0.023)	0.257***	(0.019)	3,745	0.051	(0.036)	0.284***	(0.026)	2,131	-0.032	(0.032)	0.285***	(0.023)	3,745

Notes: Observations are at the household level. Sample restrictions are stated in the column headings. Panel A-C comprises of all households who were interviewed both at base year (2010) and at end year (2012). Each row contains three separate regressions in which each variable is regressed on NGO entry in Col.3-7 and on an indicator for presence of a government health worker in 2010 in Col.8-12, with area fixed effects as controls and with standard errors clustered at village level. Household wealth is measured with 5 variables: average 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 (cement blocks/stone/burnt bricks with cement), high quality floor material (parquet / polished wood / mosaic/tiles/ cement / stones), high quality roof material (wood/planks/bamboo/iron sheets /tim/ cement/ tiles). Attrition=1 if a household was interviewed at baseline but not at endline. Household for which attrition=1 are not included in Panels A-C of this table. **** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A.4: Summary Statistics for Villages with One vs. Two Health Workers in 2012

Sample:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Villages with NGO entry and Government Health Worker in 2010							
Mean	SD	NGO hired Gov worker		Constant		Obs.	
		Coef.	Std.Err.	Coef.	Std.Err.		
A. Presence of a Health Care Provider in 2010 = {0, 1}							
Traditional healer in the village	0.583	0.500	-0.187	(0.206)	0.698***	(0.138)	36
Drug store in the village	0.528	0.506	0.203*	(0.116)	0.404***	(0.079)	36
Government clinic within 10 km	0.472	0.506	-0.312	(0.261)	0.663***	(0.180)	36
Private clinic within 10km	0.806	0.401	0.120	(0.095)	0.732***	(0.082)	36
B. Village Size and Infant Mortality in 2010							
Number of HHs in the village	152.111	79.299	-76.953**	(31.802)	199.138***	(23.653)	36
Number of infants in the village	0.279	0.102	-0.001	(0.043)	0.280***	(0.025)	36
Number infants who died in past year per HH	0.059	0.055	-0.037	(0.024)	0.082***	(0.016)	36
C. Household (HH) Socio-Economic Background in 2010							
% HHs involved in farming as main activity	0.754	0.300	0.018	(0.049)	0.743***	(0.034)	36
% HH heads who completed primary education	0.293	0.254	0.050	(0.104)	0.262***	(0.069)	36
Average number of assets owned (out of 11)	5.016	2.059	0.608	(0.677)	4.644***	(0.498)	36
Average food security (1 to 4)	2.041	0.583	-0.077	(0.137)	2.088***	(0.096)	36
% HHs with high quality house wall material	0.233	0.355	0.053	(0.050)	0.201***	(0.034)	36
% HHs with high quality house floor material	0.246	0.346	0.057	(0.063)	0.211***	(0.035)	36
% HHs with high quality house roof material	0.482	0.354	0.046	(0.057)	0.454***	(0.024)	36
Standardized index of wealth	-0.345	0.844	0.113	(0.156)	-0.414***	(0.101)	36

Notes: Sample restrictions are stated in the column headings. P-values are calculated by regressing each variable on an indicator for whether the NGO hired the government worker, with area fixed effects as controls and with robust Newey-West standard errors. The standardized index of wealth is an equally weighted average of z-scores of 5 variable: average food security, average number of assets owned by a HH, %HHs with high quality of the house roof, floor, walls. *** p<0.01, ** p<0.05, * p<0.1

Table A.5: Results on Labor Supply and Health Services – Heterogeneous Effects by Drug Store

	(1)	(2)
	Total # of health workers (NGO or Gov) = {0, 1, 2}	HH received medical care from any health worker (NGO or Gov) in the past year = {0, 1}
Gov * NGO * Drug store	-0.016 (0.210)	0.227 (0.142)
Observations	127	2,747
R-squared	0.763	0.274

Notes: Sample comprises of all villages (with and without a government health worker in 2010). Observations are at the village level in Col.1 and at the household level in Col.2. In parenthesis, we present Newey-West standard errors in Col.1 and standard errors clustered at the village level in Col.2. All regressions control for area fixed effects and the full set of interaction terms and uninteracted terms: Gov, NGO, drug store, Gov \times drug store, NGO \times drug store, Gov \times NGO. *** p<0.01, ** p<0.05, * p<0.1

Table A.6: Correlations between Health Services and Infant Mortality

	(1)	(2)	(3)	(4)	(5)
	Coef.	Std. Err.	Obs.	R-squared	Mean Dep. Var. if X=0
<i>Dependent Variable: An infant died = {0, 1}</i>					
(1) HH received medical care from any health worker (NGO or Gov)	-0.102**	(0.043)	407	0.030	0.155
(2) Delivery in a clinic	0.037	(0.035)	407	0.004	0.074
(3) Delivery assisted by a health professional	-0.004	(0.035)	407	0.000	0.096
(4) Post-natal visit within 2 months of birth	-0.077**	(0.030)	407	0.014	0.114

Notes: Each row is one regression. Sample comprises of households with a birth in the past year across all villages (with and without a government health worker in 2010). Observations are at the household level and standard errors are clustered at the village level. *** p<0.01, ** p<0.05, * p<0.1

Table A.7: Results on Post-Natal Services and Infant Mortality with Full List of Controls

Sample:	Dependent Variable						
	Fertility	Delivery and Post-Natal Care			Infant Mortality (2010-2012)		
	All HHs	HHs with a birth in the past year (2012)	Delivery assisted by a health professional = {0, 1}	Post-natal visit within two months of birth = {0, 1}	An infant died = {0, 1}	Number of infants who died	Number infants who died per 1,000 births
	Birth in the past year (2012) = {0, 1}	Delivery in a clinic = {0, 1}					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mean Dep. Var.	0.148	0.744	0.533	0.265	0.073	0.082	65.004
Gov	0.028 (0.028)	0.056 (0.082)	0.439*** (0.096)	0.374*** (0.108)	-0.054** (0.025)	-0.055* (0.030)	-63.993** (26.888)
NGO	0.008 (0.022)	0.034 (0.068)	0.189** (0.092)	0.191** (0.074)	-0.034 (0.024)	-0.045 (0.031)	-46.037* (27.031)
Gov × NGO	-0.043 (0.041)	-0.155* (0.093)	-0.394*** (0.110)	-0.454*** (0.119)	0.062* (0.035)	0.071* (0.041)	56.218 (37.130)
Constant	0.143*** (0.019)	0.874*** (0.087)	0.357*** (0.127)	0.109 (0.097)	0.108*** (0.019)	0.122*** (0.024)	110.227*** (20.115)
Observations	2,747	407	407	407	1,402	1,402	127
R-squared	0.107	0.229	0.158	0.293	0.039	0.035	0.315
[1] Gov × NGO + NGO coef	-0.035	-0.122	-0.205	-0.263	0.028	0.026	10.181
[2] Gov × NGO + NGO p-value	0.240	0.043	0.003	0.000	0.197	0.285	0.627

Notes: Sample comprises of all villages (with and without a government health worker in 2010). Observations are at the household level in Col.1-6 and at the village level in Col.7. In parenthesis, we present standard errors clustered at the village level in household-level regressions and Newey-West standard errors in village-level regressions. All regressions control for area fixed effects and the following controls, all 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 (standardized index of wealth, education, occupation). *** p<0.01, ** p<0.05, * p<0.1.

Table A.8: Multinomial Logit Estimation for Delivery and Post-Natal Care

	(1)	(2)	(3)	(4)
	Multinomial logit (0 to 4)			
	0 = No delivery			
	1 = Delivery, not assisted by a health professional, without post natal care			
	2 = Delivery, assisted by a health professional, without post natal care			
	3 = Delivery, not assisted by a health professional, with post natal care			
	4 = Delivery, assisted by a health professional, with post natal care			
	1	2	3	4
Gov	-0.390 (0.307)	0.393 (0.400)	1.193 (0.889)	1.887* (1.076)
NGO	-1.129** (0.442)	0.530 (0.475)	1.869** (0.869)	3.197*** (0.964)
Gov × NGO	0.787 (0.500)	-0.626 (0.512)	-2.248** (0.881)	-3.433*** (1.118)
Constant	-1.682*** (0.456)	-2.885*** (0.508)	-5.000*** (1.060)	-6.903*** (1.217)
Observations	2,747	2,747	2,747	2,747
Mean Dep.Var.	0.306	0.306	0.306	0.306

Notes: Sample comprises of all villages (with and without a government health worker in 2010). Observations are at the household level and standard errors are clustered at village level. All regressions control for area fixed effects and the following controls, all 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<0.01, ** p<0.05, * p<0.1.

Table A.9: Results on Infant Mortality with Full List of Controls — Decomposition by the Number of Health Workers in 2012

	Dependent Variable: Infant Mortality (2010-2012)		
	An infant died = {0, 1}	Number of infants who died	Number infants who died per 1,000 births
	(1)	(2)	(3)
Mean Dep.Var.	0.073	0.082	65.004
Gov	-0.070*** (0.023)	-0.070** (0.030)	-75.899*** (27.956)
NGO	-0.061*** (0.019)	-0.081*** (0.024)	-77.826*** (25.065)
Gov × NGO × NGO hired Gov worker	0.164*** (0.039)	0.183*** (0.046)	151.888*** (43.413)
Gov × NGO × NGO did not hire Gov worker	-0.008 (0.034)	0.001 (0.042)	16.103 (38.791)
Constant	0.128*** (0.018)	0.141*** (0.023)	117.143*** (19.469)
Observations	1,402	1,402	127
R-squared	0.063	0.056	0.481
[1] Gov × NGO × Hired Gov + NGO coef	0.103	0.102	74.062
[2] Gov × NGO × Hired Gov + NGO p-value	0.002	0.010	0.029
[3] Gov × NGO × Not hired Gov + NGO coef	-0.069	-0.080	-61.722
[4] Gov × NGO × Not hired Gov + NGO p-value	0.011	0.017	0.033

Notes: Sample comprises of all villages (with and without a government health worker in 2010). Observations are at the household level in Col.1-2 and at the village level in Col.3. In parenthesis, we present standard errors clustered at the village level in household-level regressions and Newey-West standard errors in village-level regressions. All regressions control for area fixed effects and include the following controls, all measured in 2010, and their interactions with NGO and NGO*Gov: 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 (standardized index of wealth, education, occupation). *** p<0.01, ** p<0.05, * p<0.1.

Table A.11: Results on Prices

	Dependent Variable: Price of treatment (medication and tests)					
	(1)	(2)	(3)	(4)	(5)	(6)
Mean Dep. Var.	Malaria	Dhiarra	Pneumonia	Malaria	Dhiarra	Pneumonia
	5.643	3.418	3.357	5.643	3.418	3.357
Gov	-1.299 (1.173)	-0.588 (0.976)	-0.877 (0.857)	-1.534 (1.210)	-0.609 (0.984)	-0.924 (0.871)
NGO	0.332 (1.160)	-0.464 (1.214)	-0.149 (0.960)	-0.411 (1.007)	0.018 (1.337)	0.119 (0.987)
Gov × NGO	0.561 (1.530)	-0.319 (1.304)	0.092 (1.106)			
Gov × NGO × NGO hired Gov worker				1.880 (1.596)	-0.272 (1.398)	0.253 (1.118)
Gov × NGO × NGO did not hire Gov worker				1.454 (1.537)	-1.560 (1.592)	-0.579 (1.277)
Constant	6.148*** (0.884)	4.143*** (0.714)	3.822*** (0.646)	6.274*** (0.899)	4.144*** (0.729)	3.840*** (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
[1] Gov × NGO + NGO coef	0.893	-0.783	-0.057			
[2] Gov × NGO + NGO p-value	0.352	0.161	0.902			
[1] Gov × NGO × Hired Gov + NGO coef				1.469	-0.254	0.372
[2] Gov × NGO × Hired Gov + NGO p-value				0.172	0.693	0.480
[3] Gov × NGO × Not hired Gov + NGO coef				1.043	-1.542	-0.460
[4] Gov × NGO × Not hired Gov + NGO p-value				0.359	0.023	0.480

Notes: Sample comprises of all villages (with and without a government health worker in 2010). Observations are at the household level (missing value if the household answers "don't know"). Standard errors are clustered at village level. All regressions control for area fixed effects and the following controls, all 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. Regressions in Col.4-6 also interact the controls with NGO*Gov. Prices are expressed in 1,000 Ugandan Shillings. *** p<0.01, ** p<0.05, * p<0.1

Table A.12: Logit Estimation for Health Services, Delivery and Post-Natal Care, Mortality

	Dependent Variable						
	Household Received Medical Care from the Following in the Past Year (2012) = {0, 1}			Delivery, Post-natal Care = {0, 1}			Mortal = {0, 1}
	(1)	(2)	(3)	(4)	(5)	(6)	
	NGO health worker	Government health worker	Any health worker (NGO or government)	Delivery in a clinic	Delivery assisted by a health professional	Post-natal visit within two months of birth	An infant
Mean Dep. Var.	0.235	0.313	0.457	0.744	0.533	0.265	0.073
Gov	0.072 (0.385)	2.744*** (0.357)	2.187*** (0.323)	-0.166 (0.505)	1.734*** (0.501)	4.041*** (0.870)	-0.706 (0.330)
NGO	2.631*** (0.359)	-0.446 (0.369)	1.838*** (0.269)	0.239 (0.547)	0.865* (0.476)	2.307*** (0.813)	-0.46 (0.337)
Gov * NGO	-0.859** (0.437)	-0.926* (0.559)	-2.509*** (0.392)	-0.635 (0.602)	-1.308** (0.550)	-3.991*** (0.936)	0.856 (0.443)
Observations	2,747	2,747	2,747	393	407	357	2,747
[1] Gov × NGO + NGO coef	1.771	-1.372	-0.671	-0.396	-0.443	-1.684	0.393
[2] Gov × NGO + NGO p-value	<0.001	<0.001	0.006	0.277	0.096	<0.001	0.160

Notes: This table presents coefficients evaluated with a logit regression. Sample comprises of all villages (with and without a government health worker in 2010). Observations are at the household level in Col.1-6 and at the village level in Col.7. In parenthesis, we present standard errors clustered at the village level in household-level regressions and NewWest standard errors in village-level regressions. All regressions control for area fixed effects and the following controls, all measured in 2010, and their interactions with NGO entry: presence of a clinic within 10km of the village, number of households in village, number of infants who died in the past year. *** p<0.01, ** p<0.05, * p<0.1.