# Governance and the Effectiveness of Public Health Subsidies*

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**Abstract**

Heavily subsidizing essential health products through existing health infrastructure could substantially improve health in sub-Saharan Africa. There is, however, widespread concern that poor governance – in particular, limited health worker accountability – seriously undermines the effectiveness of subsidy programs. Using innovative audits of targeted bed net distribution programs in Ghana, Kenya and Uganda, we measure the extent of local agency problems. Overall, agency concerns are modest and do not undermine the cost-effectiveness of free distribution. Around 80% of the eligible receive the subsidy as intended, and leakage to the ineligible appears limited, even when the ineligible have a high willingness to pay.

JEL codes: D73, H11, I15, I38

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# 1 Introduction

It has been estimated that up to 63 percent of child mortality could be averted through targeted coverage of inexpensive health products such as iron fortification, point-of-use water treatment, and insecticide-treated bed nets (Bryce, et al., 2005). While the health returns to these products are very large both *in utero* and in childhood, growing evidence suggests that demand for such products is limited at even low prices among poor, credit-constrained parents (Cohen and Dupas, 2010; Dupas, 2014; Tarozzi et al., 2014). Thus, free or highly-subsidized distribution is often advocated as a necessary strategy for rapidly increasing coverage.

To implement such subsidies, government agencies and other major players must be able to identify eligible beneficiaries and effectively deliver products to them. The most cost-effective way to do this is likely through the existing health infrastructure. This is particularly true for products for which medical diagnosis is necessary to identify eligibility (for example, ARVs or anti-malarials), but substantial cost-savings have also been documented for other products, like bed nets, where diagnosis is not required (De Allegri et al., 2010).

However, a potentially major concern with implementing subsidies through the existing service delivery infrastructure is that many public service providers are paid a fixed wage and are hard to fire, and thus may have little direct incentive to exert the effort needed to effectively deliver services or products (World Bank, 2004). Indeed, a number of studies show that service provision in developing countries can be quite poor. For example, health workers are often simply absent from work (Chaudhury et al., 2006; Chaudhury and Hammer, 2004; Muralidharan et al. 2011). Doctors often spend just a few minutes with patients, providing lower quality care than they know how to provide, and simultaneously over- and under-treating patients (see Das, Hammer and Leonard 2008 and Das and Hammer 2014 for reviews). Such low effort provision may have important health implications. For example, Banerjee et al. (2010) show that simply increasing the reliability of immunization services in rural Udaipur, India, sufficed to double immunization rates. In Rwanda, performance incentives for health providers led to large increases in health care utilization rates and, in turn, child health (Gertler and Vermeersch, 2012). Björkman and Svensson (2009) show that a community monitoring program in Uganda reduced health care worker absenteeism, improved child weight, and reduced child mortality.

Petty corruption is another important concern. In a 2011 report, Transparency International writes: "*Across Sub-Saharan Africa, corruption is believed to be one of the major barriers to achieving progress on the [Millennium Development Goals] MDGs. Petty corruption reduces service quality and access, serving as a tax on the poorest. For example, findings*

*from a seven-country study in Africa – Ghana, Madagascar, Morocco, Niger, Senegal, Sierra Leone and Uganda – have shown that 44 per cent of the parents surveyed had paid illegal fees for schools that were legally free for their children"* (Azeem et al., 2011).

While there are numerous citizen reports that lower cadres in many sectors extort money from the public in exchange for service delivery, it is unclear what the magnitudes of these problems are in the context of basic health services. Indeed, the fact that the target populations for such services and programs are often pregnant women and young children may cause different (perhaps higher) performance than in other contexts, both because health workers may feel sufficiently altruistic towards such individuals to be honest and exert effort, and also because the targeting rule is then easily verifiable. Despite the importance of this context, evidence on this issue is lacking, in part because measuring levels of effort, leakage and extortion is challenging (Olken and Pande, 2012).

The specific contributions of this paper are to (1) estimate the extent to which agency problems undermine the effectiveness and cost-effectiveness of targeted subsidies for preventative health products in sub-Saharan Africa; and (2) evaluate which governance features matter most for decreasing agency problems. We do so by auditing a program recommended by the WHO: providing free antimalarial bed nets to those most vulnerable to malaria – pregnant women and their unborn children – through antenatal care clinics. Our audit study took place in three countries, Ghana, Kenya, and Uganda, which vary in perceived corruption levels – out of 178 countries in the 2012 Transparency International Corruptions Index, where the least corrupt country is Denmark at rank 1 and Somalia, Afghanistan and North Korea tie for last place, Ghana was ranked 64th, Uganda 130th, and Kenya 139th. At the time of data collection, both the Kenya and Uganda governments were implementing free bed net distribution schemes for pregnant women enrolling for prenatal care. In Ghana, there was no such government program, but we set one up, and so could randomize several features to test specific hypotheses.

There are three main ways that health workers may undermine the type of subsidy programs we consider. First, they may demand under-the-counter payments from eligible clients – *extortion*. Second, they may provide the product to ineligible people – *leakage*. Leakage may increase the total cost of a subsidy program (if subsidies are given out to both eligible and ineligible individuals). Possibly more importantly, if the total number of subsidies is limited by a budget constraint, leakage may crowd out eligible recipients, who presumably have higher health returns from the subsidy. Third, health workers may provide poor effort generally, for example by failing to attend work or prevent stockouts – *shirking*.

Our main contribution is in documenting the prevalence of these behaviors in three countries. A key challenge in this measurement exercise is that agents who engage in petty

corruption typically do not readily report doing so. To overcome this, we devised a suite of measures that include audits on health center registers, back-check surveys with prenatal clients, and decoy visits to communities and health centers. Together, these measures generate a comprehensive picture of the performance of health workers in our three study sites.

In sharp relief to much of the previous literature on service delivery in developing countries, we find relatively high performance levels in all three countries. Coverage is fairly high: close to 80% of eligible subsidy recipients received the subsidy at the clinic (and 76% of them at their first prenatal visit, as they should have). Extortion is rare: only 1.4% of eligible subsidy recipients were asked to pay bribes. Leakage is modest: comparing administrative records of bed net deliveries (available only for Ghana) with our coverage estimates, we estimate an upper bound on the leakage rate at clinics of 15% in Ghana. Our "mystery clients" (ineligible men making decoy visits) were able to obtain a subsidized net from the health facility in only 4.7% of cases (and in most of these cases, they received the net "benevolently," for free). Consistent with this, in informal surveys, less than 10% of community members thought an ineligible person could obtain a bed net at the local prenatal center. Finally, shirking appears to be present but less prominent than in the previous literature: clinics were almost never closed and absence rates were lower than in other research. While we only have a few measures of the quality of care provided outside of net distribution, those also suggest relatively better performance than in other settings.

We also look at coverage and extortion for antimalarial drugs, which are supposed to be free for children under five in Kenya and Uganda. There we find very high coverage rates, but higher rates of extortion: an upper bound estimate of the percent of eligibles who were asked to make side payments is much higher than for nets, though it suggests that extortion is still far from systematic, with upper bounds at 16% in Kenya and 26% in Uganda.

While our study does not directly measure leakage higher in the distribution chain (e.g before subsidized products reach health facilities), we perform back of the envelope calculations for the public distribution programs in Kenya and Uganda by comparing observed population coverage rates in our study to publicly available data on the total number of nets distributed by these programs, and find limited leakage. Overall, the levels of leakage and coverage we estimate imply that agency problems only marginally undermine the cost-effectiveness of free distribution schemes such as the one we study.

Overall, this study thus finds much less severe agency problems than has been identified in other sectors or contexts. To what extent is this very specific to the product considered (ITNs?) As shown previously, willingness to pay for ITNs absent access to credit is low: in 2007, only 25% of households in rural Kenya were willing to pay more than $2 for a

$7-bednet (Dupas, 2014). While this means that health workers are unlikely to be offered large bribes or to find market price buyers for the many ITNs they could steal from the health facility storage room, there is ample room for health workers to extort a few dozen cents from eligibles and ineligibles alike. This is precisely this sort of petty corruption that has been identified as plaguing other sectors in the very countries we study. For example, in a study conducted in the same time period as ours, Foltz and Opoku-Agyemang (2014) find that policemen in Ghana allow only 19% of trucks to pass roadblocks without taking a bribe, and the most frequent bribe amount paid is 1 Ghanaian Cedi (around 60 US cents) – an amount that 75% of rural Kenyan households are willing to pay for an ITN (Dupas, 2014). Thus health workers could make non-trivial amounts of money from the scheme. The fact that they do not may well be because the expected revenue from corruption would not outweigh taking the expected costs if caught – while it does for police officers – but that is itself a result, given how little monitoring there is over health workers performance in practice.

We also examine whether interventions which affect the costs of corruption affect behavior. Since the research team was behind the implementation of the program in Ghana, we were able to randomly vary four aspects of the distribution scheme: (1) whether health workers received bonus pay for implementing the program, (2) whether health centers were threatened with audits, (3) the size of the initial stock of bed nets received by clinics, and (4) whether health workers were asked to distribute nets directly or, instead, distribute vouchers redeemable for free nets at local shops. The purpose of the voucher scheme was to reduce the effort cost of implementing the program for health workers, as well as change their ability to charge a markup, under the assumption that clients would be less likely to pay for a voucher than for a physical net. We find that neither the bonus compensation, nor the threat of audits, nor the stock size had any meaningful impact on performance. However, the voucher scheme worsened performance: eligible women were less likely to receive a net while mystery clients were more likely to receive one. Although we cannot say for sure why this happened, two potential (not mutually exclusive) explanations are: first, that health workers' intrinsic job motivation might have been undermined by a lack of "trust" (i.e., the fact that they are not given responsibility for the subsidized bed nets themselves); and second, that people in the community may have been less aware of the (less visible) voucher scheme. The former explanation would be similar to Rasul and Rogger (2015), who find that bureaucrats in Nigeria are less likely to complete projects if they are given less autonomy.

The remainder of the paper is organized as follows. Section 2 presents the theoretical framework that guided our study design, which we discuss in Section 3. Section 4 describes the data collection protocols used. Section 5 presents performance results from the three

audit studies and discusses their implication for the cost-effectiveness of free distribution schemes. Section 6 presents the experimental results from Ghana. Section 7 provides evidence on motivation levels of health workers and how those correlate with performance. Finally, Section 8 concludes and discusses our contribution to the literature.

# 2 Theoretical Framework

The theoretical framework underlying our research questions and study design is based on Becker and Stigler (1974), Banerjee (1997) and Niehaus et al. (2013). We consider three types of agents: the government, a health worker, and the clients of a health clinic. The government has a set of publicly provided private health products that the clients need (in our case, insecticide-treated bed nets). The goal of the government is to allocate these health products in a way that maximizes social welfare. We assume that the health products are scarce in the sense that the number of people who need them exceeds the number of products the government can afford. Individuals vary in their need for the products: we assume that there is a group of people that value the products more highly, and thus have a higher willingness to pay for the product (for example, in the case of bed nets, the private health returns to using a bed net are higher for pregnant women than for the rest of the population).

In a frictionless environment, the market would deliver the efficient outcome that those who value the product most would get them.[1] However, this is not true if there exist credit constraints, which could create a wedge between willingness and ability to pay for the credit-constrained (Cohen and Dupas 2010, Tarozzi et al. 2014). Since targeting based on credit constraints is typically infeasible and/or costly, the government could adopt an alternative rule of targeting the population with high returns on average (pregnant women) for a specified subsidy level.

The allocation of the health products is the responsibility of the health worker at a health facility. The health worker has to expend effort to deliver the product, and effort is costly. Assume that the health worker can observe the eligibility of the person who comes to the facility (e.g. the health worker can observe if the person is a pregnant woman or not). However, the government cannot monitor the health worker's behavior: in particular, the government observes neither the actual price charged by the health worker for the product, nor the eligibility of the people to whom the health worker offers (or not) the product.

The utility function of the health worker has four components: a cost of effort, a monetary payoff, and two types of non-monetary payoffs. The monetary payoff represents the health

[1]The products could also have positive externalities in which case the market outcome would not be efficient; we ignore these here for simplicity but they do not affect our predictions.

worker's salary plus any income she may obtain from being corrupt. If the monetary payoff is higher than in alternative jobs available, then the threat of losing the job generates "extrinsic motivation" to perform well. The first non-monetary payoff represents the health worker's satisfaction from helping clients achieve higher health outcomes. The *weight* the health worker puts on this non-monetary payoff is a function of her level of pro-social motivation, and the *magnitude* of this payoff depends on the health workers' effort and her beliefs about the health impact of the tasks she has to perform. The second type of non-monetary payoff represents a psychic payoff from doing one's job well. This payoff increases with the level of job-specific intrinsic motivation, which, in turn, increases with the health worker's beliefs about the health impacts of her job responsibilities, as well as with her level of autonomy. This psychic payoff goes to zero if the health worker breaks any rule on the job (i.e., gives the subsidy to an ineligible person or fails to give the subsidy to an eligible person for the specified price) in order to reduce her effort or increase her monetary payoff.

In this set-up, the health worker can engage in three forms of corruption, defined broadly as "incidents where a public employee breaks a rule for private gain" (Olken and Pande, 2013) (note that we take "private gain" here to exclude the non-monetary utility payoffs):

- *Extortion—extracting rents from the eligible*: Since the health worker has local market power (since other health facilities distributing the product are far away), the health worker can charge eligible people a price higher than the official subsidized price. Extortion will occur if the monetary payoff exceeds the reduction in the non-monetary payoff. Extortion reduces social welfare in two ways: (1) if demand is price-sensitive and there is imperfect price discrimination, extortion will lower the number of recipients; and (2) part of the government subsidy is captured by the health worker, for whom the marginal utility of cash is likely lower than for the eligible individual.

- *Leakage—diverting the subsidized product to the ineligible*: Some ineligible people may have a higher ability to pay than some eligible people (due for example to credit constraints). It could then be profit-maximizing for the health worker to allocate some of the products to ineligible individuals, which could crowd out receipt by the eligible if the total number of subsidies is limited. Leakage will happen if the resulting increase in the health worker's monetary payoff outweighs the potential reduction in her non-monetary payoff. Leakage reduces social welfare and leads to inefficiency (from a public health perspective) if there is a wedge between willingness and ability to pay such that those ineligible individuals who purchase the product have lower health returns to the product than those eligible individuals who decide not to.

- *Shirking—not implementing the program*: the health worker may not pay the effort cost

associated with delivering the subsidy to eligible clients, even though it is part of her job description. This will happen if the health worker's utility gain from lower effort outweighs the utility loss coming from the lower non-monetary payoff (and potentially lower monetary payoff if there is extortion) associated with lower effort. Shirking can reduce social welfare by reducing coverage rates among the eligible, assuming the social cost (healthworker effort) of delivering the product is outweighed by the social benefit, as it should be for products like bednets with large benefits.

Note that in our set-up, pro-socially motivated health workers could break the targeting rule *for public gain* – namely, if they have private information on how the health returns of receiving the product will vary across clients, the health workers may be able to implement a more efficient targeting rule than the blunt government rule. For example, health workers may deny the free bed net to pregnant women that are wealthy enough to already have one; or grant a free bed net to poor ineligible men who have an unprotected child.

This theoretical framework motivates the experimental interventions in Ghana, which consist of four main treatments designed to test the following hypotheses (outlined in our pre-analysis plan):

1. *Increasing existing health workers' compensation* can reduce corruption if pro-social motivation, intrinsic job motivation, or effort have positive income elasticities, or if payments increase health workers' pro-social and/or intrinsic job motivation as a form of gift exchange. Note that there is no selection margin here since we are increasing compensation *after* health workers select into the profession.

2. *Performing a top-down audit (and shutting down the program if it reveals foul play)* can reduce corruption if health workers are sufficiently pro-socially motivated to not want to deprive the community of the program, if health workers are concerned that their jobs (and corresponding monetary payoff) would be threatened if they are caught breaking program rules (extrinsic motivation), or if it is profit-maximizing for health workers to decrease corruption when the threat of being caught increases.

3. *Increasing the (perceived) tightness of the budget constraint by giving out fewer nets to the clinic* might reduce leakage if health workers believe that eligibles have higher returns (as they should under most targeting rules) and are sufficiently pro-socially motivated to care whether those people receive the subsidy.

4. *A voucher scheme* in which health workers give clients a voucher that they can redeem at a third party for a net, instead of having health workers distribute products directly, can reduce extortion and leakage if people are less willing to pay a bribe for a voucher

than for the product itself, and can reduce shirking if the effort cost for distributing vouchers is lower than the effort cost for direct distribution (which is likely since vouchers are small and can be kept conveniently in the visitation room. and so take less effort to hand over than larger nets which must be retrieved from a storage room). .

To the best of our knowledge, this work represents the first experimental tests of hypotheses 1, 3, and 4.[2] Regarding hypothesis 2, Olken (2007) finds that top-down audits reduce corruption among local officials granting road-construction contracts, but bottom-up monitoring does not. In our context, misconduct by frontline providers is likely observable by the local community since the targeting rule is based on pregnancy status, so the scope for bottom-up monitoring is higher and the need for top-down audits might be lower.

# 3 Study design

## 3.1 Study Sites

Our sample consists of 168 rural health facilities (72 in Ghana, 48 in Kenya and 48 in Uganda). We chose these three countries as follows. First, we picked Ghana as our experimental site since it did not have any bed net distribution program and therefore it was possible for the research team to implement one with randomized variation in program features. Second, and *after* observing relatively high performance in Ghana, we picked Kenya and Uganda because they both had government-led bed net distribution programs through prenatal clinics, are among the countries perceived as most corrupt according to Transparency International (TI), and because, as we shared our initial Ghana results, we received anecdotal reports that leakages were high in both these countries. We thus chose two additional countries where the *prior* was that leakage would likely be on the high side, hence providing an upper bound for the average costs of corrupt behavior on the part of health

[2]Regarding hypothesis 1, there is some evidence that higher public wages are correlated with lower corruption, but most of the evidence is cross-sectional (Van Rijckeghem and Weder, 2001; Rauch and Evans, 2000). Dal Bo, Finan and Rossi (2013) provide experimental evidence that higher wages improve selection into public service, but our experiment differs because it involves increasing the pay of existing health workers when asking them to take on a new task, thus shutting down the selection margin. Di Tella and Schargrodsky (2003) provide some evidence that higher-paid procurement officers respond more to corruption crackdowns in Argentina than lower-paid officers; however, their results could reflect factors other than wages and could run through channels other than corruption. Regarding hypothesis (3), we know from other contexts that local officials have and use local information to target scarce publicly-provided goods (i.e. Bardhan and Mookherjee 2000; Niehaus et al. 2013; Alatas et al. 2013; and Basurto, Dupas and Robinson 2015), but we do not know whether the quality of targeting increases with (perceived) scarcity. Finally, to the best of our knowledge, there is no evidence on the fourth hypotheses in the literature. However, despite the lack of evidence, hypothesis 4 is a standard argument given by voucher proponents (Sexton, 2011).

workers, while Ghana, ranking much better on the TI corruption index, was perceived as possibly providing a lower bound.[3]

In each country, health facilities were selected for inclusion based on a census conducted of all of the public and private health facilities in a given region/province.[4] Inclusion criteria for health centers in the study were: (1) having an antenatal care clinic (ANC); and (2) being rural or semi-rural. For the Ghana sample, we had the following additional criteria: (3) having no other healthcare facilities within a 2 km radius, no hospitals within a 5 km radius, and not more than one other ANC within a 5 km radius;[5] (4) having no free bed net distribution program currently in place (which very few had); (5) having at least two stores within a 2 km radius willing to participate in a voucher scheme (only 6% of clinics were excluded by this criterion)[6]; and, (6) being accessible for net deliveries (less than 2% were inaccessible). Our final sample spans 21 districts in Ghana, 10 districts in Kenya, and 6 districts in Uganda.[7]

Table 1, Panel A presents average baseline characteristics for the 168 health centers in the study. They have been operating for 16 years on average and 85% of them are public. Health centers in the study sample enroll around 28 new ANC patients every month on average, and receive 63 revisits by existing ANC patients. The average clinic has 2.9 health workers (trained nurses and/or midwives) in charge of ANC patients and roughly 50% of health centers conduct outreach visits (i.e., they go to remote communities and provide "mobile" ANC services there). Only 13% are located within 10 kilometers of a store selling bed nets, suggesting bed nets are not widely available outside subsidized distribution schemes.

Table 1, Panel B presents some statistics on coverage with insecticide-treated bed nets (ITNs) in each of the three countries. This data comes from Demographic Health Surveys conducted a few months prior to our study in Ghana, three years prior and one year after in Kenya, and two years prior in Uganda, so for these last two countries these are just indicative

[3]As rightfully noted by an anonymous reviewer, Uganda and Kenya provide an upper bound *among countries that had distribution programs at the time*. If those countries are positively selected on implementation capacity, then that upper bound may not be helpful in thinking about the potential for corruption in countries that shy away from implementing a program. The fact that Ghana did not have a program but appears to have fairly high implementation capacity (as per the performance we observe in the program we set-up) suggests selection on capacity may not be key, but obviously it is only one observation. According to 2013 World Malaria Report, 34 of 44 countries with ongoing malaria transmission in sub-Saharan Africa had an ITN distribution program through antenatal clinics in place as of 2012, however, so our results remain relevant and interesting for a large part of the continent.

[4]We sampled one of 10 regions in Ghana, one of 8 provinces in Kenya, and one of 4 regions in Uganda.

[5]Since the research team had to fund the bed net distribution program in Ghana (see section 3.3 below), this inclusion criterion was to keep subsidy costs manageable by limiting the potential increase in ANC attendance in response to the program.

[6]The stores did not have to carry LLINs on their own prior to the program.

[7]At the time of sampling, the three countries had 170, 208, and 112 districts each, respectively. Ghana and Kenya have had administrative changes since then.

and not accurate representations of the situation at the time of our audits. But they suggest that while the majority of households have access to at least one ITN, they do not have enough to cover all their members, thus there remains a latent demand for ITNs. As shown previously (see Dupas 2011 for a review), willingness to pay absent access to credit is very low, however, thus this latent demand is unlikely to translate into large bribes for ITNs, but could translate into frequent requests for free ITNs from ineligibles. And while willingness to pay is low, still over 80% of pregnant women are willing to pay 10 or 20 cents for an ITN (Cohen and Dupas, 2010), meaning that extortion from eligible is possible, and absent any accountability a profit-maximizing health worker would likely want to charge that.

## 3.2 Timeline

The data collection in Ghana took place between October 2011 and April 2012. At the time, there was no bed net distribution program through antenatal care clinics, nor any other distribution scheme, although the Ministry of Health in Ghana had done some limited distributions of bed nets through antenatal care clinics in the past so health workers were somewhat accustomed to this type of scheme.

In Kenya and Uganda, data collection took place between May and September 2013. Since 2009, national policy in Kenya is that all pregnant women are provided a free long-lasting insecticide treated net (LLIN) at their first antenatal care visit.[8] In Uganda, such distribution is not yet a national policy, but funding from the President's Malaria Initiative and USAID enabled such distribution in parts of the country, including our study area, starting in 2012 and ending in October 2013. Both public and private facilities were included in the distribution program.

## 3.3 Ghana experiments

The 72 health facilities in the Ghana sample were invited to participate in an NGO program called SALI ("Saving Lives"). The program mimicked those ongoing in Kenya and Uganda, and consisted of distributing free Long Lasting Insecticide-Treated Nets (LLINs) to pregnant women during routine antenatal care visits. The program was approved by the Ghana Health Service and was implemented by antenatal care clinic staff (most of them midwives or nurses). We hired and trained SALI staff, whose job was to roll out the distribution program – namely, to visit health facilities to introduce the program, deliver bales of nets and train health workers on the eligibility criteria for the free net and on record-keeping.

[8]Funding for this distribution program comes primarily from the Global Fund to Fight AIDS, Tuberculosis and Malaria, and from the President's Malaria Initiative.

The SALI staff was completely unaware that an evaluation of the SALI program would be implemented, as were the health workers.[9]

The program was rolled out into the 72 clinics over a 7-week period, from mid-October to early December 2011. The distribution program was announced as a continuous scheme, with health centers (or shops when applicable) given instructions on how to get a new delivery of LLINs before their stock ran out. In practice, the program stopped abruptly in all study health centers in mid-March 2012 when the Ghana Health Service rolled out a separate (unannounced) free distribution scheme for LLINs. Given this, health centers in our sample were exposed to the SALI program for up to 150 days, with an average of 109 days.

Prior to rolling out the program, we grouped the 72 clinics into 6 strata with comparable average characteristics (size, remoteness, and proximity to district borders). Within each stratum, we randomly assigned clinics into treatment groups.

*Distribution mechanism (Direct vs. Voucher)*: We randomly varied whether the LLINs were distributed directly through health centers, or indirectly through a voucher scheme wherein the health workers would distribute vouchers that could then be redeemed for a free LLIN at a local store. We assigned 48 health centers to "direct distribution" (as in the Kenya and Uganda government programs), and 24 health centers to a "voucher scheme." Since the great majority of health centers did not have any store selling bed nets in their vicinity, we stocked one or two local stores (located within two kilometers of health center) with LLINs and instructed shopkeepers to give one free LLIN to anyone who came in with a voucher from the local clinic and a corresponding ANC registration card.[10]

*Staff monitoring (Audit vs. No Audit):* Half of the clinics were randomly selected for an "audit treatment." The audit treatment was rolled out in those clinics during the second through fourth weeks of January 2012. At that time, health workers were informed that the NGO implementing the program would perform audits, starting within the next month. How the audits would be performed was not disclosed, but health centers were warned that, if the audits revealed that either leakage or extortion had occurred after the audit announcement, the program would be shut down, depriving the local community of the program.

*Pay (Compensation vs. No Compensation):* In clinics with direct distribution, where health workers had the responsibility to manage the LLIN inventory and coordinate with the SALI project staff to avoid stockouts, we randomly varied whether health workers received

[9]As such, the protocol involved deception of research subjects (health workers). As per IRB requirement, health workers were "debriefed" on the true intent of the research study in the Fall 2013, after the study had been completed.

[10]Shops in our program were not permitted to mark up the nets, so testing whether vouchers decrease stockouts was not a motivation for this treatment, although that could in principle be another advantage of vouchers.

compensation for implementing the program. The compensation was a fixed monthly fee of 100 Ghana cedis (US$60, corresponding to approximately 17% of the median monthly salary of a nurse or midwife or 25% of the median monthly salary of any healthworker) paid via direct deposit into health workers' bank accounts.

*Scarcity (Small vs. Large Delivery)*: Finally, within direct distribution clinics, we randomly varied whether the stock of LLINs delivered to the health center at the onset of the program was high or low. Since clinics were instructed to call the SALI program officer to restock the nets whenever they would run out, this variation in the level of the initial stock should have no effect (besides increasing the potential for early stockouts) unless it affected the salience of the "budget constraint."

Figure 1 shows the experimental design.[11]

**Balance** Columns (2)-(5) of Web Appendix Table A1 test for balance across our experimental groups in Ghana, both in terms of baseline characteristics (Panel A) and program implementation details (Panel B). We regress each dependent variable on a dummy variable for being assigned to the voucher treatment, audit treatment, pay treatment, and large stock treatment. Columns (2)-(5) present coefficients and standard errors from these regressions. None of the differences are significant at the 5% level.

# 4 Data

In all three countries, we collected data through two completely independent teams unaware of each other's existence. The first is a team of "mystery clients" (undercover enumerators) asked to do decoy visits to health centers and their surrounding communities. The second is a team of regular surveyors, who administered surveys to ANC clients, health workers, as well as other professionals. In Ghana, we also have administrative data from the SALI staff (itself completely independent from the two data collection teams), which kept program implementation records and also asked health centers to keep a log of program beneficiaries.

## 4.1 Decoy visits data

We sent undercover enumerators to local communities, who were trained to perform two types of decoy visits:

[11]The treatments were assigned in cross-cutting fashion. We are powered to look at main effects (e.g., payment vs no-payment) but not interactions (e.g., payment in audit clinics vs no-payment in audit clinics). This of course means that when we look at the main effects of the various subtreatments (e.g., payment vs no-payment), we will be pooling across groups that received different other subtreatments (e.g., audit and non-audit).

(1) *"Mystery Client" visits*: To identify leakage, we arranged to have undercover enumerators visit clinics (and stores, in the case of the voucher treatment) to try to obtain a subsidized net. To make this measure clearly interpretable as leakage, we chose to employ only men as mystery clients (since they are clearly ineligible for the program). After concluding the interaction and once out of sight, mystery clients recorded the details of their encounter with the local health workers, including whether they were asked to pay a bribe. To minimize possible suspicion among health workers, mystery clients dressed casually and never visited the same health center twice. They were not asked to follow a specific script. Both the order in which mystery clients visited a health center and the timing (across and within days) were randomized.

In Ghana, we paid the mystery clients 5 GHC (about half the retail price) for any bed net they were able to bring back from such decoy visits (in addition to a salary of 25 GHC per day). We scheduled 10 mystery visits per health center, 5 before the audit rollout period and 5 after. This led to an average of 0.6 mystery visits per health center per week. In Kenya and Uganda, because the bed nets distributed were from the government programs rather than our own NGO program, we did not incentivize enumerators to pay bribes for bed nets. We scheduled 3 mystery visits per health center over the course of two months.

(2) *Informal community interviews*: In all three countries, enumerators spoke with a convenience sample of community members about whether bed nets were available in the area and, if so, where, at what price, what the eligibility criteria were, whether they thought an ineligible person would be able to obtain a net, and whether they themselves had received a net at the health center.[12] To elicit truthful answers, surveyors posed as visitors and did not introduce themselves as enumerators in Ghana and Kenya. In Uganda, we were unable to obtain an IRB waiver to conduct these visits undercover so they were conducted by the regular survey team described below in Section 4.2. Again, no enumerator performed this activity in the same area twice. We polled around 18 community members per health center in each of the three countries.

An important point to note when interpreting this set of results is that all mystery clients were male and thus clearly ineligible for the program. Additionally, all the mystery clients were from areas outside the study area (so that local communities would not realize the true intent of the decoy visits). If leakage is lower to men than to ineligible women, if health workers behave differently with strangers than with local community members, or if local community members under-report leakage to strangers, the leakage we estimate will be a

[12]During each visit, the mystery clients were instructed to speak with three individuals at the local market, as well as three households in their homes. The questions about whether the community members themselves had obtained nets were only asked in Uganda and Kenya.

lower bound on the percent of requests by ineligibles that yield nets. We address this by estimating an upper bound on the overall leakage rate using the administrative and audit data described in section 4.3. (Note that the two estimates are not of the same underlying measure: the latter is an estimate of the percent of nets leaked, whereas the former is an estimate of the percent of requests by ineligibles yielding nets.) In addition, we examine how leakage to ineligibles correlates with other performance measures.

## 4.2 Regular survey data

We use three types of regular survey data.

*(1) ANC Client Back-checking surveys:* An important outcome is whether eligible clients received nets. To verify this, we hired regular teams of enumerators to survey ANC clients at their homes. We sampled the ANC clients to be surveyed as follows. In all three countries, health workers keep registers of the women who come in for antenatal visits. These ANC registers include a record of each visit, as well as some rudimentary contact information (typically just the woman's name and the area she is from). In each facility, this register was used to randomly sample 20 pregnant women who had visited the facility for antenatal care in the previous 4 months.[13] The survey team attempted to visit these women at their homes and administer a short survey about their experience at the ANC clinic, their bed net ownership and usage, including whether they received a bed net from the local health center and at what price. A subset of them were also asked to play a dictator game (so that we have a basis of comparison for the health workers, see below). The survey team was successful at reaching the great majority of the women sampled for this survey in Ghana (92%), but less so in Kenya (71%) and Uganda (66%). The rest could not be traced, typically because ANC registers contain almost no information on clients' addresses and therefore tracing women from outer villages was particularly difficult. The higher attrition rate in Kenya and Uganda likely reflects the fact that the samples in these two countries included semi-urban health

[13]These data are used to estimate coverage and extortion (but not leakage, which is estimated from the program's administrative records). From the point of view of our estimation, the threats associated with this sampling strategy are of two sorts: (a) some women who truly visited the ANC may not have been listed on the register; (b) some "fake" ANC clients were listed to boost the numbers and justify a smaller number of nets left in inventory. If those who are not listed are those who are not given a net or are asked for bribes, then (a) would lead us to overestimate coverage and/or underestimate extortion. Our visits to ANC clients (and, in particular, the percent of clients not found) allow us to estimate an upper bound on (b). That said, we consider it very unlikely that health workers in any of the three countries modified how they fill ANC registers in response to the bed net distribution programs, especially since (1) they likely did not expect anyone to use the ANC registers for audit purposes since they were asked to keep alternate records of bed net recipients, (2) the registers are formatted with one registrant per row (so all revisits are recorded on the initial row) which makes them very difficult to use for monitoring how many nets the clinic should have distributed (i.e., the number of eligible clients who visited in a given timeframe). As such, our prenatal client survey sample is likely a representative sample of the population of prenatal clients.

centers, which have wider catchment areas. In the analysis, in one specification we assume those that could not be tracked did not receive a net, providing a lower bound on coverage.[14]

*(2) Surveys of Health Workers:* Health workers involved with prenatal clients (on average, 3.1 per clinic) were sampled for a survey that measured basic demographics, other-regarding preferences (including a dictator game) and other personality traits. This survey was administered by our regular surveyor teams and took place after all other data collection exercises had been completed, since being surveyed on one's level of intrinsic motivation and altruism could temporarily affect on-the-job performance. We were not able to survey all health workers involved with prenatal clients due to official leaves, or because some health workers were too busy for a survey or simply absent. We successfully interviewed 89% of health workers in Ghana, 74% in Kenya and 70% in Uganda. In Kenya and Uganda, we also recorded attendance of ANC health workers. One (unannounced) spot check was done per clinic.

*(3) Surveys of Other Professionals*: To get some sense of how pro-social motivation and intrinsic and extrinsic job motivation differ between health workers and other people, our regular survey teams also conducted the same survey modules used with health workers with non-health workers, in particular, teachers, as well as (in Ghana and Uganda only) shopkeepers and microfinance agents.

## 4.3 Ghana administrative data

Since we set-up the distribution scheme ourselves in Ghana, we have administrative data on bed net deliveries by our SALI teams at each facility (timing and quantities delivered). We also have logs kept by health workers, in which they were asked to record some basic information (name, prenatal card number and address) for each person they gave a bed net or voucher to. The survey team attempted to visit these individuals at their homes and administered a short survey identical to the one administered to ANC clients. Surveyors were successful at reaching 94% of the individuals sampled for this survey. The success rate in tracing these individuals is in itself an outcome of interest.[15]

[14] In Uganda and Ghana, 7% of the interviews were conducted with proxies because the sampled respondent was unavailable at the time of interview; in Kenya, 1% of interviews were conducted with proxies.

[15] As described in Section 5.2, we use these records to estimate an upper bound on the leakage rate. One reason that it is an upper bound is that health workers could forget to record eligible clients who received nets, which would cause us to overestimate leakage.

# 5 Performance Results From Three Countries

We first examine the performance of the standard program (bed net distribution at clinics). For this we exclude from the analysis the 24 health centers in Ghana with a voucher scheme, keeping 48 health centers from each of the three countries studied, and we present the overall mean as well as country-specific means for each outcome, and the p-values for tests of equality for each country-pair.

## 5.1 Do the Eligible Receive the Full Subsidy?

We first consider the effectiveness of the bed net subsidy programs in reaching intended beneficiaries. The results are presented in Table 2. Our interviews with women randomly sampled from the ANC registers reveal that as many as 76% of intended beneficiaries received a net at their first prenatal visit as per program protocols (Table 2, column 1), and 80% received one at some point (column 3).[16] When we exclude clinics with reported stockouts over the sample period, the share of the eligible population receiving the subsidized net at their first prenatal care visit reaches 81% (column 2). Only 1% of them were asked to pay something in exchange for the net.

While performance levels are high on average, there is some meaningful heterogeneity across countries. Coverage is significantly higher in Kenya (90%, column 2) than in the other two countries (Ghana - 77%; Uganda - 69%). When asked why they did not receive a bed net, around 9% of the Ugandan women (20% of those who ventured an explanation) mentioned that it was because they already had a net or were rich enough to afford one, suggesting that health workers may have been, to some extent, targeting the subsidized nets to those needing them the most. Extortion is also significantly higher in Uganda, although the absolute level (3%) is still low.

**Errors of exclusion or efficient targeting?** In Table 3, we test more formally whether incomplete coverage represents errors of exclusion (truly poor women who should have received a net) or the outcome of health workers exercising discretion over how to allocate the subsidy based on local information. We investigate whether, *within clinic*, prenatal clients which have a higher socio-economic status (proxied by education), and thus are more likely

[16] These estimates exclude any ANC registrants who were sampled from the registers but we were unable to track. A very conservative lower bound approach would be to assume all of the registrants who we were unable to track and interview did not receive nets – note that we believe this is too conservative since the likelihood of tracking was based on factors that were plausibly orthogonal to likelihood of net receipt (in particular, we do not think that ANC clients we could not trace are "fake patients", since facilities have no incentive to over-report ANC clients in their registers, as discussed in footnote 13). The conservative lower bound approach would yield a 64% coverage rate for Kenya, 71% for Ghana, and 46% for Uganda.

to be able to afford a net on their own, are less likely to receive a free net. We find suggestive but weak evidence that more educated women were less likely to get nets. An additional year of education is associated with a 0.7 percentage point reduction in the likelihood of receiving a net at the first visit (Table 3, panel A, column 1). This implies that a woman at the 75th percentile in the distribution of years of education (7.5 years) is 3.1 percentage points (13%) less likely to receive a free net at her first visit than a woman at the 25th percentile (3 years). Unsurprisingly, targeting appears more pronounced in Ghana (col. 2) and Uganda (col. 4) than in Kenya (col. 3), where the coverage rate was close to 100%.[17]

To test whether targeting improves when the stock of nets is low, in column 5 we limit the sample to ANC visits that took place within one month of a stockout. Consistent with improvements in targeting, the magnitude of the effect increases, but we lack the precision to distinguish the effects from each other.

## 5.2 Leakage to the Ineligible

Table 4 shows the results of the decoy health center visits by our "mystery clients" trying to obtain nets for which they were ineligible. We first note that on 20.5% of the visits in Kenya and Uganda, the clinic was actually out of stock (we know this from independent visits made by the survey team – see column 1). Stockouts were not measured independently in Ghana, but mystery client reports suggest it was rarer (4.6%, column 2). We thus focus on non-stockout visits to make meaningful comparisons across countries, but we note that the stockout number used in Ghana is likely an upper bound, since health workers could have told ineligibles asking for nets that the clinic was out of stock as a way to gently deny their requests.

Only 4.7% of the 685 non-stockout attempts made across all three countries were successful (Table 4, column 3). This varied from 11% in Uganda to 8.7% in Kenya to only 2.2% in Ghana. All of the nets leaked to mystery clients in Kenya and Uganda were given out for free (column 4), which is not surprising since the mystery clients in these two countries were not incentivized to pay for the (government sponsored) nets. What is more surprising is that while mystery clients in Ghana had a higher reservation price – recall that we paid them 5 GHC per (NGO sponsored) net they successfully acquired from health centers– they were less successful at obtaining nets than their counterparts in Kenya and Uganda. Only 1.3% obtained a net by bribing; and only 0.9% got a net for free (compared to 9% in Kenya and

[17] Outcomes from the first visit are likely more reflective of health worker targeting than outcomes across all visits (for example, more-educated people who did not get nets might return to the clinic specifically for a net). The results across all visits, shown in Panel B of Table 3, are consistent but somewhat weaker, indicating that there is some "correction" at visit 2.

11% in Uganda). Requests for payments, shown in column 5, were rarer in Kenya (3.6%) and Uganda (1.1%) than Ghana (5.1%). However, the average amount requested in Ghana was very high (more than the full price of the net, even after bargaining had happened – column 6), and actual transactions occurred after only a quarter of the payment requests, possibly suggesting that some health workers may have been asking for a high price as a way to get rid of the visitor, or that they intended to replace the leaked net with a purchased net

The informal interviews mystery clients conducted with randomly sampled community members (columns 8-10 of Table 4) also suggest low levels of leakage. In all three countries, about 10% of community members thought the male (and so obviously ineligible) mystery client could get a net from the local facility. When asked if they themselves had acquired a net, less than 4 percent of men said they had (an upper bound since some may be reporting a net they legitimately received while taking a pregnant wife or child under five to the facility).

**Errors of inclusion or efficient targeting?** In Table 5, we investigate the extent to which the leakage to our mystery clients (especially in Uganda and Kenya, where around 10% of mystery clients obtained free nets) comes from health workers bending the targeting rule for the public good. In particular, we test whether health workers are more likely to leak nets to mystery clients whose "narrative" made them appear like they had a higher return to bed net usage, for example because they had a pregnant wife or vulnerable child. This analysis is limited by two factors: the choice of strategy was left to the enumerators, and, possibly owing to differences in training, there were systematic cross-country differences in the strategies used. In Ghana, mystery clients almost always said that the net would be for personal use (a few of them mentioned a pregnant wife), while in Uganda and Kenya, some mystery clients mentioned a sick child at home, though in Kenya they only did so if asked by health workers. Given this, the regressors in Table 5 vary across countries.

The results in Table 5 suggest that mentioning a pregnant wife did not increase the odds that the mystery client obtained a net, often because health workers responded to such demands by saying "have your wife come for prenatal care and she will get one." In contrast, mystery clients who mentioned a child were significantly more likely to obtain a free net. This result holds within country (columns 3-4) and also helps explain the cross-country variation we observe in leakage.[18]

Of course, to the extent that pretending to have a needy child at home is "cheap talk", the fact that health workers respond to it is not necessarily evidence of improved targeting – the health workers may perceive that they are targeting efficiently when they are not.

[18] Again, we view this evidence as suggestive, since the mystery clients' narratives were not randomly assigned, so the story used could also be endogenous to the interaction or correlated with other mystery client characteristics, such as their power of persuasion.

**Total Local Leakage Rate (Ghana only)** Leakage to mystery clients does not allow us to estimate total volumes leaked since we do not know the volume of requests. To get a sense of the likely magnitude for the total leakage rate, in this section we estimate an upper bound using a completely different data source: the administrative records of bed net deliveries to health centers, as well as the records on beneficiaries kept by health centers, which we audited. We can do this exercise only in Ghana, the only country for which we have information on the total number of nets supplied in each clinic (we have this data since we implemented the program ourselves through the SALI team; it was not possible for us to obtain detailed governmental records of bed net deliveries to individual health centers in Kenya and Uganda). Combining all of the available information for Ghana, we estimate an upper bound for the percent of bed nets unaccounted for as follows: we compare the number of nets delivered by the program to the facility to the estimated number of nets that reached an eligible person. To estimate the number of nets that reached an eligible person, we use the log of beneficiaries kept by health workers at the request of the SALI program, and subtract invalid entries. Invalid entries were defined in two ways. First, all duplicate entries were considered invalid. Second, among non-duplicate entries, we estimate the share of invalid entries using the data from our random audits of the logs. Audited entries were considered invalid if the person named in the entry could not be found (6.4% of entries), was found and not eligible (1.5% of entries), or had not received a net (2.7% of entries). This estimate is an upper bound since some of those not found or not recorded in the administrative ledger may have been legitimate program beneficiaries, but in our calculation we assume they did not receive a net.[19]

Figure 1A shows the distribution across the clinics of the estimated (upper bound) number of bed nets unaccounted for, while Figure 1B shows the distribution of the estimated share. The average estimated leakage rate is 14.7%. In the vast majority of clinics, the number of bed nets unaccounted for was quite low, with a median of 20 and a 75th percentile of 37 nets, numbers that would not be unreasonable for simple misplacing.[20]

[19]Note that we exclude audits where the person was found, eligible, and surveyed, but where the data about whether the person received a net is missing (most missing data are in surveys conducted with proxies), so effectively assume missing data is random; if we assume instead that none of the respondents with missing data received nets (a very conservative assumption), the total leakage rate would increase to 16.8%. Data is only available for 47 of the 48 direct distribution clinics because, for one clinic, the survey team lost the surveys for respondents sampled from the SALI ledger, and so we cannot compute the "% of valid entries" for that clinic.

[20]Note that the number of unaccounted-for nets can be negative either as a result of sampling error in the estimate of the percent valid entries (so we may underestimate the number of valid entries), or errors in the records kept by the SALI program on the number of nets they delivered (though we think this is unlikely). In any case it is reassuring that only three clinics have negative values, and the value is never less than -15 nets. (For the one clinic with value less than -5, it is likely due to sampling error, since 100% of the respondents sampled from the SALI ledger in that clinic were found, were eligible, and had received nets.)

**Leakage Across the Entire Delivery Chain** Our results so far suggest that leakage at the point of distribution (once the nets have reached health facilities) is limited and does not threaten the cost-effectiveness of subsidy schemes. But what about leakage higher up in the chain? While such leakage would not contradict our finding that health workers at the point of distribution are performing well, it would have implications for cost effectiveness. In this section, we do a simple accounting exercise to estimate the total rate of leakage in the Uganda and Kenya programs. The nets procured for distribution must be equal to the number of nets received by eligibles plus the number of nets leaked. Our estimates of the number of nets procured in both countries are very similar to our estimates of the number of nets received by eligibles, suggesting that leakage higher up was limited.

In Kenya, 2,800,000 free ITNs were procured for the year 2013, to be distributed to an estimated eligible population of 2,837,475 eligible pregnant women and children under the age of one.[21] This implies a maximum potential coverage rate of 98%. Our observed coverage rate of 91% among pregnant women therefore suggests a total leakage rate of around 7%.

In Uganda, the program we audited reports distributing a total of 268,804 bed nets to 34 districts for the October 2012 to September 2013 period. The total estimated ANC population over that period is 493,631.[22] Thus the program delivered enough bed nets to cover 55% of eligible pregnant women. Our estimated coverage rate is higher than that, at 66%. This could be because the districts we studied received more bednets per pregnant woman than average (perhaps because our study area is centrally located), or because women who registered for ANC for the first time during the program were more likely to receive nets than women who visited the ANC but had already registered. In any case the numbers suggest leakage higher up in the chain was likely limited.

To conclude, while corruption higher up in the distribution chain is not the focus of our study, it appears limited in the bed net distribution schemes we studied. Our finding that local leakage is low thus implies low mistargeting overall. One caveat to the calculations above, however, is that our estimates of coverage come from a single region in each country, whereas the supply figures are national.[23]

[21] See http://www.pmi.gov/docs/default-source/default-document-library/malaria-operational-plans/fy12/kenya_mop_fy12.pdf?sfvrsn=6, Table 4 on p. 18, accessed August 26 2014.

[22] See http://www.usaid.gov/sites/default/files/documents/1860/SMP_Year_5_Annual_Report-Final_Oct2012-Sep2013.pdf, p. 9, accessed August 26 2014.

[23] If the region we study was favored by the government and received more nets per capita than others, our calculations would be underestimating leakage, as seems to be the case in Uganda. This is less of a concern in Kenya where the study took place in Western Province, which overwhelmingly favored the loser in the presidential elections of both 2007 and 2012. A second caveat is that our 48 facilities per country fall under the jurisdiction of only 10 districts in Kenya and 6 districts in Uganda; therefore our delivery chain leakage estimates reflect the performance of only 16 agencies.

### 5.3 Cost-Effectiveness Implications

Our administrative records from Ghana suggest a conservative upper bound on leakage at the facility level of around 15%. Leakage higher up in the chain is minimal, according to the estimates from Kenya and Uganda, suggesting that total leakage is at the most 20%. Is 20% high or low? Clearly, and not surprisingly, this figure is much lower than the high rates of leakage observed in some studies for *cash* payments (for example, Reinikka and Svensson (2004) estimate leakage rates for education grants in Ghana and Uganda of 49% and 87%, respectively, while Niehaus and Sukhtankar (2013) find leakage of 70% for government wages in India). In addition to the obvious liquidity advantage of stolen cash over stolen bednets, the difference could come from the observability of the program – indeed, once schools and parents knew about cash grants for education in Uganda, Reinikka and Svensson's estimate of leakage dropped to 18% (Reinikka and Svensson, 2011). Our estimated leakage rate is comparable to the lower bound of 18% found by Olken (2005) for leakage of food in a food relief program in Indonesia, and on par with recent evidence on the allocation of government transfer benefits in Indonesia (Alatas et al. 2013).

While 20% thus falls in the left tail of existing estimates of leakage for other sectors, maybe a better way to gauge whether it is small or large is to estimate its implication for the cost-effectiveness of free distribution programs. Assuming no positive health impacts from leakage (so counting leakage as a pure deadweight loss –a strong assumption), 20% leakage implies an increase in the price per bed net delivered to an eligible person by 0.2/(1-0.2)=25% with no change in total health benefits. As shown in detail in Table IX of Cohen and Dupas (2010), the cost effectiveness of bednets depends on assumptions about the private and social health returns to bednets among the eligible. Cohen and Dupas estimate costs between $200 and $662 per child life saved depending on assumptions, which would increase to $250-$827 with 20% leakage. These remain orders of magnitude below the cost-effectiveness threshold of approximately $20,000 per life saved ($241 per disability-adjusted life year saved times 80 years) suggested by the 1993 World Development Report (World Bank, 1993).

## 6 Experimental Results from Ghana

We now turn to the effects on performance of the four randomized program features in Ghana: the voucher scheme, the audit threat, compensation pay, and stock size. Because the audit threat was rolled out midway through the program, we use a difference-in-differences specification to determine the effects of audits, comparing the results before and after the time when audit threats were rolled out at clinics that were vs. were not sampled for the

audit threat. Thus, we estimate regressions of the following form:

$$y_{ict} = \alpha + \beta_1 Voucher_c + \beta_2 Audit_c \times Post_t + \beta_3 Pay_c + \beta_4 SmallDelivery_c + \beta_5 Post_t + \delta Audit_c + \eta' X_c + u_{ict} \quad (1)$$

where $y_{ict}$ is the outcome of individual $i$ at health center $c$ in period $t$, $X_c$ is a vector of health center level controls (specifically: randomization strata fixed effects, baseline ANC attendance, and ANC staff size), and $Audit_c$, $Voucher_c$, $Pay_c$ and $SmallDelivery_c$ are treatment dummies. $Post_t$ is a dummy equal to 1 if $t$ is the post-audit period. We cluster the standard errors at the health center level.

The results are shown in Table 6. We see little effect of most of the experimental treatments, except for the voucher scheme. The voucher scheme did not affect extortion, as bribe requests were minimal (1%) under both the voucher and direct distribution schemes. However, surprisingly in the context of both the conventional wisdom and our hypothesis (from our pre-analysis plan and Section 2) that vouchers would increase coverage by decreasing effort costs, the first two columns of Table 6 show that subsidy coverage among the eligible was lower under the voucher treatment (row 1). Health workers were 19.5 percentage points less likely to deliver the subsidy to prenatal patients (17.8 percentage points less likely for the first visit).[24]

One potential explanation comes from awareness: the percent of community members who were aware of the nets program was 8.5 percentage points lower (off of a base of 72 percentage points) in the areas surrounding voucher clinics relative to direct clinics (col. 6). That voucher schemes might have lower awareness is intuitive: vouchers, which can fit in a pocket, have lower visibility than bulky bed nets.[25] Although we cannot say for sure, low awareness could explain the lower coverage rate observed among the eligible: unaware women are unlikely to request a voucher if the health worker does not offer them one.

At the same time, mystery clients were 3.1% more likely to obtain a program net in voucher clinics than in direct clinics, a large increase relative to the base level of 2% in direct clinics (although only significant at the 10% level). One potential explanation is that lower community awareness in voucher communities meant less community monitoring of health workers, which made them feel more comfortable accepting offers from ineligibles. Overall,

[24]Because vouchers add an extra step to the process (pregnant women have to go to the store to redeem the voucher), incomplete redemption could also increase the coverage gap between voucher and direct clinics. In our sample, however, redemption rates are very high (over 95%). Thus, the gap in overall net receipts (19.9 percentage points) is only a little larger than the gap in product receipt at the clinic.

[25]Of course, bed nets were also being distributed by the stores in the voucher scheme, but community awareness of what happens in a few stores may be lower than awareness of what happens in clinics.

however, when we look at the total local leakage rate estimated using administrative records, it was over 50% lower in voucher clnics than direct clinics, perhaps suggesting that the decrease in awareness/demand outweighed the increase in leakage conditional on solicitation (see appendix table A2).

A second potential explanation for the voucher scheme's lower performance is its impact on the intrinsic job motivation of health workers. Qualitative evidence provided by the SALI program staff suggests that the voucher scheme lowered health worker autonomy and morale, because health workers felt as though they were not trusted. In fact, 2 out of 24 voucher clinics refused to implement the program at all, while 0 of the 48 direct distribution clinics refused.[26]

Turning to the other randomized program features, the audit threat did not affect overall performance.[27] Also notable is the fact that the payment treatment had no effect on any outcomes measured. The reason does not seem to be low power, since we can often rule out even modest effects (particularly because the sign of the point estimates is often opposite of the hypotheses laid out in Section 2). For example, our 95% confidence intervals allow us to reject effects of payments on coverage of eligible as small as 6 percentage points.

Finally, we find inconclusive evidence on whether the small delivery treatment decreased leakage. The effect on leakage to mystery clients is large and negative (a 1.6 percentage point decrease off of a base rate of 2%),[28] but not statistically significant. In addition, there is a large and significant positive effect on the likelihood that community members refer mystery clients to the health facility for a bed net.[29]

[26]We thank Kathleen Beegle for pointing out that this morale dampening effect may have been particularly pronounced in our experiment for the following reason. Health workers knew that we delivered bed nets to local shops for safekeeping, instead of delivering them to the health center. Therefore health workers likely perceived the voucher program as an anti-corruption scheme. If we had instead asked health workers to distribute vouchers for bed nets readily available in the retail sector, the voucher scheme may not have been perceived this way. In practice, this was not an option we could pursue since 90% of health centers did not have a shop selling bed nets within 10 kilometers (see Table 1).

[27]When we estimate the effects of audits separately for clinics in the voucher scheme, we do find that the audit threat reduces the tendency of performance to worsen over time in these clinics, but the effect is small compared to the cost of audits.

[28]This could be the reason why we observed more *free* nets being given to ineligible mystery clients in Kenya and Uganda than in Ghana (what we call "benevolent leakage"). The Ghana program was implemented by a small NGO at a small scale with unknown quantities of nets to offer, whereas in Kenya and Uganda where regular deliveries from district headquarters mean that leakage may not increase the risk of exclusion errors (pregnant women missing out on nets).

[29]The impact of the small delivery treatment on the initial stock was substantial: the initial stock delivery was 270 nets on average among the direct distribution clinics that were not in the small delivery treatment, compare to only 140 or so for small delivery clinics. However, 140 nets is still enough for over 1 month of projected net distribution based on the baseline registration and visit data (see Web Appendix Table A1: the average clinic saw 116 patients, including both new registrants and follow-up visits, each month). Thus, it is possible that the small delivery treatment was not small enough to seriously increase the salience of the budget constraint. Since delivering enough nets for only one week worth of distribution at a time would have

# 7 Discussion

In this section, we explore possible explanations for the high performance levels of ANC workers in our study areas. We first document that the high performance we observe was not limited to bed net distribution. We then document that health workers appear positively selected in terms of pro-social motivation compared to other professionals, and that they also exhibit higher levels of job-specific intrinsic and extrinsic motivation. Across clinics, these characteristics have some, albeit modest, predictive power for performance.

## 7.1 Performance on other tasks

Table 7 presents data on health worker performance on other tasks. Data from the ANC patient interviews show that nurses spent an average of 18 minutes with each patient. Nurses conducted palpation (the key prenatal check that nurses are supposed to perform) for 96% of the clients, and this is comparable across countries (col 2). While it is difficult to benchmark these numbers, they are clearly much larger than the 4-8 minutes spent per patient among doctors in India, Paraguay and Tanzania, or the one question asked per patient in India reported in Das, Leonard and Hammer (2007). Average wait time for a checkup is about one hour on average. ANC staff members also seem to engage in good record-keeping, with 96% of the key identifier fields filled in the registers (col 8).[30]

In Kenya and Uganda, we also asked about additional services that should be performed at ANC clinics: during ANC visits, 84% of women received intermittent preventive treatment for malaria (IPT, col 4) and 73% received iron tablets (col 5). These figures are broadly similar to the coverage rates from bed net distribution. If women brought a child into the clinic for malaria treatment, 73% of the time they received the recommended Artemisinin-based Combination Therapy (ACT) drugs for free, as they should have (col 6). However, reported payment requests for ACTs are more common than what we observed for nets – in 19% of visits, women reported that they received the drugs but had to pay (col 7). Although it is possible that people confused payments for ACTs with other ancillary fees (e.g., lab tests) associated with malaria visits, another potential explanation is that health workers are more corrupt with drugs than they are with nets. This could be because willingness to pay for treatment is typically higher than for prevention (Dupas, 2011; Cohen, Dupas and Schaner 2015), and therefore extorting for drugs may be more effective than for bed nets. Interestingly, we observe a positive correlation between payment requests for ACTs and bribe

large financial implications in terms of delivery costs, estimating whether it could improve targeting would not be policy-relevant, however.

[30]The "key fields" are name, registration date, ANC card #, address, # children, and gestational age at registration. We digitized data from the ANC registers for sampled patients only.

requests from mystery clients (correlation of 0.34, significant at the 1% level) at the health facility level. It is reassuring that the high extortion rates for ACTs do not compromise high coverage (92%), perhaps because health workers can price discriminate.

Web appendix Figure A2 shows the results of unannounced attendance spot checks conducted at each clinic in the Kenya and Uganda samples. Of the health workers who were officially supposed to be on duty, 8% (=.05/(.05+.61)) were absent in Kenya and 20% (=.13/(.13+.53)) in Uganda.[31,32] Perhaps more important than the individual-level attendance results are the results on clinic closure, since clinics in this setting are large enough that health workers can load-share and so absenteeism may not compromise performance: clinics were closed for fewer than 1% of mystery client visits (Table 7, col 6). Also suggestive that attendance may not directly impact service quality is the fact that we do not find a correlation between attendance and any of our other performance measures (see Web Appendix Table A3).

## 7.2 Explaining high performance

As discussed in section 2, the likelihood that health workers engage in what we call "corrupt" behavior may decrease with their level of motivation, either intrinsic or extrinsic. To study this, Web Appendix tables A4 and A5 presents results from surveys administered to health workers and other professionals. In Panel A, we present country-level averages of various motivation measures among health workers. In Panel B, we run the following regressions:

$$y_{i,c} = \beta_1 + \beta_2 \times Teacher_i + \beta_3 \times Shopkeeper_i + \beta_4 \times MFI_i + X_i + v_c + \varepsilon_{ic}$$

where $y_{ic}$ is the outcome of worker $i$ in country $c$, and $Teacher_i$, $Shopkeeper_i$ and $MFI_i$ are dummy variables equal to 1 if the individual is a teacher, shopkeeper or microfinance agent, respectively; and $v_c$ is a vector of country fixed effects. We present the coefficient estimates for $\beta_2$, $\beta_3$ and $\beta_4$, each representing the difference between the respective profession

[31]Note that the "away on official duty" and "official day off" categories that we exclude may include absenteeism disguised as official days off. Chaudhury et al. (2006) excludes workers who are not on duty (which would correspond most closely to our "official day off" category) from their absence calculations, but count as absent those away on official duty (less than 4% of health workers on duty in their case, much lower than the 19% (16/82) we observe); if we tabulate the results that way, it would mean absence rates of 26% in Kenya (=.21/(1-.18)) and 36% in Uganda, relatively similar to the 35% rate found across countries and 38% rate found in Uganda by Chaudhury et al. (2006).

[32]These attendance rates differ from the survey compliance rates for the healthworker survey for several reasons: first, 33% of the healthworkers who were present during the surveyors' first visit were not interviewed because they were too busy or because surveyors ran out of time; second, some health workers were off duty or away on official leave; and third, surveyors returned to most clinics on multiple dates to increase completion rates. The first two would cause compliance rates to underestimate attendance rates; the third would cause them to overestimate.

and health workers. $X_i$ is a vector of demographic controls (age and gender).

**Pro-social Motivation.** The great majority of health workers say that they receive personal satisfaction from helping people and do not expect anything in return (Table A4, Panel A). Within country, health workers appear much more pro-socially motivated than the other professionals we surveyed (Table A4, Panel B).

Besides survey responses, which can be subject to social desirability bias, we have an incentivized measure of other-regarding preferences from a dictator game. We gave players an envelope with ten bills and told them that the money they left in the envelope would be delivered to a randomly-selected community member living in their community.[33] Interestingly, the share left in the envelope by health workers is identical across all three countries (26-27%). More detailed results in Web Appendix Figure 3 show that health workers in Kenya and Uganda tend to leave more than other professionals (with the one expection of MFI employees in Uganda, who are more generous than Uganda health workers): pooling the other professionals together, health workers in Kenya (Uganda) gave 60% (22%) more than workers in other professions, with both differences significant at the 5% level. In Ghana, however, health workers give less, although the results should be taken with caution given the timing of the data collection.[34]

**Intrinsic Job Motivation.** ANC nurses and midwives could also be more intrinsically motivated to perform well on their job than other professions if the perceived impacts of their effort are higher (e.g., because potential recipients could die if deprived of essential health products) or if they have more autonomy and satisfaction in their jobs. Columns 1-5 of Web Appendix Table A5 indicate that the majority of health workers see their jobs as benefiting society, believe their work is appreciated, and have high levels of job satisfaction. On all these measures the differences with other professions are significant.

The experimental result that providing financial compensation to health workers for implementing the Ghana program had no effect on performance is consistent with health workers being sufficiently motivated without it. The relatively poor performance we observed under the voucher scheme in Ghana, which undermined health workers autonomy, is also consistent with an important role for intrinsic motivation.

[33]The 10 bills were each 1 GHC in Ghana, 50 Ksh in Kenya and 1,000 UGX in Uganda. To avoid social pressure effects, the respondent was told that the surveyors would not open the envelope themselves.

[34]In Ghana, the dictator games were played in 2012 with health workers and ANC clients, and in 2014 with the other professionals. In both instances we asked them to split 10 bills of 1GHC each. Given an inflation rate of approximately 9% over this time period, the two rounds of dictator games are not directly comparable because the stakes differed (though the evidence on this is mixed, see Andersen et al. 2011 for some recent evidence that stakes may matter in the ultimatum game).

**Extrinsic Motivation.** Web Appendix Table A5, columns 6 to 8, show that health workers are also highly extrinsically motivated. They generally report high levels of job insecurity, with the majority of health workers "strongly disagreeing" with the statement that "health worker jobs are very secure" (column 6).[35] Health workers' perceived level of job security is significantly lower than that of teachers. This may be because performance is easily observable: the tasks health workers do are fairly standard, and in the specific context of the bed net distribution schemes we audited, leakage is easily observable since the eligibility criteria is a commonly observable one (pregnancy). Finally, we find that health workers feel very closely monitored by the Ministry of Health, though relatively less so in Uganda, where they also performed relatively worse overall (Table A5, column 7). Health workers also report higher levels of monitoring than other professions (Panel B). [36]

### 7.2.1 Correlations with clinic performance

Do these characteristics map into higher performance? Because we do not have health worker specific performance outcomes (since our performance measures are at the clinic level), we can only test for correlations at the clinic level. We do so in Table 8, in which we regress clinic performance on standardized indices of pro-social motivation, intrinsic motivation, and extrinsic motivation. We find that other-regarding preferences and extrinsic motivation are positively correlated with some measures of performance, but that intrinsic motivation is not. In particular, we find that other-regarding preferences is positively correlated with the coverage rate among the eligible and negatively correlated with leakage to the ineligible,[37] and that coverage among the eligible was higher in health facilities whose health workers had a higher extrinsic motivation score.

# 8 Conclusion

Increasing coverage of life-saving health products in rural sub-Saharan Africa requires distribution at heavily subsidized prices, and the most cost-effective way to do this is through

[35]This is consistent with surveys we conducted with head nurses in Kenya and Uganda, which revealed that around 10% of them knew at least one health worker who had lost her job due to poor performance. In Ghana, no head nurses reported knowing someone who had lost their job, but they argued it did not mean misconduct would go unpunished. In equilibrium, the threat of job loss may be enough to deter misconduct.

[36]The fact that health workers believe they are accountable could explain the experimental finding that the threat of top-down audits was ineffective at increasing performance in Ghana: health workers may have expected there to be an audit even before the threats were made.

[37]These results are consistent with Brock, Lange and Leonard (2013), who find a positive correlation between altruism as measured through the dictator game and effort provided by doctors in Tanzania, and with Callen et al. (2013), who find that doctors with higher public sector motivation are less likely to be absent and less likely to falsify reports.

existing health systems. But whether government health workers can do this effectively is an open question. Will they respect the eligibility rule? Will they demand bribes? Will they even bother to implement the program? How can we design distribution schemes to avoid these problems? We shed some light on these questions by auditing government distribution schemes in Kenya and Uganda, as well as implementing and auditing a program in Ghana, in which we randomly varied several features, including bonus pay, the threat of audits, and whether the distribution is direct or indirect (through vouchers). A key contribution is measuring performance, extortion and leakage in various unobtrusive ways (e.g., "mystery client" visits).

We find that distribution programs administered through existing health centers perform better than conventionally believed. Across the three countries, 80% of eligible women received the subsidy, only 1% of eligible women were asked to pay bribes, and at most 15% of subsidies leaked to ineligible people, most often for free, and more often when ineligibles mentioned having a needy child. While the relatively low level of leakage could come from a lack of demand from ineligibles, in Ghana we experimentally "tempted" health workers by sending ineligible men with a high willingness to pay for the subsidized product, and we still found almost no leakage. Since performance was already high, it is *ex post* unsurprising that our experimental results suggest a limited role for further improving performance through the threat of top-down audits or bonus pay. On the other hand, voucher schemes, which are popular as a way to reduce health workers' discretion and which have been implemented in a number of countries (most notably in Tanzania), appear to reduce program effectiveness.

While our data comes from only three countries, the programs we consider were implemented by different institutions (the government in Kenya and Uganda, vs. an NGO in Ghana) and audited at very different points in their implementation (after more than a year in Kenya and Uganda, vs. in the first few months in Ghana), suggesting that our results may be representative of similar programs in other contexts. An interesting question is whether the results carry through to distribution schemes for curative products. The answer seems to be: somewhat, but not fully. We observe higher rates of extortion for anti-malarial drugs than for bed nets. But there again, compared with anecdotal reports of large-scale diversion, the glass appears more full than empty, with a great majority of eligible patients receiving the drugs for free as intended.

The relatively high levels of performance we observe go against the growing conventional wisdom that service provision in developing countries is universally poor. In fact, permissions to conduct this study were difficult to obtain, because the main funding agency (NIH for the Ghana experiment) and the data collection agency (IPA) were very wary of its highly sensitive nature. Anyone we discussed our study design with *ex ante* expected us to observe

poor performance levels, in particular much higher non-benevolent leakage. Why are our results different from expectations?

One consideration is that we consider a targeting rule that is very easy to verify, and so makes it harder to hide leakage. So, it could be that leakage rates are higher for other, less-obvious targeting schemes. While we fully acknowledge that leakage rates could be different under a different targeting mechanism, many products/subsidies are in practice targeted at women or other easily identified subgroups such as young children. Thus, assessing leakage levels for "easy" targeting rules, as we have done, is important as a standalone research question even if the external validity to other targeting rules is unknown. A second consideration is that service quality varies from country to country and so far service provision has only been studied rigorously in a small subset of countries, mostly outside of sub-Saharan Africa, and with a strong focus on India (to cite a few, Banerjee et al., 2004; Das and Hammer 2007; Muralidharan et al. 2011; Joshi and Sivaram, 2014; Das et al. 2015; Hanna and Wang, 2014; Dhaliwal and Hanna, 2015).[38] The seminal Chaudhury et al. (2006) study includes 6 countries, only one of them in Africa (Uganda), while many others focus on South Asia. What's more, absenteeism is typically considered to be a good proxy for performance (the Chaudhury et al. 2006 study exclusively measured absenteeism), and while this may be an important metric in contexts where health centers are small enough that absenteeism of one worker means the health center is closed, absenteeism may not have direct consequences on service in more common contexts. In our data, health worker absenteeism does not correlate with coverage or leakage (Table A3). Another important difference is that health workers responsible for the subsidy programs we consider are nurses and midwives (who staff ANC clinics throughout Africa), not medical doctors, whose performance has been shown to be low in other contexts.

The nascent literature on selection into public service (Ferraz and Finan, 2011; Dal Bo, Finan and Rossi, 2013) suggests that increasing the pay of bureaucrats leads to better selection. In our study areas, health workers are paid on average slightly higher than teachers, while they have comparable years of education (columns 5-6 of Web Appendix Table A4), so this could explain positive selection into health work. Alternatively, the high observed levels of pro-social motivation among health workers could reflect treatment, not selection.

[38]While most of these papers focus on quality of care, Joshi and Sivaram (2014) study targeting of a conditional cash transfer scheme for poor women delivering at facilities in India and estimate substantial leakage to wealthier households.

# References


[1] Alatas, Vivi, Abhijit Banerjee, Rema Hanna, Benjamin A. Olken, Ririn Purnamasari and Matthew Wai-Poi (2013). Does Elite Capture Matter? Local Elites and Targeted Welfare Programs in Indonesia. NBER Working paper 18798.

[2] Andersen, Steffen, Seda Ertaç, Uri Gneezy, Moshe Hoffman, and John A. List (2011). Stakes Matter in Ultimatum Games. *American Economic Review* 101 (7): 3427-39.

[3] Ashraf, Nava, Oriana Bandiera and Scott Lee (2015). Do-gooders and Go-getters: Career Incentives, Selection, and Performance in Public Service Delivery. Working Paper.

[4] Azeem, Vitus A., Linda Ofori-Kwafo, Evelyn Nuvor and Mary Awelana Addah (2011). Realizing the MDGs by 215: Anti-corruption in Ghana, Transparency International and Ghana Integrity Initiative.

[5] Banerjee, Abhijit. V. (1997). A Theory of Misgovernance. *Quarterly Journal of Economics* 112(4), 1289-332.

[6] Banerjee, Abhijit, Esther Duflo, Rachel Glennerster, and Dhruva Kothari (2010). Improving Immunization Coverage in Rural India: A Clustered Randomized Controlled Evaluation of Immunization Campaigns with and without Incentives. *British Medical Journal* 340:c2220.

[7] Bardhan, Pranab and Dilip Mookherjee (2000). Capture and Governance at Local and National Levels. *American Economic Review* 90 (2): 135–139.

[8] Basurto, Pia, Pascaline Dupas and Jonathan Robinson (2015). Decentralization and Efficiency of Subsidy Targeting: Evidence from Chiefs in Rural Malawi. Working paper.

[9] Becker, Gary and George Stigler (1974). Law Enforcement, Malfeasance and the Compensation of Enforcers. *Journal of Legal Studies* 3(1), 1-19.

[10] Björkman, Martina and Jakob Svensson (2009). Power to the People: Evidence from a Randomized Field Experiment on Community-Based Monitoring in Uganda. *Quarterly Journal of Economics* 124(2): 735–769.

[11] Brock, Michelle J., Andreas Lange and Kenneth L. Leonard (2013). Generosity Norms and Intrinsic Motivation in Health Care Provision: Evidence from the Laboratory and Field. EBRD Working Paper #147.

[12] Bryce J., C. Boschi-Pinto, K. Shibuya, and R. E. Black, WHO CHERG (2005). WHO estimates of the causes of death in children. *Lancet* 365, 1147–1152.

[13] Callen, Michael, Saad Gulzar, Ali Hasinain, Yasir Khan, and Arman Rezaee (2013). Personalities and Public Sector Performance: Experimental Evidence from Pakistan. Working paper.

[14] Chaudhury, Nazmul and Jeffrey Hammer (2004). Ghost Doctors: Absenteeism in Rural Bangladeshi Health Facilities. *World Bank Economic Review* 18 (3): 423-441.

[15] Chaudhury, Nazmul, Jeffrey Hammer, Michael Kremer, Karthik Muralidharan, and F. Halsey Rogers (2006). Missing in Action: Teacher and Health Worker Absence in Developing Countries. *Journal of Economic Perspectives* 20(1): 91-116.

[16] Cohen, Jessica and Pascaline Dupas (2010). Free Distribution or Cost-Sharing? Evidence from a randomized malaria experiment. *Quarterly Journal of Economics* 125(1): 1-34.

[17] Das, Jishnu, and Jeffrey Hammer (2007). Money for Nothing: The Dire Straits of Medical Practice in India. *Journal of Development Economics* 83(1): 1-36.

[18] Das, Jishnu, and Jeffrey Hammer (2014). Quality of Primary Care in Low-Income Countries: Facts and Economics. *Annual Review of Economics* 6: 525-553.

[19] Das, Jishnu, Jeffrey Hammer and Kenneth Leonard (2008). The Quality of Medical Advice in Low-Income Countries. *Journal of Economic Perspectives* 22(2): 93-114.

[20] Das, Jishnu, Alaka Holla, Michael Kremer and Karthik Muralidharan (2015). Quality and Accountability in Health: Audit Evidence from Primary Care Clinics in India. Working paper.

[21] De Allegri, M., P. Marschall, S. Flessa, J. Tiendrebéogo, B. Kouyaté, A. Jahn, and O. Müller (2010). Comparative cost analysis of insecticide-treated net delivery strategies: sales supported by social marketing and free distribution through antenatal care. *Health policy and planning* 25(1): 28-38.

[22] Dal Bo, Ernesto, Frederico Finan and Martin A. Rossi (2013). Strengthening State Capabilities: The Role of Financial Incentives in the Call to Public Service. *Quarterly Journal of Economics* 128(3): 1169-1218.

[23] Dhaliwal, Iqbal, and Rema Hanna (2015). "Deal with the Devil: The Successes and Limitations of Bureaucratic Reform in India". Working paper.

[24] Di Tella, Rafael and Ernesto Schargrodsky (2003). The Role of Wages and Auditing during a Crackdown on Corruption in the City of Buenos Aires. *Journal of Law and Economics* 46: 269-92.

[25] Dupas, Pascaline (2014). Short-Run Subsidies and Long-Run Adoption of New Health Products: Evidence from a Field Experiment. *Econometrica* 82(1): 197-28.

[26] Ferraz, Claudio, and Frederico Finan (2011). Motivating Politicians: The Impacts of Monetary Incentives on Quality and Performance. Working paper.

[27] Foltz, Jeremy B. and Kweku A. Opoku-Agyemang (2014). Do higher salaries lower petty corruption? A policy experiment on West Africa's highways". Working paper.

[28] Gertler, Paul, and Christel Vermeersch (2012). Using Performance Incentives to Improve Health Outcomes. World Bank Working Paper.

[29] Guyatt, H.L., M. H. Gotink, S. A. Ochola, R. W. Snow (2002). Free bed nets to pregnant women through antenatal clinics in Kenya: a cheap, simple and equitable approach to delivery. *Tropical Medicine and International Health* 7: 409–420.

[30] Hanna, Rema and Shing-Yi Wang (2013). Dishonesty and Selection into Public Service. NBER Working Paper No. 19649.

[31] Joshi, S., & Sivaram, A. (2014). Does it pay to deliver? an evaluation of india's safe motherhood program. *World Development*, 64, 434-447.

[32] Keefer, Philip and Stuti Khemani (2013). Do Informed Citizens Receive More, or Pay More? The Impact of Radio on the Government Distribution of Public Health Benefits. Working paper.

[33] Muralidharan, Karthik, Nazmul Chaudhury, Jeffrey Hammer Michael Kremer, and F. Halsey Rogers (2011). Is there a Doctor in the House? Absent Medical Providers in India. Working paper.

[34] Niehaus, Paul, Antonia Attanassova, Mariane Bertrand and Sendhil Mullainathan (2013). Targeting with Agents. *American Economic Journal: Economic Policy* 5 (1): 206-238.

[35] Niehaus, Paul and Sandip Sukhtankar (2013). Corruption Dynamics: the Golden Goose Effect. *American Economic Journal: Economic Policy* 5 (4): 230-69.

[36] Olken, Benjamin (2005). Corruption and the Costs of Redistribution: Micro Evidence from Indonesia. *Journal of Public Economics* 90 (4-5): 853-870.

[37] Olken, Benjamin (2007). Monitoring Corruption: Evidence from a Field Experiment in Indonesia. *Journal of Political Economy* 115(2): 200-249.

[38] Olken, Benjamin, and Rohini Pande (2012). Corruption in Developing Countries. *Annual Review of Economics* 4: 479-505.

[39] Olken, Benjamin, and Rohini Pande (2013). Governance Review Paper, J-PAL Governance Initiative.

[40] Rasul, Imran and Daniel Rogger (2015). Management of Bureaucrats and Public Service Delivery: Evidence from the Nigerian Civil Service. Working paper.

[41] Rauch, James E and Peter B. Evans (2000). Bureaucratic Structure and Bureaucratic Performance in Less Developed Countries. *Journal of Public Economics* 75(1): 49-71.

[42] Reinikka, Ritva, and Jakob Svensson (2004). Local Capture: Evidence from a Central Government Transfer Program in Uganda. *Quarterly Journal of Economics* 119(1): 679–705.

[43] Reinikka, Ritva, and Jakob Svensson (2011). The power of information in public services: Evidence from education in Uganda. *Journal of Public Economics* 95(7–8): 956–966.

[44] Sexton, Alexis R. (2011). Best practices for an insecticide-treated bed net distribution programme in sub-Saharan eastern Africa. *Malaria journal* 10(1): 157.

[45] Tarozzi, Alessandro, Aprajit Mahajan, Brian Blackburn, Dan Kopf, Lakshmi Krishnan, and Joanne Yoong (2014). Micro-Loans, Insecticide-Treated Bednets, and Malaria: Evidence from a Randomized Controlled Trial in Orissa, India. *American Economic Review* 104(7): 1909-41.

[46] Van Rijckeghem, Caroline and Beatrice Weder (2001). Bureaucratic corruption and the rate of temptation: do wages in the civil service affect corruption, and by how much? *Journal of Development Economics* 65(2): 207-331.

[47] World Bank (1993). *World Development Report 1993: Investing in Health*. New York: Oxford University Press.

[48] World Bank (2004). *World Development Report 2004: Making Services Work for Poor People*. Washington DC: The World Bank and Oxford University Press.

Table 1. Characteristics of health facilities in the sample and DHS data on bed net coverage

| | *Sample Mean [Std. Dev.] for:* | | | |
|---|---|---|---|---|
| Panel A. Facility characteristics | Full Sample | Ghana | Kenya | Uganda |
| Survey year | | 2011 | 2013 | 2013 |
| Years since facility is operating | 16.01 | 17.25 | 13.96 | 16.30 |
| | [15.86] | [13.74] | [16.86] | [17.67] |
| Public facility | 0.85 | 0.90 | 1.00 | 0.60 |
| | [0.36] | [0.30] | [0.00] | [0.49] |
| # of monthly ANC new registrants[a] | 27.99 | 25.73 | 29.64 | 29.75 |
| | [20.06] | [20.31] | [19.31] | [20.50] |
| # of monthly ANC follow-up visits | 63.06 | 90.22 | 49.40 | 35.98 |
| | [61.25] | [77.59] | [36.44] | [29.23] |
| # of midwives and nurses for ANC | 2.93 | 2.01 | 4.15 | 3.08 |
| | [2.28] | [1.20] | [3.31] | [1.58] |
| Facility conducts outreach ANC activities | 0.49 | 0.23 | 0.92 | 0.46 |
| | [0.50] | [0.42] | [0.28] | [0.50] |
| Nets available for sale within 10km | 0.13 | 0.10 | 0.10 | 0.21 |
| | [0.34] | [0.30] | [0.31] | [0.41] |
| Has a maternity ward | 0.82 | 0.85 | 0.96 | 0.63 |
| | [0.39] | [0.36] | [0.20] | [0.49] |
| Accessible during the rainy season | 0.89 | 0.81 | 0.94 | 0.96 |
| | [0.32] | [0.40] | [0.24] | [0.20] |
| Health worker privately sells nets at facility | 0.02 | 0.04 | 0.00 | 0.00 |
| | [0.13] | [0.20] | [0.00] | [0.00] |
| Number of Health Facilities | 168 | 72 | 48 | 48 |
| | | | | |
| Panel B. Bed net coverage[b] | | | | |
| DHS Survey year | | 2011 | 2010/2014 | 2011 |
| Average household size | | 4.3 | 4.4/n.a. | 4.9 |
| Share of households with at least one insecticide-treated net (ITN) | | 0.53 | 0.48/0.83 | 0.60 |
| Average number ITNs per household | | 0.80 | 0.80/1.80 | 1.30 |
| Percentage of households with at least one ITN for every two persons who stayed in the household last night[c] | | 0.22 | n.a./0.417 | 0.33 |

Notes: For Ghana sample, includes all health facilities/communities, whether sampled for direct or indirect (voucher) distribution.

[a] ANC stands for antenatal care

[b] Source: Demographic and Health Surveys. For each country, we show the average for the region included in our study.

[c] This is the DHS definition for universal coverage

Table 2. Coverage and extortion among eligibles

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Data Source: | Backcheck surveys with random subset of ANC Clients | | | | | | |
| | | | | | *If not offered net:* | | |
| | Received net at first ANC visit | *If no stockouts*[a]*:* Received net at first ANC visit | Received net at some ANC visit | *If offered net at some visit:* Was requested to pay | Thinks reason is stockout | Does not know why | Thinks reason is already has one |
| Overall Mean | 0.76 | 0.81 | 0.80 | 0.01 | 0.25 | 0.50 | 0.07 |
| Ghana | 0.74 | 0.77 | 0.79 | 0.01 | 0.11 | 0.63 | 0.04 |
| Kenya | 0.90 | 0.90 | 0.91 | 0.01 | 0.66 | 0.17 | 0.06 |
| Uganda | 0.63 | 0.69 | 0.66 | 0.03 | 0.25 | 0.49 | 0.09 |
| Observations | 2,028 | 1,495 | 2,028 | 1,605 | 473 | 473 | 473 |
| P-value for equality of means: | | | | | | | |
| Ghana = Kenya | 0.00*** | 0.00*** | 0.00*** | 0.72 | 0.00*** | 0.00*** | 0.69 |
| Ghana = Uganda | 0.03** | 0.16 | 0.01*** | 0.04** | 0.01*** | 0.03** | 0.08* |
| Kenya = Uganda | 0.00*** | 0.00*** | 0.00*** | 0.02** | 0.00*** | 0.00*** | 0.54 |

Notes: There are 144 health facilities in the sample (48 per country). Ghana sample: Only includes facilities sampled for direct distribution.

[a] Clinics with no stockouts during the sampled time period identified using data from attendance checks in Uganda and Kenya, and from mystery client visits from Ghana.

Table 3. Non-coverage among eligibles: Errors of Exclusion or Efficient Targeting?

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Data Source: | Backcheck surveys with random subset of ANC Clients | | | | |
| | All | Ghana | Kenya | Uganda | All countries - ANC visits in month preceding stockout only |
| Panel A. Dependent Variable: Received net - visit 1 | | | | | |
| Years of education | -0.0068** | -0.0083* | -0.0026 | -0.0065 | -0.0155 |
| | [0.0030] | [0.0044] | [0.0034] | [0.0065] | [0.0178] |
| Health facility Fixed effects | X | X | X | X | X |
| Observations | 2,028 | 771 | 671 | 586 | 131 |
| R-Squared | 0.357 | 0.274 | 0.369 | 0.349 | 0.686 |
| Dep. Var. Mean | 0.762 | 0.744 | 0.903 | 0.625 | 0.542 |
| Panel B. Dependent Variable: Received net - any visit | | | | | |
| Years of education | -0.0046* | -0.0039 | -0.0022 | -0.0066 | -0.0099 |
| | [0.0028] | [0.0040] | [0.0037] | [0.0063] | [0.0151] |
| Health facility Fixed effects | X | X | X | X | X |
| Observations | 2,028 | 771 | 671 | 586 | 131 |
| R-Squared | 0.361 | 0.285 | 0.390 | 0.364 | 0.711 |
| Dep. Var. Mean | 0.796 | 0.794 | 0.914 | 0.664 | 0.588 |

Notes: Standard errors in brackets, clustered at the level of the health facility. Ghana sample: Only includes facilities sampled for direct distribution. Regressions have month fixed effects to control for potential stockouts, and include controls for registrant age and parity. The mean number of years of education among clients surveyed is 5 (4.2 in Ghana, 4.6 in Kenya and 6.9 in Uganda, which adopted free primary education much earlier). Across all countries (column 1), the gap between the 25th and the 75th percentile in terms of years of education is 4.5 years.

Table 4. Leakage to ineligibles: Evidence from mystery client visits and community interviews

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| Data Source: | "Mystery client" (MC) visits | | | | | | | Community Interviews | | |
| | | | If clinic had nets in stock[b] | | | If Payment requested: | | | | |
| | Clinic out of stock during visit (as measured through other data sources)[a] | MC told that the clinic is out of stock | Acquired program net | Acquired program net for free | Payment requested for net | Initial amount requested as percent of full price[c] | Final amount requested as percent of full price[c] | Respondent thinks that (male) surveyor could get a net at a health center | Ineligible young man received net (lower bound)[d] | Ineligible young man received net (upper bound)[e] |
| Overall Mean | 0.205 | 0.134 | 0.0467 | 0.0378 | 0.0424 | 0.902 | 0.745 | 0.0993 | 0.00699 | 0.0381 |
| Ghana | | 0.046 | 0.022 | 0.009 | 0.051 | 1.070 | 0.882 | 0.092 | | |
| Kenya | 0.042 | 0.090 | 0.087 | 0.087 | 0.036 | 0.121 | 0.097 | 0.093 | 0.025 | 0.069 |
| Uganda | 0.368 | 0.472 | 0.110 | 0.110 | 0.011 | 0.323 | 0.323 | 0.113 | 0.000 | 0.007 |
| Observations | 288 | 766 | 685 | 687 | 684 | 27 | 27 | 2,559 | 143 | 289 |
| P-value for equality of means: | | | | | | | | | | |
| Ghana = Kenya | | 0.19 | 0.03** | 0.01*** | 0.51 | 0.00*** | 0.00*** | 0.98 | | |
| Ghana = Uganda | | 0.00*** | 0.01*** | 0.00*** | 0.01** | 0.00*** | 0.00*** | 0.31 | | |
| Kenya = Uganda | 0.15 | 0.00*** | 0.59 | 0.59 | 0.24 | 0.00*** | | 0.35 | 0.31 | 0.00*** |

Notes: Missing coefficients mean that outcome not collected in that country. There are 144 health facilities in the sample (48 per country). Ghana sample: Only includes facilities sampled for direct distribution.

[a] Stockout data collected during attendance spot checks done by the research team in Kenya and Uganda.

[b] Conditional on there not being a stockout (calculated from attendance spot check data for Kenya and Uganda, and from MC reports in Ghana). Upper bound in Ghana since health workers could have told mystery clients they were stocked out to get rid of them.

[c] Full price calculated as the wholesale price converted to local currency using exchange rate during the middle of the ANC registration times.

[d] Lower bound because set to missing when he received net but someone in the household was pregnant or under 5

[e] Upper bound because includes people who got a net but were in a household that may have been eligible (was reported to have a pregnant woman or child under 5). Only upper bound if assume percent of eligibles that get nets weakly higher than percent of ineligibles.

Table 5. Leakage: Errors of Inclusion or Efficient targeting?

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Data Source: | Mystery Client visits | | | |
| Dependent Variable: | Received free net | | | |
| | All | Ghana | Kenya | Uganda |
| Requested for pregnant woman | 0.012 | 0.011 | 0.023 | |
| | [0.023] | [0.014] | [0.14] | |
| Requested for child | 0.18*** | | | 0.19** |
| | [0.045] | | | [0.089] |
| If asked, said that had child | 0.11** | | 0.11 | |
| | [0.047] | | [0.075] | |
| MC signaled that educated | 0.0077 | 0.0077 | | |
| | [0.016] | [0.0090] | | |
| Healthworker female | -0.012 | -0.012 | | |
| | [0.022] | [0.013] | | |
| Health facility Fixed effects | X | X | X | X |
| Observations | 683 | 455 | 137 | 91 |
| R-Squared | 0.402 | 0.114 | 0.466 | 0.375 |
| Mean of the Dependent Variable | 0.0378 | 0.009 | 0.087 | 0.110 |

Notes: The first three regressors are mutually exclusive indicator variables reflecting the strategy used by the mystery client when seeking a bed net from the healthworker. The choice of strategy was left to the mystery clients, and, possibly owing to differences in training, there were systematic cross-country differences in the strategies they used, hence the regressors vary across countries in columns 2-4. Standard errors in brackets, clustered at the level of the health facility. There are 144 facilities in the sample (Ghana sample excludes voucher clinics).

Table 6. Ghana: experimental results

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| Data Source: | Backcheck surveys with random subset of ANC Clients | | | Surveys with Program Log beneficiaries | Community Interviews | | "Mystery Client" visits | | | |
| Dependent Variable: | Received net/voucher at first ANC visit | Received net/voucher at some ANC visit | *If offered net at some visit:* Was requested to pay | Listed beneficiary ineligible | Respondent thinks that (male) surveyor could get a net at a health center | Respondent aware of net distribution program | Payment requested for net | Acquired program net | Acquired program net for free | Clinic stocked out |
| Effect of: | | | | | | | | | | |
| Voucher | -0.178** | -0.195*** | -0.002 | 0.013 | -0.067*** | -0.085** | 0.035 | 0.031* | 0.007 | 0.073** |
| | [0.072] | [0.069] | [0.009] | [0.012] | [0.025] | [0.034] | [0.026] | [0.018] | [0.008] | [0.030] |
| Audit | 0.033 | 0.069 | 0.017 | -0.032** | -0.060 | 0.008 | 0.003 | 0.010 | -0.012 | 0.010 |
| | [0.056] | [0.054] | [0.013] | [0.014] | [0.042] | [0.066] | [0.031] | [0.025] | [0.013] | [0.040] |
| Small delivery | 0.007 | 0.006 | -0.009 | 0.001 | 0.061*** | 0.038 | -0.015 | -0.015 | -0.011 | 0.020 |
| | [0.059] | [0.055] | [0.007] | [0.012] | [0.021] | [0.035] | [0.022] | [0.012] | [0.007] | [0.021] |
| Health worker payment | -0.061 | -0.056 | -0.003 | 0.010 | -0.009 | -0.002 | 0.010 | 0.002 | 0.002 | 0.005 |
| | [0.061] | [0.058] | [0.007] | [0.012] | [0.021] | [0.035] | [0.021] | [0.012] | [0.007] | [0.020] |
| Later program period | -0.079* | -0.120*** | -0.021** | 0.003 | 0.058* | -0.024 | -0.046* | -0.036* | 0.001 | -0.001 |
| | [0.041] | [0.041] | [0.010] | [0.008] | [0.029] | [0.052] | [0.025] | [0.019] | [0.011] | [0.031] |
| Observations | 1,158 | 1,158 | 815 | 1,229 | 1,322 | 1,322 | 717 | 717 | 720 | 718 |
| R-Squared | 0.094 | 0.108 | 0.023 | 0.027 | 0.030 | 0.025 | 0.028 | 0.029 | 0.029 | 0.060 |
| Dep. Var. Mean in direct distribution facilities | 0.744 | 0.794 | 0.00873 | 0.0144 | 0.0916 | 0.716 | 0.0503 | 0.0209 | 0.00833 | 0.0460 |

Notes: There are 72 health facilities in the sample, all in Ghana. Each column corresponds to an OLS regression with randomization strata fixed effects and two health-center level controls: baseline ANC attendance and ANC staff size. Standard errors clustered at the health facility level. ***,**,* indicates significance at 1, 5 and 10 percent. "Effect of Audit" is the difference in differences coefficient, so the coefficient on AuditXLater program period, where "later program period" is the period after the initial audit threat in audit clinics, or after the audit threats were conducted at nearby clinics for non-audit clinics; all regressions also control for the main effect of audits.

Table 7. Performance beyond net distribution

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Data Source: | Backcheck surveys with random subset of ANC Clients | | | | | | | ANC Register Audit | Mystery Client visits |
| Dependent Variable: | Avg. minutes spent with nurse during ANC checkup | Palpated by nurse during ANC visit | Average wait time for checkup | Received IPT during ANC visit | Received iron tablets during ANC visit | Got free ACT drugs last time brought child for malaria treatment | Was charged fee for ACT last time brought child for malaria treatment | % of key fields filled in[a] | Clinic closed during first visit attempt |
| Overall Mean | 17.91 | 0.960 | 63.70 | 0.835 | 0.730 | 0.729 | 0.191 | 0.964 | 0.00595 |
| Ghana | 12.294 | 0.937 | 57.900 | N/A | N/A | N/A | N/A | 0.963 | 0.006 |
| Kenya | 25.249 | 0.985 | 72.374 | 0.932 | 0.660 | 0.777 | 0.158 | 0.965 | 0.000 |
| Uganda | 20.956 | 0.977 | 65.741 | 0.732 | 0.803 | 0.621 | 0.265 | 0.964 | 0.014 |
| Observations | 2,283 | 2,310 | 2,246 | 1,180 | 1,183 | 424 | 424 | 2,617 | 1,008 |
| P-value for equality of means: | | | | | | | | | |
| Ghana = Kenya | 0.00*** | 0.00*** | 0.03** | N/A | N/A | N/A | N/A | 0.84 | 0.04** |
| Ghana = Uganda | 0.00*** | 0.00*** | 0.32 | N/A | N/A | N/A | N/A | 0.94 | 0.41 |
| Kenya = Uganda | 0.01*** | 0.31 | 0.41 | 0.00*** | 0.00*** | 0.01*** | 0.05* | 0.87 | 0.15 |

Notes: Standard errors for regressions clustered at clinic level. There are respondents from 168 health facilities in the sample (Ghana sample includes all facilities, including those sampled for indirect distribution via vouchers). Results are identical when the voucher facilities are excluded. Columns 4-7: these questions were only asked in Kenya and Uganda.

[a] Key fields are name, reg date, ANC card #, address, # children, and gestational age at registration.

Table 8. Correlations between performance, health worker and clinic characteristics

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Data Source: | Backcheck surveys with random subset of ANC Clients | | | Community Interviews | "Mystery Client" visits | | | | Attendance checks |
| Dependent Variable: | Got net/voucher at first visit to clinic | Got net/voucher at any visit to clinic | Payment requested for net (conditional on offer) | Respondent thinks that (male) surveyor could get a net at a health center | Payment requested for net | Acquired program net | High potential opportunity to acquire net | Clinic stocked out | Health worker was absent during spot check |
| *Healthworker characteristics* | | | | | | | | | |
| Pro-social motivation (standardized index)[a] | 0.037* | 0.038* | 0.0004 | 0.006 | -0.0034 | -0.030*** | -0.045** | -0.029 | 0.0029 |
| | [0.022] | [0.020] | [0.004] | [0.008] | [0.0093] | [0.011] | [0.021] | [0.024] | [0.039] |
| Intrinsic job motivation (standardized index)[a] | 0.022 | 0.015 | 0.001 | 0.01** | 0.0079 | 0.011 | 0.023 | -0.013 | -0.026 |
| | [0.017] | [0.016] | [0.003] | [0.006] | [0.0086] | [0.0078] | [0.021] | [0.018] | [0.022] |
| Extrinsic job motivation (standardized index)[a] | 0.038* | 0.03 | -0.003 | -0.0006 | -0.01 | 0.014 | 0.014 | 0.016 | -0.029 |
| | [0.023] | [0.021] | [0.004] | [0.009] | [0.0090] | [0.012] | [0.022] | [0.026] | [0.019] |
| Similarity to local population (standardized index)[b] | -0.0021 | 0.0029 | -0.0004 | -0.008 | 0.00012 | 0.012 | 0.03 | 0.059*** | 0.014 |
| | [0.019] | [0.017] | [0.003] | [0.009] | [0.011] | [0.013] | [0.020] | [0.021] | [0.017] |
| *Clinic characteristics* | | | | | | | | | |
| Above-median ANC registrants | -0.046 | -0.038 | 0.008 | 0.03* | -0.0071 | -0.038** | -0.0019 | 0.069* | -0.02 |
| | [0.040] | [0.037] | [0.008] | [0.02] | [0.015] | [0.018] | [0.031] | [0.036] | [0.045] |
| Clinic accessible in the rainy season | 0.026 | 0.019 | 0.0005 | 0.01 | 0.013 | 0.014 | 0.074** | 0.018 | -0.016 |
| | [0.077] | [0.074] | [0.007] | [0.03] | [0.022] | [0.021] | [0.037] | [0.049] | [0.074] |
| Total number of staff working in ANC | 0.0089* | 0.011** | 0.0001 | -0.003 | -0.0054** | -0.00087 | -0.0057 | -0.0063 | -0.0022 |
| | [0.0052] | [0.0045] | [0.0006] | [0.003] | [0.0023] | [0.0017] | [0.0042] | [0.0055] | [0.0062] |
| Private facility | -0.43*** | -0.49*** | 0.002 | 0.05 | -0.043 | -0.063** | -0.11* | 0.078 | |
| | [0.12] | [0.12] | [0.008] | [0.05] | [0.041] | [0.024] | [0.057] | [0.057] | |
| NGO facility | -0.15** | -0.14** | 0.07** | 0.06* | -0.024 | -0.026 | 0.029 | 0.16 | -0.061 |
| | [0.071] | [0.068] | [0.03] | [0.03] | [0.021] | [0.042] | [0.074] | [0.11] | [0.053] |
| Observations | 2028 | 2028 | 1549 | 2559 | 765 | 766 | 762 | 766 | 96 |
| R-squared | 0.065 | 0.073 | 0.035 | 0.014 | 0.02 | 0.043 | 0.082 | 0.133 | 0.242 |
| Mean of the dependent variable | 0.76 | 0.8 | 0.01 | 0.1 | 0.041 | 0.043 | 0.14 | 0.13 | 0.083 |

Notes: Each column is a separate regression, with controls for country fixed effects, the experimental treatments in Ghana, and healthworker age and gender. Columns 1 and 2 also control for whether there were any stockouts in those clinics, as measured by the attendance checking team in Uganda and Kenya (there is no control in Ghana where stockouts were determined by healthworker effort). Column 9 excludes Ghana where no attendance checks were performed. Standard errors clustered at the level of the health in brackets. ***,**,* indicates significance at 1, 5 and 10 percent. Ghana sample: Direct distribution clinics only.

[a] Indexes are averages across standardized variables as grouped in Tables 8 and 9, which are then re-standardized to have a mean of 0 and std dev of 1. The pro-social motivation index also contains the share left in the dictator game (shown in Fig 3).

[b] The similarity index is the average across standardized versions of three variables: (1) percentage of ANC registrants who have the same ethnicity as the health worker; (2) indicator for being born in same region as clinic; (3) indicator for being born in same district as clinic.

Figure 1. Clinic-level Estimate of the Number of Program Bed Nets Unaccounated for (Ghana only)

Figure 1A. Number of nets unaccounted for

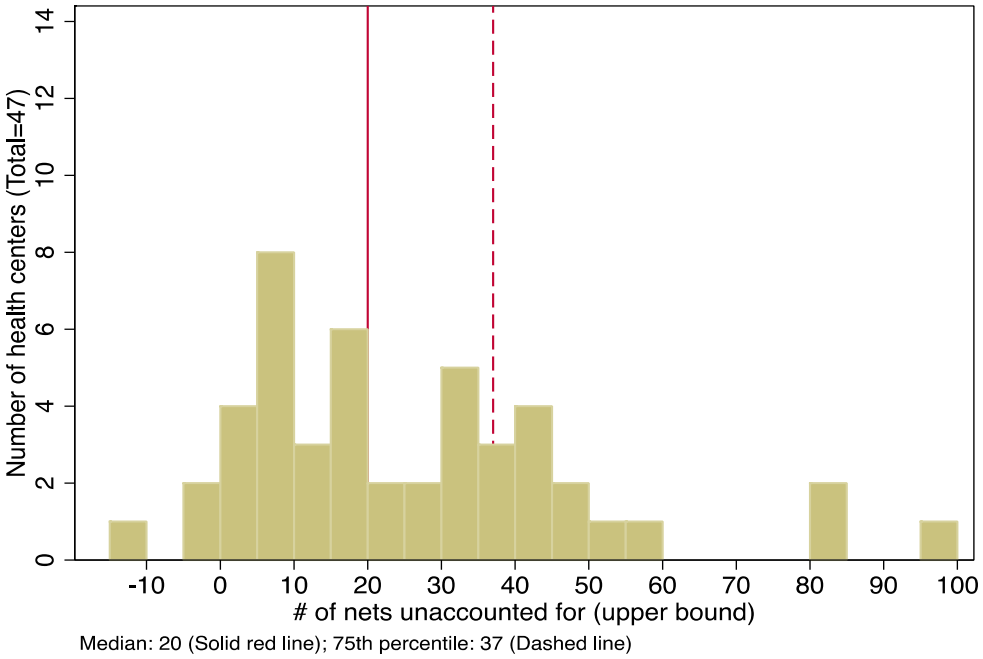
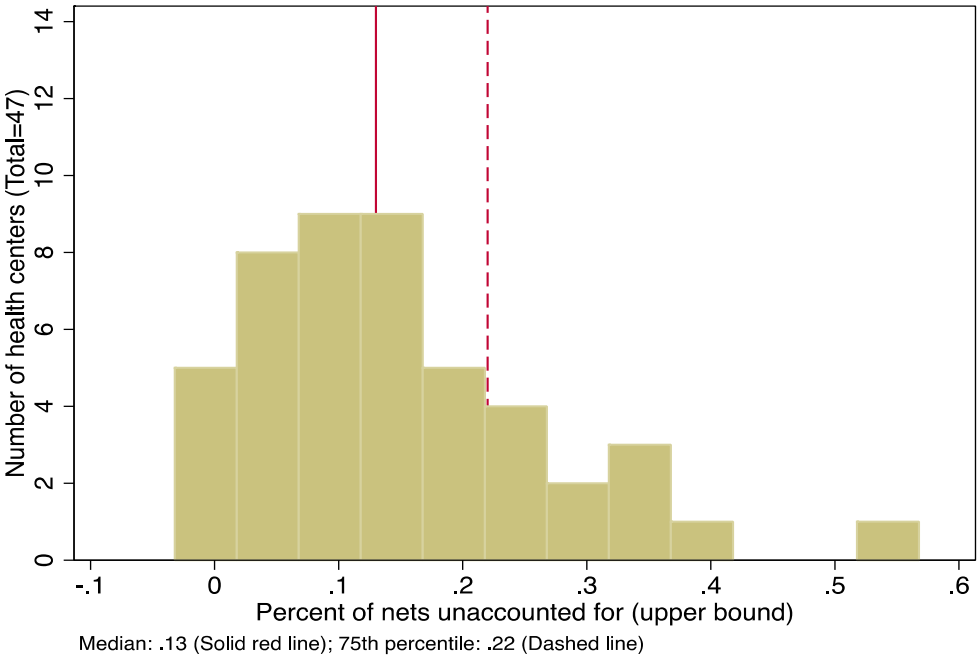



Figure 1B. Percent of nets unaccounted for




Note: Based on 47 health facilities with direct distribution (all in Ghana). For each facility, the estimated number of program nets unaccounted for is the difference between the total number of nets delivered to the facility and the estimated number of "valid" (eligible) beneficiaries listed in the program ledgers. The prevalance of invalid ledger entries was established through audits of randomly selected listed beneficiaries. These audit surveys were misplaced by the survey team for one facility that is why we have only 47 and not 48 observations.

Table A1. Ghana experimental sample: Summary statistics on participating health centers and balance check

| | | *Coeff. Estimate (s.e) on Treatment Dummy:* | | | |
|---|---|---|---|---|---|
| | Sample Mean (Std. Dev.) | Voucher | Audit Threat | Small Delivery | Health worker Payment |
| Panel A: Baseline Characteristics of Health Centers | | | | | |
| # of monthly ANC new registrants[a] | 25.73 | -0.45 | 2.56 | -1.49 | -1.79 |
| | (20.24) | (6.33) | (4.79) | (6.26) | (6.26) |
| # of monthly ANC follow-up visits | 90.22 | 11.67 | 11.01 | 1.56 | 10.40 |
| | (77.32) | (24.51) | (19.41) | (22.05) | (22.05) |
| # of midwives and nurses for ANC | 2.01 | -0.06 | -0.42 | -0.29 | -0.37 |
| | (1.20) | (0.43) | (0.29) | (0.35) | (0.35) |
| Facility conducts outreach ANC activities | 0.23 | -0.05 | 0.00 | -0.05 | -0.12 |
| | (0.42) | (0.14) | (0.11) | (0.13) | (0.13) |
| Years since facility is operating | 17.25 | -3.81 | -0.43 | -1.12 | -2.69 |
| | (13.69) | (4.49) | (3.43) | (4.32) | (4.35) |
| Facility is a CHPS compound[b] | 0.25 | 0.02 | 0.06 | -0.12 | 0.04 |
| | (0.43) | (0.12) | (0.11) | (0.13) | (0.13) |
| Public facility | 0.06 | -0.02 | 0.00 | 0.13 | 0.13 |
| | (0.23) | (0.06) | (0.05) | (0.070)* | (0.070)* |
| Has a maternity ward | 0.85 | -0.02 | -0.08 | -0.04 | -0.04 |
| | (0.36) | (0.12) | (0.09) | (0.10) | (0.10) |
| # of other ANC facilities within 10 km radius | 2.08 | -0.27 | -0.50 | 0.96 | -0.21 |
| | (2.91) | (1.10) | (0.70) | (0.90) | (0.90) |
| Has distributed nets in the past | 0.07 | -0.08 | 0.03 | 0.00 | -0.08 |
| | (0.26) | (0.08) | (0.06) | (0.08) | (0.08) |
| Accessible during the rainy season | 0.81 | -0.08 | 0.11 | 0.00 | 0.00 |
| | (0.40) | (0.13) | (0.09) | (0.11) | (0.11) |
| Distance (in km) from region capital | 86.29 | -1.54 | 8.49 | -10.62 | -6.80 |
| | (49.43) | (16.72) | (12.77) | (14.34) | (14.34) |
| Nets available for sale within 10km | 0.10 | -0.02 | -0.03 | 0.04 | 0.04 |
| | (0.30) | (0.11) | (0.07) | (0.09) | (0.09) |
| Health worker privately sells nets at facility | 0.04 | 0.06 | 0.03 | 0.04 | 0.04 |
| | (0.20) | (0.06) | (0.05) | (0.04) | (0.04) |
| ANC client Dictator Game: Amount given (out of 10 GHC) | 1.91 | -0.24 | 0.05 | 0.34 | -0.16 |
| | (1.48) | (0.49) | (0.37) | (0.42) | (0.42) |
| Panel B: Program Implementation Details | | | | | |
| Phase-in Rank (1 to 6) | 3.50 | 0.40 | -0.06 | -0.62 | 0.54 |
| | (1.71) | (0.54) | (0.41) | (0.51) | (0.51) |
| Initial stock of nets delivered | 184.03 | 2.08 | 12.50 | -129.17 | 8.33 |
| | (146.24) | (34.13) | (32.48) | (43.800)*** | (43.80) |
| Total # of staff who attended training | 4.59 | -0.58 | -0.73 | 0.21 | 0.20 |
| | (2.16) | (0.81) | (0.52) | (0.63) | (0.63) |
| Share of ANC staff trained on SALI program | 0.81 | -0.16 | -0.05 | 0.17 | -0.02 |
| | (0.28) | (0.080)** | (0.07) | (0.080)** | (0.08) |
| In-Charge present for training | 0.68 | -0.10 | 0.08 | 0.13 | -0.29 |
| | (0.47) | (0.13) | (0.11) | (0.14) | (0.140)** |
| Duration of program (days) | 109.06 | -8.73 | -0.89 | 2.96 | 3.04 |
| | (22.39) | (7.80) | (5.74) | (4.23) | (4.23) |
| Number of Health Facilities with Treatment | Total N=72 | 24 | 24 | 24 | 24 |

Notes: Each row corresponds to one OLS regression. Standard errors in brackets. ***,**,* indicate significance at 1, 5 and 10% levels.
[a] ANC stands for Antenatal Care. [b] CHPS stands for Community and Health Planning Services, these are community-based services in remote areas.

Table A2. Ghana: experimental results for total local leakage

| | (1) |
|---|---|
| | Dependent Variable: Total local leakage rate (administrative data estimate) |
| Effect of: | |
| Voucher | -0.084* |
| | [0.043] |
| Audit | -0.027 |
| | [0.029] |
| Small delivery | 0.015 |
| | [0.034] |
| Health worker payment | -0.002 |
| | [0.035] |
| Observations | 71 |
| R-Squared | 0.241 |
| Dep. Var. Mean in direct distribution facilities | 0.147 |

Notes: The table presents the results of an OLS regression with randomization strata fixed effects and two health-center level controls: baseline ANC attendance and ANC staff size. The local leakage rate is the percent of bed nets unaccounted for, computed as described in main text Section 5.2). There are only 71 observations (instead of 72) because one facility refused to participte in the bed net distribution program. Instead of imputing a zero leakage rate to that facility we exclude it from the analysis.
Standard errors clustered at the health facility level. ***,**,* indicates significance at 1, 5 and 10 percent. "Effect of Audit" is the main effect, not the diff-in-diff coefficient, since there is only one measurement of this variable per health center (no pre- and post- measurements).

Table A3. Correlations between performance measures and absenteeism

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Data Source: | Backcheck surveys with random subset of ANC Clients | | | Community Interviews | "Mystery Client" visits | | | |
| Dependent Variable: | Got net/voucher at first visit to clinic | Got net/voucher at any visit to clinic | Payment requested for net (conditional on offer) | Respondent thinks that (male) surveyor could get a net at a health center | Payment requested for net | Acquired program net | High potential opportunity to acquire net | Clinic stocked out |
| *Healthworker characteristics* | | | | | | | | |
| Share absent | 0.0015 | 0.00028 | -0.006 | -0.03 | -0.025 | 0.0041 | 0.025 | -0.023 |
| | [0.091] | [0.088] | [0.008] | [0.03] | [0.023] | [0.063] | [0.12] | [0.16] |
| *Clinic characteristics* | | | | | | | | |
| Above-median ANC registrants | -0.033 | -0.026 | 0.008 | 0.03 | -0.0087 | -0.046** | -0.026 | 0.026 |
| | [0.039] | [0.035] | [0.008] | [0.02] | [0.014] | [0.018] | [0.028] | [0.032] |
| Clinic accessible in the rainy season | 0.019 | 0.012 | 0.0008 | 0.01 | 0.015 | 0.0064 | 0.054* | -0.02 |
| | [0.079] | [0.078] | [0.006] | [0.03] | [0.024] | [0.021] | [0.028] | [0.045] |
| Total number of staff working in ANC | 0.0048 | 0.0071 | 0.0002 | -0.002 | -0.0052** | -0.002 | -0.0066 | -0.0053 |
| | [0.0052] | [0.0043] | [0.0006] | [0.003] | [0.0024] | [0.0019] | [0.0042] | [0.0046] |
| Private facility | -0.46*** | -0.51*** | 0.004 | 0.04 | -0.04 | -0.054*** | -0.066 | 0.11*** |
| | [0.16] | [0.16] | [0.008] | [0.05] | [0.037] | [0.019] | [0.042] | [0.036] |
| NGO facility | -0.19** | -0.17** | 0.07** | 0.06* | -0.018 | -0.036 | -0.014 | 0.12 |
| | [0.079] | [0.076] | [0.03] | [0.03] | [0.021] | [0.042] | [0.079] | [0.11] |
| Observations | 2028 | 2028 | 1549 | 2559 | 765 | 766 | 762 | 766 |
| R-squared | 0.078 | 0.082 | 0.034 | 0.01 | 0.016 | 0.035 | 0.086 | 0.124 |
| Dep. Var. Mean | 0.76 | 0.8 | 0.01 | 0.1 | 0.041 | 0.043 | 0.14 | 0.13 |

Each column is a separate regression, with controls for country fixed effects, the experimental treatments, and whether the healthworkers had the "honesty test" as a part of their dictator game. Columns (1) and (2) also control for whether there were any stockouts in those clinics, as measured by the attendance checking team in Uganda and Kenya (there is no control in Ghana where stockouts were determined by healthworker effort). Standard errors clustered at the level of the health facility in brackets. ***,**,* indicates significance at 1, 5 and 10 percent. Ghana sample includes only facilities sampled for direct distribution.

[a] Indexes are averages across standardized variables as grouped in Tables 8 and 9, which are then re-standardized to have a mean of 0 and std dev of 1. The other-regarding preferences index also contains the share left in the dictator game (shown in Fig 3).

Table A4. Pro-social Motivation and Selection into Health Work

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Pro-Social Motivation | | | | Job Characteristics | |
| | Survey response on a scale from 1 (don't agree) to 5 (strongly agree) to the statement: | | | | | |
| | Helping people brings personal satisfaction | If you help someone, they should do you a favor in return | It is important to do good things for my community | My family comes first, my work second | Monthly pay[a] | Years of education |
| Panel A. Country-level averages across health workers | | | | | | |
| Ghana | 4.848 | 1.463 | 4.939 | 3.331 | 235.8 | 14.02 |
| | [0.0481] | [0.109] | [0.0288] | [0.105] | [13.99] | [0.228] |
| Kenya | 4.898 | 1.321 | 5 | 3.265 | 387.7 | 15.87 |
| | [0.0501] | [0.105] | [0] | [0.129] | [16.28] | [0.0630] |
| Uganda | 4.631 | 2.403 | 4.785 | 3.295 | 141.2 | 15.67 |
| | [0.0482] | [0.135] | [0.0316] | [0.136] | [7.149] | [0.127] |
| Observations | 450 | 450 | 449 | 444 | 412 | 449 |
| P-value for equality of means: | | | | | | |
| Ghana = Kenya | 0.47 | 0.35 | 0.04** | 0.69 | 0.00*** | 0.00*** |
| Ghana = Uganda | 0.00*** | 0.00*** | 0.00*** | 0.83 | 0.00*** | 0.00*** |
| Kenya = Uganda | 0.00*** | 0.00*** | 0.00*** | 0.87 | 0.00*** | 0.17 |
| Overall Mean | 4.791 | 1.731 | 4.906 | 3.300 | 250.7 | 15.13 |
| Panel B. Comparisons with other professions (omitted category: health workers) | | | | | | |
| Teacher | -0.282*** | 0.473*** | -0.114*** | 0.238** | -33.10** | 0.309*** |
| | [0.0563] | [0.103] | [0.0330] | [0.102] | [12.95] | [0.116] |
| Shop owner | -0.347*** | 1.261*** | -1.608*** | 0.963*** | -106.1*** | -5.985*** |
| | [0.0801] | [0.145] | [0.136] | [0.130] | [17.90] | [0.457] |
| Microfinance agent | -0.324*** | 0.961*** | -0.163*** | 0.708*** | -155.4*** | -1.908*** |
| | [0.0769] | [0.146] | [0.0525] | [0.123] | [12.71] | [0.209] |
| Observations | 1,136 | 1,138 | 1,134 | 1,127 | 1,094 | 1,172 |

Notes: Panel A: Data from surveys with health workers only. Ghana sample only includes workers from facilities sampled for direct distribution. Panel B: Data from surveys with health workers, shopkeepers, teachers and MFI agents. Regressions control for country FE. Cols (5) and (6) of panel B also control for worker gender and age. *** p<0.01, ** p<0.05, * p<0.1.

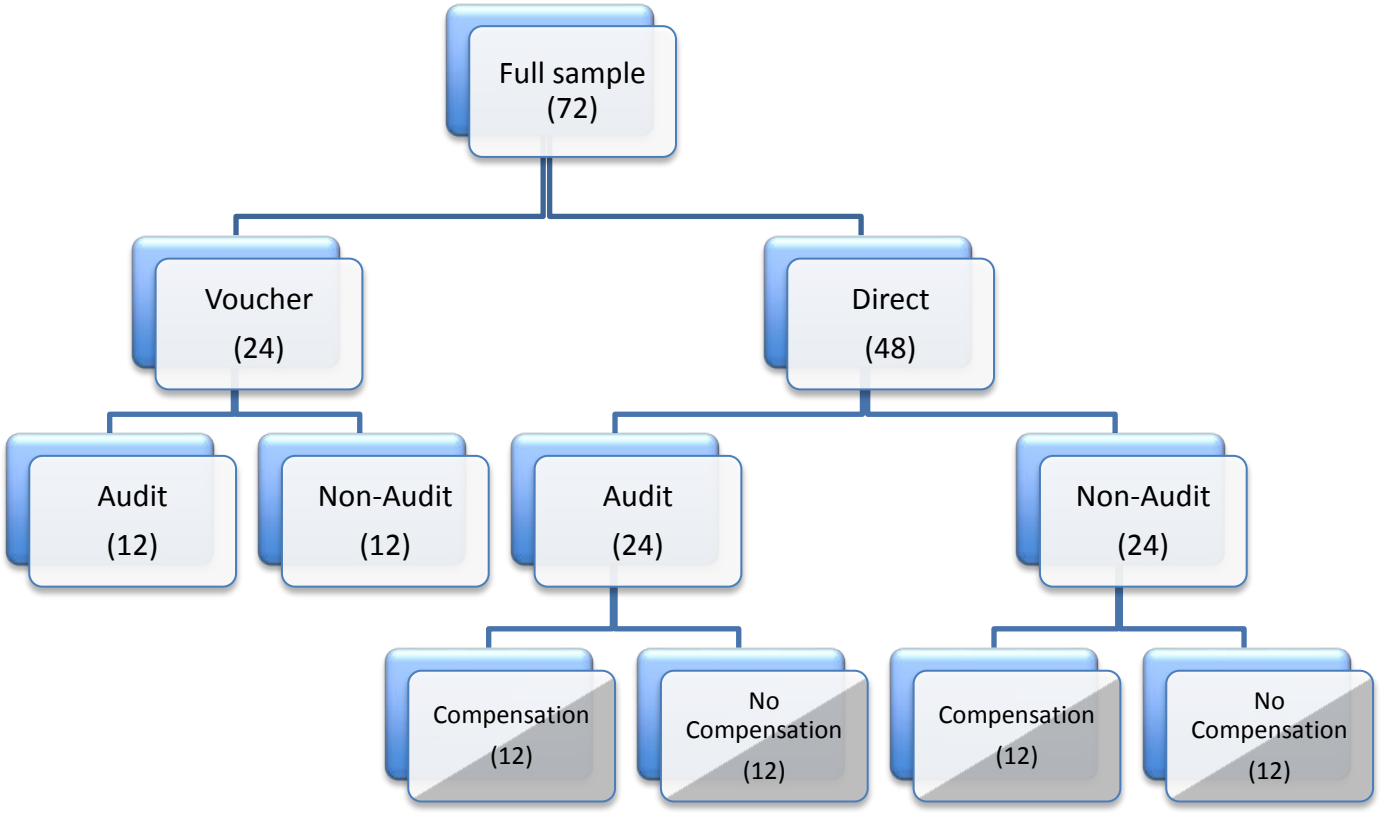
[a] Winsorized at 99th percentile. Converted to USD using the exchange rate at the time the survey was taken, except for the other profession salaries (i.e., non-healthworker salaries) in Ghana: since healthworkers in Ghana were surveyed two years before the other professions (2012 vs 2014), the other profession salaries were first converted to 2012 Ghana cedis using inflation rates, then converted to USD using exchange rates at the time the healthworker surveys were conducted.

Table A5. Intrinsic and Extrinsic Job Motivation

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | Survey response on a scale from 1 (don't agree) to 5 (strongly agree) to the statement: | | | | | | | |
| | Intrinsic Job Motivation | | | | | Extrinsic Motivation | | |
| | As a [*profession*], I have the responsibility to be a role model in my community | This [*work place*] plays a very important role in this community | I am very satisfied with my job | People in remote areas do not have enough appreciation for [*profession]* | [*Profession*] should be paid more | [*Profession*] jobs are very secure -- even if a worker does a bad job they won't be fired | This [facility/school] is closely monitored by the Ministry of [Health/Education] | This [facility/school] is closely monitored by local NGOs |
| Panel A. Country-level averages across health workers | | | | | | | | |
| Ghana | 4.909 | 4.896 | 4.341 | 3.135 | 4.710 | 1.288 | 4.834 | 2.276 |
| | [0.0334] | [0.0378] | [0.125] | [0.133] | [0.0734] | [0.0726] | [0.0609] | [0.154] |
| Kenya | 4.912 | 4.971 | 4.081 | 2.378 | 4.657 | 1.241 | 4.912 | 3.504 |
| | [0.0643] | [0.0291] | [0.133] | [0.163] | [0.0930] | [0.0760] | [0.0646] | [0.165] |
| Uganda | 4.879 | 4.866 | 3.831 | 3.087 | 4.691 | 1.523 | 4.365 | 4.007 |
| | [0.0304] | [0.0303] | [0.0979] | [0.113] | [0.0491] | [0.0652] | [0.0960] | [0.0932] |
| Observations | 450 | 449 | 448 | 447 | 448 | 449 | 448 | 446 |
| P-value for equality of means: | | | | | | | | |
| Ghana = Kenya | 0.96 | 0.12 | 0.15 | 0.00*** | 0.66 | 0.65 | 0.38 | 0.00*** |
| Ghana = Uganda | 0.52 | 0.54 | 0.00*** | 0.78 | 0.83 | 0.02** | 0.00*** | 0.00*** |
| Kenya = Uganda | 0.64 | 0.01** | 0.13 | 0.00*** | 0.74 | 0.01*** | 0.00*** | 0.01*** |
| Overall Mean | 4.900 | 4.909 | 4.094 | 2.890 | 4.688 | 1.352 | 4.703 | 3.220 |
| Panel B. Comparisons with other professions (omitted category: health workers) | | | | | | | | |
| Teacher | -0.0120 | -0.152*** | -0.447*** | 0.499*** | -0.0756 | 0.443*** | -0.382*** | -0.152 |
| | [0.0383] | [0.0346] | [0.106] | [0.121] | [0.0646] | [0.0763] | [0.0642] | [0.122] |
| Shop owner | -0.524*** | -1.008*** | -0.139 | 0.458*** | -0.782*** | N/A | N/A | N/A |
| | [0.0797] | [0.111] | [0.114] | [0.150] | [0.105] | | | |
| Microfinance | -0.524*** | -0.330*** | -1.026*** | 0.0481 | -0.168** | 0.0823 | N/A | N/A |
| | [0.0719] | [0.0571] | [0.146] | [0.144] | [0.0759] | [0.110] | | |
| Observations | 1,138 | 1,133 | 1,134 | 1,126 | 1,131 | 997 | 870 | 867 |

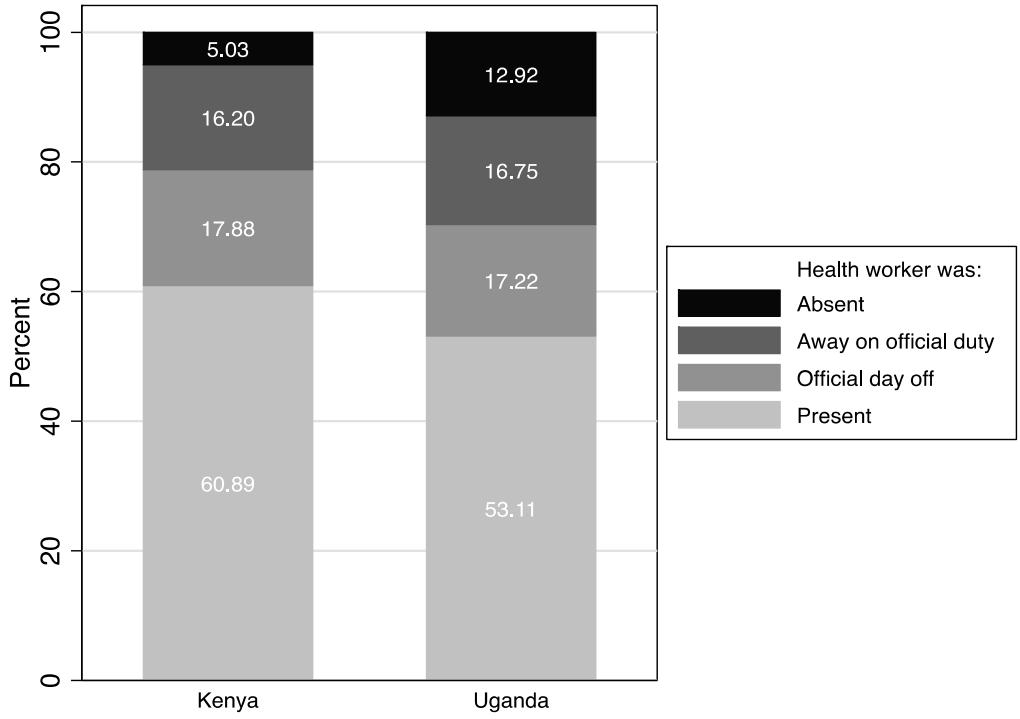
Notes: Panel A: Data comes from surveys with health workers at 144 health facilities. Ghana sample only includes workers from facilities sampled for direct distribution. Panel B: Data from surveys with health workers, shopkeepers, teachers and MFI agents. Each column is a separate regression, with controls for country FE. Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Figure A1. Ghana experimental design



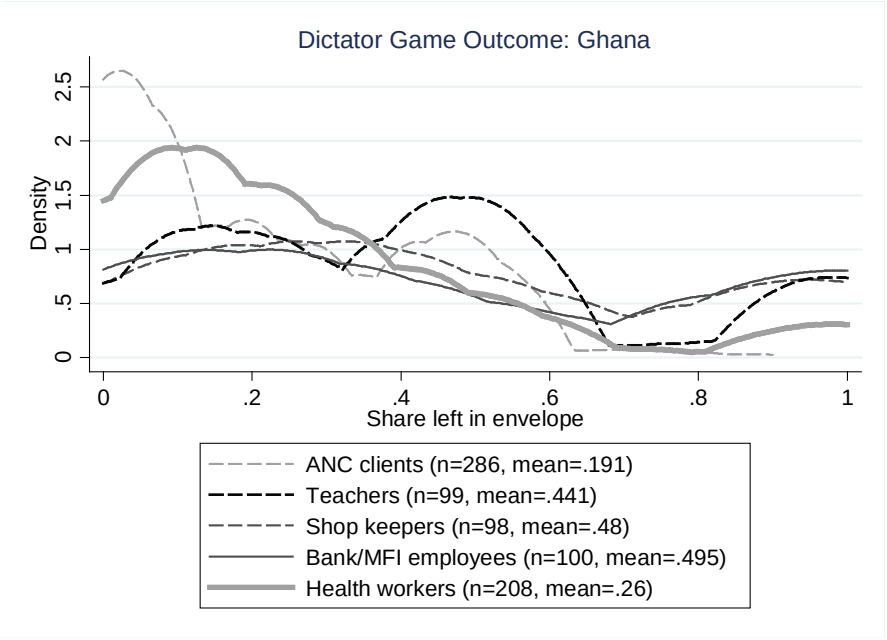

Notes: Sample size numbers are given in terms of number of clinics. Gray shading means split 50/50 between small and large delivery.

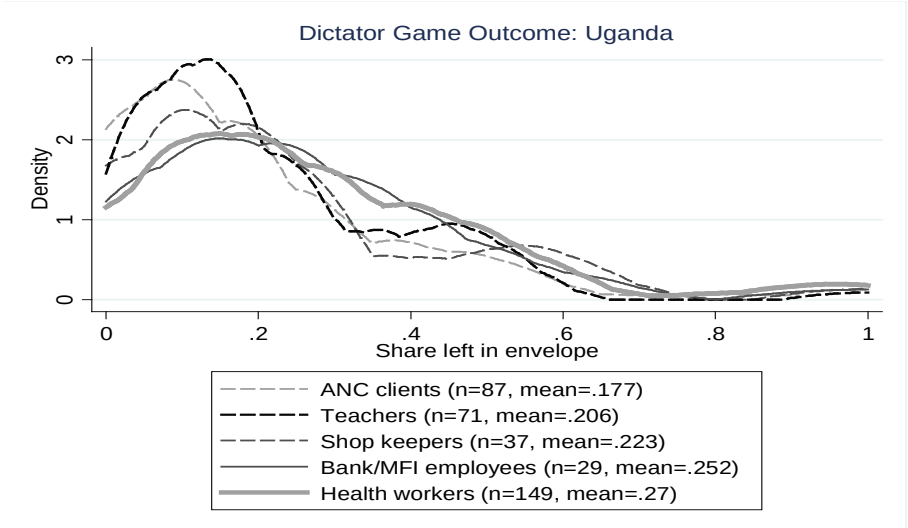
Figure A2. Health worker attendance data




Notes: Individual-level data from one unnannounced spot check. Kenya: 188 health workers from 48 facilities. Uganda: 214 health workers from 48 facilities. No unannounced spot check were performed in Ghana.

Figure A3. Other-regarding preferences of health workers compared to others


Notes: The dictator game allowed the participant to leave as much money as they wanted, anonymously, for a community member, out of an envelope with 10 bills.