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Going beyond incentivizing formal health providers: Evidence from the Rwanda Community Performance-Based Financing Program

Abstract

Pay-for-performance programs are introduced in an increasing number of low and middle-income countries with the goal of reducing maternal and child mortality and morbidity through increased health service utilization and quality. While most programs incentivize formal health providers, some constraints to utilization might be better alleviated by incentivizing other actors in the health care system. This paper presents results from a randomized controlled trial set to evaluate the effects of two incentive schemes that were introduced on top of Rwanda's national Performance-Based Financing program at the health facility level. One scheme rewarded community health worker cooperatives for the utilization of five services by their communities. The second scheme provided in-kind transfers to users of three services. The analysis finds no impact of the cooperative performance payments on coverage of the targeted services, behaviors of community health workers, or outcomes at the cooperative level. Although health centers experienced frequent stock outs of the gifts, the demand side intervention significantly increased timely antenatal care by 9.3 percentage points and timely postnatal care by 8.6 percentage points. This study shows that demand-side incentives can increase service utilization also when provided in addition to a supply-side pay-for-performance scheme.

JEL classification codes: I12, O15, H51

Introduction

Maternal and child mortality rates have reduced significantly in Sub-Saharan Africa between 1990 and 2015. It is estimated that the under-five mortality rate reduced by 52 percent and maternal mortality rate by 49 percent (United Nations 2015). However, both mortality rates in the region remain about twice as high as the corresponding world averages, and the ambitious targets set by the Millennium Development Goals have not been achieved. Further reducing these rates has remained in the heart of the post-2015 international development agenda and new targets were set to be achieved by 2030 by the Sustainable Development Goals.[1] To further improve maternal and child survival, a focus has been put on increasing coverage rates of maternal and child health services.

Pay-for-performance schemes have been increasingly introduced in the health care systems of low- and middle-income countries to improve coverage and quality of health services (Miller and Babiarz 2013; Witters et al. 2012). The Rwanda Performance-Based Financing (PBF) program is a high profile scheme that was launched in 2006.[2] In this program, health facilities receive financial incentives conditional on the number of services provided as well as measures of quality of care. Studies have found that the PBF scheme significantly increased the health outcomes of children, quality of prenatal care and coverage of health services such as institutional deliveries, preventative care visits by children and voluntary counseling and testing for HIV by couples (Basinga, Gertler et al. 2012, Gertler and Vermeersch 2012 and de Walque, Gertler et al. 2015).

Other African countries, such as Cameroon and Benin, also implement such schemes targeting maternal and child health services at scale. Many more countries are either piloting such programs or have them implemented at a regional level (World Bank 2015). However, while positive results have been shown in Rwanda and elsewhere (e.g. Bonfrer et al. 2014), some experiences with these complex interventions have resulted in mixed or no improvements in targeted outcomes (e.g. Van de Poel et al. 2015; Huillery and Seban 2015; Engineer et al. 2015). Questions such as which indicators to pay for and who should be paid remain of special interest. In the African context, these schemes have mostly focused on incentivizing formal health providers at the health facility level. However, some programs have also

[1] www.un.org/sustainabledevelopment

[2] Pilot PBF programs have been introduced in the country as early as 2001 (Meesen et al. 2006; Soeters, Habineza and Peerenboom 2006; Rusa et al. 2009).

incentivized other agents, such as local governments, community bodies, community health workers, and patients.

This study evaluates the impacts of two interventions that were introduced with the aim of increasing coverage of maternal and child health services through incentives to community health workers (CHWs) and users of health services. The interventions were introduced in the context of the Community Performance-Based Financing (CPBF) program at the end of 2010.[3] The first intervention was provision of financial rewards to cooperatives of volunteer community health workers (CHWs) for utilization of five targeted maternal and child health services by the communities they serve. The second intervention consisted of endowing gifts to women conditional on receiving three targeted reproductive health services. Both interventions incentivized services provided at health centers and were introduced on top of the ongoing national PBF program that incentives health centers for the same outcomes. [4]

Both interventions might alleviate constraints to health service utilization in ways in which the PBF intervention cannot. If the policy goal is to increase coverage, independently of quality of care, rewarding users directly can be more effective than incentivizing providers. Although providers can exert more effort on outreach activities and on improving services, the decision of whether to arrive at a health center is ultimately taken by the users. Demand-side cash transfers programs have been increasingly introduced in the health sector of low and middle-income countries (e.g. Gertler and Boyce 2001; Thornton 2008; Barham and Maluccio 2009). Systematic reviews of the literature have found these programs, and the related voucher programs, to be effective in increasing coverage of targeted services in most cases (Lagarde et al. 2008, Bellows et al. 2010 and Gopalan et al. 2014, and Murray et al. 2014). An experiment in India also showed that small in-kind incentives can have a large impact on take-up of immunization services and were more cost effective than improving the reliability of the availability of the services (Banerjee, Duflo et al. 2010).

Performance payments to CHWs is a less studied policy tool. In comparison to the formal health providers, CHWs workers typically have better knowledge of their communities. In comparison to their communities, they have better knowledge about the services provided at the health centers. Incentivizing CHWs might be effective if they could use their local knowledge, and trust of their

[3] The World Bank provided financing to the government of Rwanda for this program under a Poverty Reduction Strategy Credit and through a grant from the Health Results Innovation Trust Fund. More information and resources on the program can be found at www.rbfhealth.org/project/rwanda.

[4] Health centers are the main first point of contact between the population and the health care system. These facilities provide both outpatient and inpatient care such as deliveries.

communities, to inform about the health services in ways that are more convincing than those already used by the formal health providers. Previous studies have found that financial performance payments to CHWs can increase motivation and performance but can also decrease performance on non-incentivized tasks (Kok et al. 2015). Incentivizing cooperatives of CHWs for utilization of services by their communities is a novel approach that has not been rigorously evaluated before.

The evaluation relies on an experimental design in which the two interventions were introduced in randomly selected sectors (sub-districts) in 19 districts.[5] Fifty of the sectors implemented each of the two interventions, fifty implemented both and 48 implemented neither. CHW cooperatives in sectors selected for the performance payment scheme received quarterly payments conditional on utilization rates in their catchment areas. Cooperatives in sectors not selected for this intervention received quarterly payments that were not tied to performance. These payment amounts equaled the average amounts received by the cooperatives under the scheme. In sectors selected for the demand-side in-kind transfers scheme, health centers received funding to procure the gifts. Facilities received this funding for a period of about two and a half years. The analysis relies on baseline survey conducted prior to the launch of the program and a follow-up survey conducted after more than three years of implementation and about nine months after last funds were transferred to the facilities for the demand-side incentives. Data were collected through interviews of households, CHWs and cooperative leaders. The follow up survey also included interviews with health centers' staff.

The results indicate no impact of the CHW cooperative performance payments on the targeted indicators of timely antenatal care, in-facility delivery and growth monitoring of children. In addition, we cannot reject that there was no impact on use of modern family planning methods. Furthermore, the intervention did not increase the amount of effort exerted by CHWs or affect the way in which cooperatives were run. The demand-side in-kind transfers, however, caused an increase of 9.3 percentage points in the rate of women who initiated antenatal care within the first 4 months of their pregnancy and an increase of 8.6 percentage points in the rate of women who received postnatal care in the ten days following delivery. No significant impact was found on the rate of women who delivered in a health facility attended by a skilled health provider. There were no synergies found between the two

[5] There was no formal trial registry for this study but the analysis presented in this paper follows the protocol described in the World Bank project documents and application for ethical clearance that were written prior to implementation.

interventions. Outcomes were similar in the treatment arm implementing the demand-side scheme only and the arm implementing both interventions.

This study contributes to a growing body of literature on pay-for-performance programs in the health sector in developing countries. It is unique in its evaluation of interventions that were added on top of an ongoing performance-based financing program at the health-facility level. This paper relates to studies of programs that paid for health-related outcomes to agents who are not formal health providers. Examples of such programs include block grants to villages in Indonesia, incentives to school principals for reducing anemia among students in China, and payments to childcare workers in India for reducing malnutrition (Olken et al. 2014; Miller et al. 2012; and Singh 2015).

This study also contributes to the literature on conditional transfers by evaluating a large-scale government-implemented program in Sub-Saharan Africa that endowed conditional in-kind transfers. Unlike the programs in Latin America, the policy intervention was not part of a bigger social protection program and was primarily implemented by health centers that procured and distributed the gifts. Unlike the experiment studies by Thornton (2008), which also took place in Sub-Saharan Africa, and by Banerjee, Duflo et al. (2010), which also provided in-kind transfers, the CPBF scheme is a large-scale multi-year program. Evaluating the impacts of a program run by a government on a large scale, rather than by a research team or an NGO, is of value by itself as it might be implemented differently and result in different impacts on outcomes of interest. For example, health centers experienced frequent stock outs of the gifts. That might not have occurred under a more controlled small-scale implementation of such a program.

The Interventions

The Community Performance-Based Financing program was designed with the objective of expanding coverage of maternal and child health services and improving the quality of monitoring data collected at the village level. A focus has been put on services whose coverage was not impacted by the PBF at the health facility level. The program tries to achieve these objectives through expansion of performance-based payments to additional agents in the health system, apart from formal health providers.

Each village in Rwanda has three volunteer community health workers: one female in charge of maternal and neonatal health, and a male and a female that serve as multidisciplinary CHWs.[6] CHWs

[6] The CHWs, which are elected by the village residents, must be able to read and write, be 20 to 50 years old, and reside in the village.

within the catchment area of a health center are organized in a CHW cooperative. All CHWs must be members of the cooperatives and membership is closed to any other individual. When cooperatives receive transfers from the program, a minimum of 70 percent must be invested in income-generating activities of the cooperatives' choosing. The other 30 percent, as well as revenues from the income-generating activities, can be allocated among the cooperative members. It is up to the cooperatives to decide how to allocate these funds among their members.

Community health workers were integrated into the PBF scheme in 2009. Initially, payments to cooperatives depended on timely completion of quarterly reports on data CHWs collected on their communities. With the introduction of the CPBF program, payments to cooperatives were also conditioned on utilization of targeted health services in their corresponding catchment areas. The CHW cooperatives performance incentives are paid quarterly based on the provided number of five targeted maternal and child health services.[7] The incentivized services, provided at the health centers, were growth monitoring of children 6-59 months old, antenatal care provided to women in the first four months of their pregnancy, in-facility deliveries, family planning consultations for new users, and family planning consultations for regular users.

The demand-side in-kind transfers scheme endowed women with gifts for meeting the following eligibility criteria: initiation of antenatal care within the first four months of a pregnancy, delivery in a health facility, and initiation of postnatal care within ten days of delivery. Health centers received funding to procure the gifts. Monetary values were set as ceilings for each indicator and facilities were provided with suggested content for the incentive packages. Table 1 presents the monetary values and suggested incentive package for each service. Gifts of a value of up to 5 USD were to be endowed for timely antenatal care and values of 6.67 and 3.33 USD were set for in-facility delivery and timely postnatal care respectively.[8] Women were only eligible to receive the gifts for one pregnancy during the program implementation.

There were frequent reports of stock-outs of the gifts with third of the health centers reported experiencing frequent stock outs in the follow up survey. Lack of funds was the most commonly

[7] Payments are provided after a verification and approval by the health centers, sector steering committees, district steering committees and the Ministry of Health. The process can take up to 100 days (Renaud and Semasaka 2014).

[8] To benchmark the gift values, it is estimated from household consumption data that in 2010 about 81 percent of the population lived on less than 3.10USD a day and 60 percent lived on less than 1.90USD a day (iresearch.worldbank.org/PovcalNet).

provided reason. Many women who fulfilled the eligibility criteria did not receive the gifts. Some women received promises (or vouchers) for receiving the gifts at a later time.

Methods

The evaluation of the two interventions relies on the experimental design of the study, depicted in Figure 1. Sectors (sub-districts) in 19 districts were randomly assigned to different study arms.[9] The districts are in four of the five provinces of the country, excluding the province of the capital city Kigali. Sectors without a public or non-for-profit faith-based health center were excluded, as were 30 sectors where the demand-side in-kind transfers were piloted.[10] The remaining 198 sectors were included in the study sample.

The sectors were randomly assigned into four study arms with the sectors blocked by district and poverty ranking defined by the country's Vision Umurenge social protection program.[11] A four-arm design was selected to evaluate the impact of the individual interventions as well as assess whether there exists a multiplicative effect on outcomes when both cooperatives and health services' users are incentivized. In all study arms, CHW cooperatives received funds conditional on submitting the routine reports on their communities. In the first study arm, T_{CHW}, the quarterly amounts paid to cooperatives depended on performance on the selected five indicators. In the second study arm, T_D, payments to cooperatives were not linked to performance but health centers received funds to implement the demand-side in-kind transfers for timely antenatal care, in-facility delivery and timely postnatal care. In the third study arm, T_{CHW+D}, both the CHW cooperative performance payments and demand-side transfers were implemented. The fourth study arm, C, served as a control group, and pay-for-reporting was the only CPBF component implemented. In the two study arms in which payments to cooperatives were not linked to performance (T_D and C), cooperatives received the average quarterly amounts given to cooperatives in the two study arms in which cooperatives were paid for performance (T_{CHW} and T_{CHW+D}). The goal was to evaluate the impact of tying payments to performance and not the impact of different level of payments to the cooperatives. The percentage of the funds that had to be invested in

[9] The 19 districts include the 18 districts of the impact evaluation of the PBF at the health facility level in 2006-2008. An additional district was added to increase the statistical power of the study.

[10] A sector typically contains a single public or non-for-profit faith-based health center with the catchment area of the health center corresponding to the boundary of the sector. However, there are some sectors that do not contain a health center and others have more than one.

[11] The randomization was conducted by the research team. More information on the Vision 2020 Umurenge Program can be found at www.statistics.gov.rw/survey/vision-2020-umurenge-program-vup-baseline-survey

the cooperatives' income-generating activities, as well as the autonomy to decide how to allocate the money among the members, were the same in all treatment arms.

A baseline survey was fielded from February to May 2010 to measure outcomes prior to the launch of the program, and to establish internal validity of the study. For the household-level survey, 12 households with a woman aged 15-49 with a recent pregnancy or birth were selected from the catchment area of each of the 198 health centers.[12] First, three cells (groups of villages) were randomly selected, and then four villages within each cell were randomly selected. In each village, a field supervisor consulted the village leader and/or community health workers to identify the household with the most recent birth in each village.[13] This resulted in a sample of 2,376 households. In each village, the CHW in charge of maternal and neonatal health was to be interviewed. Interviews were completed with 2,005 CHWs (about 84 percent of the target). In addition, interviews were conducted with 197 cooperative presidents.

A follow-up survey took place between November 2013 and June 2014. The survey teams returned to the same villages sampled for the baseline survey and identified (i) the women interviewed at baseline and (ii) women with the most recent birth or pregnancy in each village.[14] For the remainder of the paper, the sample of women interviewed in the baseline will be referred to as the 'original sample' and the sample of women who were recently pregnant at the time of the follow-up survey will be referred to as the 'follow-up sample'. Interviews were completed with 2,157 women of the original sample and 2,343 women of the follow-up sample. Tracking of original sample was attempted also outside the districts in which they resided during the baseline survey, which was the main cause of the longer duration of fieldwork. 2,200 CHWs in charge of maternal and neonatal health in the same villages were interviewed as well as 197 presidents of CHW cooperatives.

Implementation of the cooperative performance payments and demand-side in-kind incentives started in October 2010. Table 2 presents the unit fees paid to the cooperatives in the different implementation years. For budgetary reasons, most unit fees were halved by the end of 2011 and reduced by an additional 25 percent the following year. If the amount of effort exerted depends on the reward

[12] Power calculations were conducted with the 2008 household survey conducted for the impact evaluation of Performance-Based Financing at the health facility level. The calculations were based on in-facility delivery and use of prenatal care.

[13] During the fieldwork, the survey team learned that some villages, in five of the sectors, were served by health facilities different than the ones affiliated with the CHW cooperative selected for the sample. In these cases, additional households in the villages covered by the selected cooperatives were added to the sample.

[14] The same procedure as in the baseline survey was implemented to identify the women with recent pregnancies.

amounts, the reduced unit fees might weaken the impact of the intervention. Four additional indicators related to tuberculosis and HIV testing were added during the implementation of the program. These indicators were added nationally and are not discussed in this paper.

While the cooperative performance payments were implemented continuously until after the follow-up survey, health centers received their last payments for the demand-side transfers on February 2013. The termination of transfers to the health centers was unexpected to the health centers as well as to the research team and was not announced. At the time of the follow-up survey, about 90 percent of the health centers in the T_D and T_{CHW+D} arms reported providing the gifts as a policy. However, most women reported not getting them. Out of the 956 women in the T_{CHW+D} and T_D groups who report receiving antenatal care in the first four months of their pregnancy, only 19 percent reported also receiving gifts. Twelve percent reported receiving a gift after delivering in a health facility and 7 percent reported receiving the in-kind transfers after receiving postnatal care within ten days after delivery. For each of these criteria, about 3 percent of the eligible women did not receive the gifts but were promised to receive them at a later stage. The rates of women meeting the eligibility criteria in the C and T_{CHW} arms who received gifts from the health facilities where they received care are 11, 4, and 1 percent for timely antenatal care, in-facility delivery and timely postnatal care, respectively. In all cases, the differences between the groups are statistically significant at the 1 percent level. Ideally, the data would have been collected while the program was still fully implemented. Shortages of gifts at the health centers might attenuate estimated impacts.

Descriptive Analysis

Sample characteristics and balance

Tables A1 and A2 in the appendix present summary statistics from the baseline survey of the characteristics of the original sample of pregnant women, CHWs in charge of maternal and neonatal health and CHW cooperatives. The tables report means by the experiment's treatment arms and p-values of tests of differences between the three intervention arms and the control.[15] Overall, the randomization achieved balance between the four arms with respect to observable characteristics.

As can be seen in Table A1, almost all women have received at least one antenatal consultation during their most recent pregnancy, but only 63 percent initiated antenatal care within the first four months of

[15] Baseline balance is assessed by regressing the different baseline variables on treatment arms, controlling for randomization strata dummies and with standard errors clustered at the sector level.

the pregnancy and 37 percent received four or more consultations (number of consultations recommended by WHO guidelines). Forty percent of the women reported ever using any modern method of family planning. Seventy-nine percent have delivered in a health facility, attended by a skilled health provider.

A comparison of the baseline sample to that of the Rwanda Demographic and Health Survey 2010 sample of women who gave birth in the two years preceding the survey in the four provinces covered by our study reveals that the baseline rates of utilization of maternal health services are similar in both surveys. The rates of women who received at least one antenatal consultation, initiated antenatal care within the first four months of their pregnancy and delivered in a health facility attended by a skilled health provider are identical at 98, 63 and 79 percent respectively. The rate of women who completed at least the suggested number of four antenatal consultations is 37 percent in our sample relative to 36 percent in the RDHS. The comparability of the two samples alleviates the concern that the selection of women with the aid of village leaders and community health workers resulted in a sample of women who are more likely to use health services relative to the overall population of pregnant women. In Table A3 in the appendix, we show that the characteristics of the follow-up sample of women who were pregnant shortly before being interviewed are balanced across treatment arms. This implies that the implementation of the different interventions did not influence the selection of women into the sample.

Some health centers endowed women with gifts even prior to the implementation of the intervention evaluated in this analysis. These health centers procured gifts from their own resources to increase coverage of services for which they were rewarded through the PBF scheme at the health facility level. About 5 percent of women reported receiving gifts for attending antenatal consultations, 4 percent for in-facility delivery and less than 2 percent for postnatal care. The values of these transfers are estimated to be less than a third of the values suggested for the CPBF in-kind transfers for each of the services.

Table A2 presents the baseline characteristics of CHWs in charge of maternal and neonatal health and their cooperatives. The data portrays the reorganization of the community health work program happening at the time. For example, although all CHWs in charge of maternal and neonatal health were supposed to be female, about 14 percent were men. About 54 percent of CHWs reported being in the role for a year or less. The average reported years of experience is 2.7. The CHWs reported having visited an average of 28 households in the month preceding the survey and spending an average of 17 hours per week on their community health duties.

As can be seen in the lower panel of Table A2, the average number of cooperative members was 105.4, serving an average of 37 villages. In the 12 months preceding the survey, the cooperatives had recruited an average of 35 members, dismissed two members and had two members resign. The cooperative leaders reported having had an average of 7.5 meetings during the preceding year. Most cooperatives had less than the target number of members (three per village) while many cooperatives had more than three CHWs per village.[16] The results of the follow-up survey (not presented in the tables) show that during the implementation of the program, the cooperatives were indeed reorganized according to the guidelines. Most of the cooperatives (80 percent) reported their number of members to be exactly three times the number of villages they serve. In addition, the ratio of females to males was two to one, as expected.

Attrition

During the follow-up survey, the field teams managed to complete interviews with 99 percent of the target number of women with recent births (the follow up sample) and 93 percent of the target number of CHWs in charge of maternal and neonatal health. There are no statistically significant differences in these rates between the treatment arms. However, the attrition rate of the original sample - those who were pregnant shortly before the baseline - is not balanced. As can be seen in Table A4 in the appendix, successful re-interviews were conducted at the follow-up round with 94 percent of the original sample in the control group, 92 percent in the T_D group, and 89 percent in the T_{CHW} and T_{CHW+D} groups. Exposure to the performance payments intervention is significantly correlated to higher attrition also when controlling for a range of baseline characteristics of the women. Although attrition rates were different across the different treatment arms, we do not find patterns of attrition to be different across treatment arms in terms of women's baseline characteristics.

Most of the analysis is conducted with the follow-up sample of women who were identified as having been pregnant shortly before the follow-up survey. We show in Table A1 in the appendix that the characteristics of the follow-up sample is balanced across treatment arms when considering demographic characteristics that should not be impacted by the interventions. For the analysis of the impacts on family planning outcomes, however, we employ the original sample and take into account the unbalanced attrition.

[16] Prior to the reorganization of the community health program, many villages had CHWs in charge of social affairs or with HIV/AIDS specialization.

Impacts of the CPBF Interventions

Given the experimental design and the balance between the study arms, the main empirical specification used to estimate the impacts of the different treatments is

$$y_i = \alpha + \beta_1 T_{D,i} + \beta_2 T_{CHW,i} + \beta_3 T_{CHW+D,i} + \sum \gamma_s d_{s,i} + \epsilon_i,$$

where the unit of observation i can represent a woman, a CHW or a cooperative. y is an outcome measured at the follow-up survey. $T_{D,i}$, $T_{CHW,i}$, and $T_{CHW+D,i}$ represent sector assignment to one of the three treatment arms. $d_{s,i}$ are randomization block dummies. When the unit of observation is a woman or a CHW, the error term is clustered at the sector level.

Below, we present first the program impacts on the four targeted maternal and child health services. This analysis was conducted using the data collected through interviews with the follow-up sample of recently pregnant women. We then present the analysis of the impact on fertility and use of modern family planning methods, using the original sample of women who were pregnant shortly prior to the baseline survey. Finally, we report the effects of the CPBF programs on the behavior of CHWs, their interaction with recently pregnant women and outcomes at the cooperative level.

Impact on maternal and child health services

Table 3 reports the results on the impacts of the interventions on utilization of maternal and child health services by the follow-up sample of recently pregnant women. It is important to keep in mind that while both interventions targeted timely antenatal care and in-facility delivery, only the demand-side incentives directly targeted timely postnatal care and only the CHW cooperative incentives directly targeted child growth monitoring. Theoretically, however, both interventions could indirectly increase utilization of non-incentivized services through increased engagement with the health centers.

The first three columns of Table 3 report the results on the impact of the intervention on utilization of the targeted maternal health services. There is no impact of the CHW cooperative performance payments detected on any of the three outcomes. The demand-side intervention, however, has increased the rate of women receiving first antenatal consultation within the first four months from 72.3 percent among the control group to 81.4 percent among the T_D group. The rate is 80.2 percent among the T_{CHW+D} group. The rate of women who received postnatal care within ten days after delivery is 13.4

percent among the control group, 21.7 percent among T_D group and 20 percent among the T_{CHW+D} group. For both outcomes, the effects on the T_D and T_{CHW+D} arms are significant at the 1% level. No statistically significant impact is detected on the rate of women who deliver in health facilities.

Timely antenatal and postnatal care, as well as in-facility deliveries, were directly incentivized by the program. Table 3 also shows results of the impact of the interventions on related but non-targeted outcomes. One of the motivations for incentivizing early initiation of antenatal care is to increase the rate of women who complete the recommended series of four consultations during their pregnancies. As Column 5 shows, women in the treatment arms implementing the demand-side incentives are more likely to report receiving at least four consultations. The effect is statistically significant at the 5% level for the T_D arm but not significant for the T_{CHW+D} arm (p-value of 0.115). The results in column 6 indicate that the demand-side incentives did not only increase the rate of timely postnatal care but also the rate of women who received any postnatal consultation. The effects of 9.9 percentage points on the T_D arm and 8.5 percentage points on the T_{CHW+D} arm are statistically significant at the 1% level.

Results of the impact of the intervention on child growth monitoring are presented in the fourth column of Table 3. The indicator used is whether a child was measured in the 6 months preceding the survey to determine his or her nutritional status. We perform the analysis on the sample of children 6-59 months old of women in the follow-up sample of recently pregnant women.[17] There are no statistically significant differences between the treatment arms with respect to the rate of children who received growth monitoring services.

In sum, the CHW cooperative performance payments were not found to impact any of the target maternal and child health services. The demand-side in-kind transfers significantly increased timely prenatal and postnatal care but not in-facility delivery. Given the sharp increase in in-facility delivery rate among the control group from 79 percent in the baseline survey to 94 percent in the follow up survey, there might have been little scope for the CPBF interventions to have additional impact. Only for one outcome was there a statistically significant difference between the T_{CHW+D} and T_D group. This suggest there was no multiplicative effect when the two interventions were implemented jointly.

Impact on fertility and use of modern family planning methods

[17] We report the results for children of the follow-up sample because, as discussed in the previous section, attrition was unbalanced for the original sample of women with pregnancies prior to the baseline survey. We did however perform the analysis also for the larger sample of children of all women and found no evidence of impact of the program on rates of growth monitoring.

The CHW cooperative performance payments intervention rewarded cooperatives for family planning consultations of both new and regular users. The impacts of the program on family planning is estimated using the original sample of women who were pregnant shortly before the baseline survey. The two outcomes explored are an indicator for having had an additional pregnancy since the baseline interview and whether the women reported using modern contraceptive methods at the time of the follow-up survey. Because of the difference in attrition rates between the treatment arms, we present results also of regressions including controls for baseline characteristics of the women, their households and the CHWs in their villages as well as interactions of these controls with treatment assignments centered at sample means.

Overall, 56 percent of the women reported having an additional pregnancy after 2010 and fifty percent of the women report using some modern contraceptive method. As can be seen in Table 4, women in the T_{CHW} arm were more likely to have a pregnancy since baseline by six percentage points. The coefficient is significant at the 5% level in the regression specification without the controls. However, once the controls are added, the magnitude of the coefficient reduces to 2 percentage points and it is not statistically significant. We do not find a significant effect of neither the T_{CHW} nor the T_{CHW+D} treatments on use of modern method of family planning. Because the attrition rates were unbalanced between the treatment arms, we are not stating that there was no impact of the CHW cooperative performance payments on the use of modern family planning. However, we conclude that we cannot reject that there is no impact and we can reject large impacts of the performance payments on use of modern family planning.

Another check we conducted to assess difference in fertility among the treatment arms is to compare the characteristics of follow-up sample of women who were recently pregnant at the time of the follow-up survey. If the cooperative performance payments intervention had an impact on modern family planning use, we would expect to see differences in characteristics such as age and number of previous births among pregnant women in the different treatment arms. As reported in Table A3 in the appendix, the recently pregnant women in the sectors exposed to the performance payments (T_{CHW} and T_{CHW+D}) are similar to those in the other sectors. These similarities in characteristics also suggest there has been no impact of the CHW cooperative performance payments on use of modern family planning.

The demand-side intervention did not incentivize family planning consultations but it could theoretically impact use of family planning methods through its impacts on antenatal and postnatal consultations. We do not find an effect of the in-kind transfers on pregnancies since baseline. In the specification

without controls, we find a significant relationship between the intervention and reports of using modern family planning method. The 6 percentage point effect, that is significant at the 5% level, reduces to five percentage points when the controls are added and the statistical significance level drop to 10%. There is no impact found on the T_{CHW+D} group. For all other indicators considered in our analysis, we find similar outcomes for the T_D and the T_{CHW+D} groups. Therefore, we consider this result as weak evidence and cannot confidently conclude that there was indeed an impact of the demand-side in-kind transfers program on use of modern contraceptive methods.

Impact on CHW behavior and cooperative dynamics

The results presented above do not point to an impact of the CHW cooperative performance payments on the targeted outcome indicators. We performed further analysis to estimate whether having the cooperative payments conditional on the collective performance affects individual behavior by the community health workers. Theoretically, it could be that CHWs exerted greater efforts in response to the performance payments even if these efforts did not lead to increased or timely utilization of targeted health services by the communities they served.

There are different ways in which the CHW cooperative performance payments could also impact the interactions between cooperative members and the way the cooperatives are run. The performance determining the payments is measured at the cooperative level but the effort is exerted at the individual level in the different villages. On the one hand, this could lead to frictions if members are suspecting others are free-riding. On the other hand, it could lead to greater cooperation or positive pressure to perform if levels of effort exerted are observed by other members.

Panel A of Table 5 reports the impact of the intervention on four self-reported measures of CHW behavior. The CHWs reported spending an average of about 10 hours providing health services in a typical week. [18] The CHWs in the three treatment arms reported spending on average an hour more than what the CHWs in the control group reported. However, the differences are not statistically significant. There are also no statistically significant impacts detected on the reported number of households the CHWs visited in the month preceding the survey.

[18] CHWs were asked differently in the baseline and follow-up surveys regarding the time they spent on health activities. In the baseline, they were asked how many hours per day and how many days per week they work as a CHW. In the follow-up survey, they were directly asked how many hours they spend providing health services in a typical week.

The CHWs were also asked whether they seek advice from other CHWs. Overall, about 75 percent of CHWs declared frequently seeking advice from other members of their village community health team and 60 percent reported seeking advice from CHWs outside the village. CHWs in the T_{CHW} arm were less likely to report seeking advice from other CHWs in their village by 8 percentage points. The difference is statistically significant at the 10% level. No statistically significant impact was detected for the other treatment arms. There are also no statistically significant differences in the CHWs reports of seeking advice from CHWs outside their villages.

In Panel B of Table 5, results are presented on the impact of the interventions on reports of recently pregnant women regarding interactions with CHWs. A high percentage of women, 78, reported receiving information on antenatal care from a CHW during their most recent pregnancy. Women in the T_{CHW} arm were less likely to report receiving such advice by five percentage points. The effect is statistically significant at the 5% level. The women were also asked how many months pregnant were they when the CHWs became aware of their pregnancy. Interestingly, the women in the two treatment arms implementing the demand-side in-kind transfers reported the CHWs were aware of their pregnancy earlier than the women in the two other arms. While the difference is only about a third of a month, it is significant at the 1% level. It is likely that the women made the CHWs aware of their pregnancies earlier to make sure they were eligible for the transfers. Fifty-eight and 56 percent of women reported being referred or accompanied by a CHW to antenatal care and delivery respectively. Surprisingly, the rate of women who were referred or accompanied to deliveries is lower by five percentage points in the T_{CHW} arm, although this is one of the paid indicators. The difference is significant at the 10% level. A low rate of women, 24 percent, reported receiving information on postnatal care from the CHWs. In comparison to the control group, women in the T_{CHW+D} arm were eight percentage points more likely to report receiving such information. There were no statistically significant differences in the likelihood of women in the different treatment arm to report meeting a CHW in the past three months either in their homes or in the villages.

Results of the analysis of the impacts of the program on different cooperative-level outcomes are presented in Table 6. Cooperative presidents reported an average of 4.5 member meetings in the 12 months preceding the survey. There is no statistically significant difference between the treatment arms. The presidents also reported that the performance of cooperative members was internally

evaluated on average eight times in the year preceding the survey.[19] There is no evidence that the number of internal evaluations is impacted by tying CPBF payments to cooperative performance. We also find no impact of the interventions on indicators related to recruitment and retention of CHWs.

Because it is up to the cooperatives to decide how to distribute payments among their members, one way in which cooperatives can deal with potential free-riding is to distribute the payments according to personal performance. Most cooperatives distributed equal amounts to their members and 46 percent distributed amounts depending on performance. Counterintuitively, cooperatives in the T_{CHW} were less likely to report tying payment to performance by 20 percentage points (significant at the 5% level). When comparing the two arms implementing the performance payments to the two that do not, however, there is no statistically significant difference in tying member payments to performance.

Overall, the results indicate that the CHWs in the treatment arms implementing the cooperative performance payments scheme did not exert more effort than the other CHWs. If anything, there is weak evidence that the CHWs in the T_{CHW} arm exerted less effort. The CHWs in the T_{CHW+D} arm, though, have not behaved differently from those in the control arm. The results also suggest that there were no differences in the way the cooperatives were run and on movement of CHW in and out of the cooperatives.

Discussion

We find mixed results with respect to the impact of the interventions introduced as part of the Rwanda Community Performance-Based Financing program. On the one hand, the CHW cooperative performance payment scheme did not affect targeted outcomes, behaviors of CHWs as well as outcomes at the cooperative level. On the other hand, we find that the demand-side in-kind transfers scheme caused substantial increases in the rates of women who received timely antenatal and postnatal care. We find no synergies between the two interventions. Joint implementation of the interventions did not result in different outcomes then when only the demand-side incentive scheme was in place.

Rewarding users can improve outcomes if the gifts cause high enough increases in women's utility such that they will change their behaviors to become eligible for the gifts. The intervention might also change behavior by changing perceptions of women. For example, women might assign higher importance to timing of care, whether they are incentivized or not, after observing that resources have been invested

[19] Three cooperative presidents reported 40 or more annual internal evaluations of members. These observations were dropped as they seem unrealistic.

in rewarding early prenatal and postnatal care. Receiving the gifts might also improve women's general attitude toward the health centers.

The way in which the interventions were implemented, and deviations from the original program guidelines, are likely to affect how the incentive schemes impacted the results. In the case of the demand-side intervention, frequent stock outs of gifts were experienced by the health centers. Although the results are consistent with previous studies of schemes that incentivize health service utilization with conditional transfers, they are remarkable considering that most eligible women reported not receiving the transfers.[20] It is possible that women went to the health centers with the expectation to receive the gifts and only learned about the lack of gifts while already receiving the services. Although funding provided to health centers to procure the gifts stopped, the program itself was not announced to be terminated, so both health providers and users could have been under the impression that the program was ongoing.

As for the CHW cooperative performance payments, the financial rewards per service were reduced during the implementation because of budgetary constraints. For the CHWs to increase effort towards a targeted service, the reward has to be perceived as at least equal to the cost incurred by exerting the additional effort. The cost, for example, can be in terms of the time the CHW would have to spend away from household tasks or income-generating activities. As shown Table 2, the per-service incentive amounts have been continuously reduced. In the follow-up survey, CHWs were asked to report the amount received in their last CPBF quarterly payment, excluding dividends from the cooperatives' income-generating activities. The average reported amount was only about 7.3 USD. For reference, the GNI per capita was estimated to be 690 USD in 2014. This means that for an average Rwandan the CPBF payments would represent a very small change in income. The PBF scheme at health facilities, for comparison, increased staff salaries by 38 percent (Basinga, Gertler, et al. 2011). It could be that higher financial rewards per service would have resulted in the hoped increases in service utilization.

Another factor that could have further diminished the expected return to effort exertion by the CHWs is the transmission of the financial incentives through the cooperative structure. When CPBF payments were transferred to the cooperative, at least 70% of the payments had to be invested in the cooperatives' income-generating activities. It was up to the cooperatives to decide how to allocate the CPBF payments and dividends from the income-generating activities among an average of more than

[20] This is partially due to the timing of the follow-up survey months after the last funding was transferred to the health centers.

100 members. Therefore, the reward for an individual CHW does not depend only on her effort but also on the unobservable efforts of the other cooperative members in their perspective villages, the success of their income-generating activities and the cooperative's revenue allocation decisions. Moreover, focus group discussions conducted early during the implementation of the program revealed that CHWs were confused about the payment mechanisms of the CPBF program (Condo et al. 2014).

The study was not set up to evaluate the organization of community health workers in cooperatives and cannot identify their impact as the same organization was used in all study arms. There are ways in which the organization of CHWs in cooperatives is theorized to positively impact the performance of the CHWs. For example, the income received from the cooperatives might permit the CHWs to spend more time on health activities rather than on individual income-generating activities. The cooperatives might also enable sharing of health knowledge and collaboration. However, transferring the financial incentives through the cooperatives might not serve as an optimal platform for inducing individual effort by the CHWs in their perspective villages as it can weaken the link between efforts exerted and perceived rewards.

It is also important to keep in mind that the study compared outcomes between sectors in which cooperatives were paid for reporting health indicators and outcomes in sectors in which cooperatives were paid for performance on indicators (conditional on completed reports). The regular reporting by CHWs already orients CHWs towards the prioritized indicators. Given their health knowledge and available resources and time there might have been little scope for additional improvements in performance on these indicators. It could also be that as volunteers they have pro-social preferences they are intrinsically motivated to serve their communities and therefore are less likely to respond to financial incentives. Previous studies have shown that pro-social preferences might lead health providers to exert effort even in the absence of supervision and extrinsic rewards (for example, Reinikka and Svensson 2010, Leonard and Masatu 2010). Nevertheless, a large body of literature, including the studies on pay-for-performance schemes mentioned above, have shown that monetary and non-monetary rewards, as well as career opportunities can improve provision of public services (for example, Ashraf et al. 2014, Ashraf et al. 2014).

Consistent with other data sources, such as the Rwanda DHS, the data collected for the CPBF impact evaluation show overall increase in coverage of maternal and child health services as portrayed by the

increase in utilization by the control group.[21] Ongoing policies and newly introduced interventions were targeting the same outcomes. For example, in the duration of the study, the ministry of health introduced and scaled up a program of community-based provision of family planning methods directly by community health workers (Chin-Quee et al. 2016).[22] The other interventions might have already addressed the same constraints to utilization that the CPBF interventions did and leave little room to achieve additional marginal improvements in coverage. Nevertheless, we can to assign a causal impact of the demand-side transfers.

Another important factor to consider in the context of the CPBF program is that it was introduced in addition to the ongoing PBF program at the health facility level. The demand-side incentives improved indicators that were not impacted by incentivizing formal health providers. However, we cannot compare the effectiveness of incentivizing health providers versus only incentivizing users of the health care system as the all health centers received performance payments. It could be that there were synergies between the incentives to the facilities and the users. It is noteworthy though that we find an impact of the in-kind transfers although health centers could independently endow women with gifts in order to increase their performance with respect to incentivized indicators. As the number of countries in Sub-Saharan Africa that are introducing or scaling up pay-for-performance schemes to incentivize health providers is rapidly increasing (World Bank 2015), this study shows that incentivizing users can enhance the impact of these schemes on service utilization.

[21] For example, the rate of timely initiation of antenatal care increased from 63 percent in the baseline survey to 72 percent in the follow up survey. The shares of women who attended four antenatal consultation and of in-facility deliveries increased from 36 to 40 and from 79 to 94 respectively.

[22] The program was scaled up at the district level and therefore did not pose a threat to the internal validity of the experiment in which treatment was randomized at the sub-district level.

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Ethical Approval
Approvals for this study were obtained from the Rwanda National Ethics Committee and the National Health Research Committee. Informed consent was obtained from all study participants.

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Figure 1: Experimental design

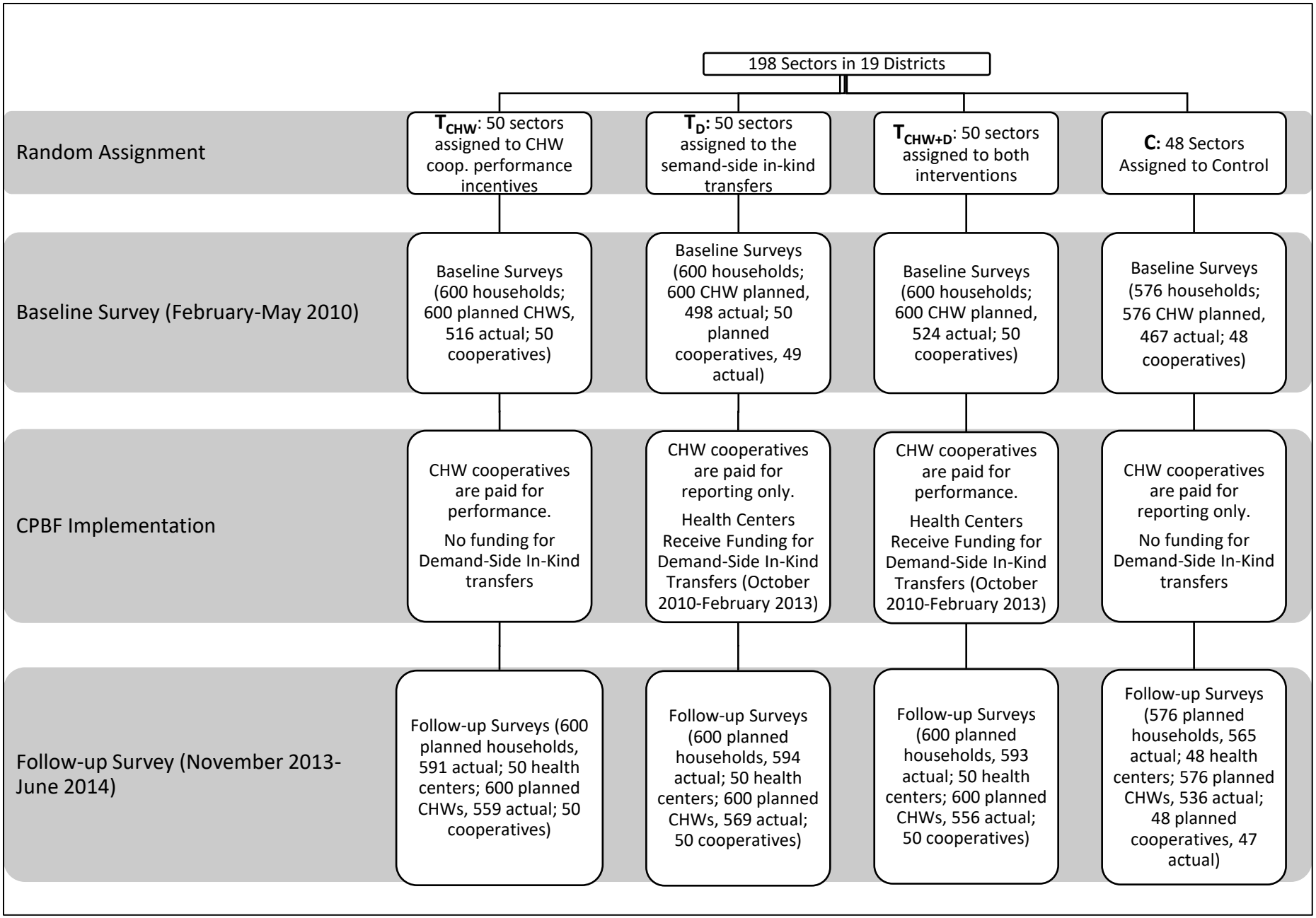

Table 1: Eligibility and value of in-kind incentives

Service	Eligibility [a]	Incentive Value Ceiling (in USD)	Suggested Incentive Package [b]
Antenatal Care	Initiation of antenatal care within the first 4 months of pregnancy	$5	Adult cloth and water treatment tablets or baby cloth package and water treatment tablets
Delivery	Delivery in Health Center	$6.67	Baby soap and baby shawl and baby bed sheets
Postnatal Care	Initiation of postnatal care within 10 days after delivery	$3.33	An umbrella and water treatment tablets or Adult cloths

[a] Women could not receive gifts for services received for more than one pregnancy in the duration of the program.

[b] As suggested by the CPBF Implementation Manual (2011).

Table 2: Unit fees (in USD) of targeted indicators by year for the CHW cooperative performance payments

Incentivized indicators	2010	2011	2012	2013	2014
Growth Monitoring: Children 6-59 months monitored for nutritional status	3.24	0.57	0.43	0.43	0.43
Timely Antenatal Care: women receiving first antenatal consultation within first 4 months of pregnancy	2.24	1.12	0.81	0.81	0.81
In-facility Delivery: assisted deliveries in health facilities	2.73	1.37	0.99	0.99	0.99
New Family Planning User: new users receiving consultation in health center	2.90	1.45	1.05	1.05	1.05
Regular Family Planning User: regular users of modern long-term methods of contraception	2.11	1.06	0.77	0.77	0.77

Source: Ministry of Health

Table 3: Impact of the performance incentives on use of targeted maternal and Child health services among recently pregnant women

	Targeted Outcomes				Non-Targeted Outcomes	
	(1) Timely ANC [a]	(2) In-Facility Delivery [b]	(3) Timely PNC [c]	(4) Growth Monitoring [d]	(5) 4 or more ANCs [e]	(6) Any PNC [f]
T_D: Demand-side incentives	0.093***	0.013	0.086***	0.001	0.062**	0.099***
	(0.025)	(0.013)	(0.028)	(0.037)	(0.029)	(0.027)
T_{CHW}: CHW cooperative incentives	0.013	0.019	-0.025	0.009	0.036	-0.005
	(0.028)	(0.013)	(0.024)	(0.034)	(0.033)	(0.025)
T_{CHW+D}: Demand-side and cooperative incentives	0.080***	-0.013	0.070***	-0.063	0.051	0.085***
	(0.025)	(0.014)	(0.025)	(0.042)	(0.032)	(0.027)
Control group mean	0.723	0.942	0.134	0.769	0.399	0.166
p-value: $T_D = T_{CHW+D}$	0.543	0.054*	0.582	0.108	0.689	0.644
p-value: $T_{CHW} = T_{CHW+D}$	0.008***	0.024**	0.000***	0.047**	0.635	0.001***
p-value: $T_D = T_{CHW} = T_{CHW+D} = 0$	0.000***	0.098*	0.000***	0.126	0.185	0.000***
Number of observations	2,334	2,334	2,313	1,195	2,323	2,333

Outcomes measured at the follow-up survey in 2013/14 through interviews with the follow-up sample of recently pregnant women. Standard errors are clustered at the sector level and are reported in parentheses. All regressions include randomization block dummies as controls.

[a] Initiated antenatal care within first four months of pregnancy; sample of women with recent pregnancies that resulted in live births.

[b] Delivered in a health facility; sample of women with recent pregnancies that resulted in live births.

[c] Initiated postnatal care within ten days after delivery; sample of women with recent pregnancies that resulted in live births.

[d] Child was measured to assess his/her nutritional status in the preceding 6 months; sample of children 6-59 months of women with recent pregnancies.

[e] Four or more antenatal consultations during pregnancy; sample of women with recent pregnancies that resulted in live births.

[f] Any postnatal consultation after delivery; sample of women with recent pregnancies that resulted in live births.

* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 4: Impact of the performance incentives on use of modern family planning methods and fertility among baseline women

	Pregnancy since baseline		Currently using modern FP method	
	(1)	(2)	(3)	(4)
T_D: Demand-side incentives	0.002	-0.022	0.058**	0.051*
	(0.028)	(0.028)	(0.027)	(0.028)
T_{CHW}: CHW cooperative incentives	0.057**	0.024	-0.004	0.018
	(0.026)	(0.027)	(0.031)	(0.034)
T_{CHW+D}: Demand-side and cooperative incentives	0.012	-0.001	0.013	0.004
	(0.028)	(0.029)	(0.029)	(0.033)
Control group mean	0.536	0.536	0.489	0.489
Controls and interactions of treatment arms with controls centered at sample mean	No	Yes	No	Yes
p-value: $T_D = T_{CHW+D}$	0.744	0.477	0.096	0.093*
p-value: $T_{CHW} = T_{CHW+D}$	0.098*	0.337	0.570	0.804
p-value: $T_D = T_{CHW} = T_{CHW+D} = 0$	0.099*	0.213	0.069*	0.164
Observations	2,157	1,899	2,154	1,896

Outcomes measured at the follow-up survey in 2013/14 through interview with the original sample of women who were pregnant prior to the baseline survey. All regressions include randomization block dummies as controls. Columns 1 and 3 include background characteristics from the baseline survey in 2010: women's age, marital status, schooling level, number of household members, number of prior births, distance to health center, age of CHW in charge of maternal and neonatal health in the village, number of years of experience of CHW. The controls are interacted with treatment assignment, following the procedure suggested by Lin (2015).

Standard errors are clustered at the sector level and are reported in parentheses.

* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 5: Impact of the performance incentives on CHW behavior and interactions with women

	T_D		T_{CHW}		T_{CHW+D}		Control group mean	p-value: $T_D = T_{CHW+D}$	p-value: $T_{CHW} = T_{CHW+D}$	p-value: $T_D = T_{CHW} = T_{CHW+D} = 0$	N
Panel A: Reports by CHWs in charge of maternal and child health											
Hours spent providing health services in a typical week	1.139	(0.813)	1.032	(0.814)	1.072	(0.788)	9.135	0.934	0.960	0.435	2,201
Households visited in the past month	-4.127	(3.027)	-0.975	(3.036)	-3.904	(3.066)	36.02	0.943	0.350	0.437	2,198
Frequently seek advice from other CHWs in village	-0.065	(0.041)	-0.082*	(0.045)	-0.002	(0.041)	0.791	0.130	0.086*	0.135	2,200
Frequently seek advice from other CHWs outside the village	-0.006	(0.044)	-0.020	(0.050)	0.046	(0.044)	0.607	0.220	0.183	0.494	2,201
Panel B: Reports by women with recent pregnancies											
Received information on antenatal care from CHW	0.004	(0.028)	-0.054**	(0.027)	0.005	(0.027)	0.778	0.957	0.013**	0.033**	2,325
Months pregnant when CHW became aware of pregnancy [a]	-0.338***	(0.107)	-0.153	(0.117)	-0.354***	(0.113)	4.069	0.786	0.058*	0.005***	1,781
CHW refer or accompany to ANC	0.015	(0.032)	-0.007	(0.031)	0.015	(0.034)	0.577	0.998	0.491	0.854	2,318
CHW refer or accompany to delivery	-0.017	(0.028)	-0.053*	(0.028)	-0.028	(0.030)	0.556	0.700	0.412	0.299	2,202
Received information on postnatal care from CHW	0.050*	(0.027)	-0.024	(0.023)	0.077***	(0.027)	0.236	0.320	0.000***	0.000***	2,317
Met with a CHW in the past 3 months	0.026	(0.025)	-0.016	(0.024)	0.020	(0.027)	0.746	0.832	0.192	0.358	2,317
Met with a CHW at home in the past 3 months	0.006	(0.031)	-0.038	(0.029)	-0.010	(0.029)	0.538	0.604	0.315	0.433	2,317

Outcomes measured at the follow-up survey in 2013/14. Standard errors are clustered at the sector level and are reported in parentheses. All regressions include randomization block dummies as controls.

[a] The question was only asked to women who received information on ANC from a CHW.

* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 6: Impact of the performance incentives on cooperative dynamics

	T_D		T_{CHW}		T_{CHW+D}		Control group mean	p-value: $T_D = T_{CHW+D}$	p-value: $T_{CHW} = T_{CHW+D}$	p-value: $T_D = T_{CHW} = T_{CHW+D} = 0$	N
Cooperative meetings in the past 12 months	0.060	(0.694)	0.659	(0.700)	-0.299	(0.700)	4.426	0.603	0.166	0.567	196
Internal performance assessments in past 12 months	0.887	(0.857)	0.355	(0.865)	0.599	(0.859)	7.383	0.736	0.775	0.764	194
Vacant positions	0.164	(0.254)	-0.325	(0.254)	0.183	(0.256)	0.532	0.938	0.044**	0.156	197
Members recruited in past 12 months	0.565	(0.980)	1.651*	(0.982)	0.180	(0.989)	5.213	0.696	0.133	0.331	195
Members dismissed in past 12 months	0.109	(0.746)	-0.684	(0.745)	-0.728	(0.750)	1.447	0.263	0.952	0.558	196
Any member dismissed in past 12 months	-0.017	(0.098)	-0.141	(0.098)	-0.095	(0.099)	0.362	0.427	0.633	0.437	197
Members resigned in past 12 months	0.395	(0.964)	0.550	(0.993)	0.370	(0.981)	3.806	0.979	0.853	0.954	140 [a]
Payments distributed according to performance	-0.101	(0.092)	-0.202**	(0.092)	-0.024	(0.093)	0.532	0.405	0.052*	0.119	196

Outcomes measured at the follow-up survey in 2013/14 through interviews with cooperative presidents. All regressions include randomization block dummies as controls.

[a] The outcome variable is missing for many cooperatives because of a skip pattern error in the questionnaire.

* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Appendix

Table A1: Baseline Characteristics of the sample of Women with Recent Pregnancies by Treatment

	Treatment Arm [a]				P-values of Balance Tests [b]				Obs.
	T_D	T_{CHW}	T_{CHW+D}	C	T_D -C	T_{CHW} -C	T_{CHW+D} -C	Joint	
Province									
South	0.18	0.18	0.2	0.19	0.92	0.92	0.88	0.99	2,376
East	0.28	0.3	0.28	0.27	0.92	0.75	0.92	0.99	2,376
West	0.28	0.28	0.3	0.27	0.92	0.92	0.75	0.99	2,376
Distance to facility [c]	4.46	4.1	4.13	4.25	0.57	0.70	0.72	0.79	2,360
Household members	5.05	4.95	5.05	4.99	0.65	0.74	0.63	0.83	2,376
Age	28.07	27.82	28.23	28.74	0.11	0.03**	0.23	0.16	2,376
Married	0.91	0.92	0.9	0.91	0.82	0.77	0.59	0.82	2,329
Education Level									
No School	0.16	0.18	0.18	0.19	0.14	0.53	0.60	0.52	2,318
Primary	0.72	0.69	0.69	0.67	0.10	0.52	0.46	0.43	2,318
Secondary	0.12	0.13	0.13	0.13	0.62	0.93	0.76	0.96	2,318
Covered by Mutuelle	1.07	1.1	1.11	1.12	0.06*	0.33	0.72	0.19	2,368
Ever used modern family planning method	0.4	0.37	0.41	0.41	0.83	0.33	0.95	0.72	2,376
Number of lifetime births	3.11	2.95	2.97	3.1	0.98	0.30	0.38	0.53	2,368
Number of living children	2.78	2.63	2.67	2.78	0.96	0.22	0.41	0.48	2,364
Care during most recent pregnancy									
At least one ANC visit	0.97	0.99	0.98	0.98	0.37	0.25	0.90	0.14	2,227
First ANC in first 4 months of pregnancy	0.61	0.66	0.61	0.63	0.76	0.44	0.75	0.67	2,203
Four or more ANC visits	0.36	0.36	0.38	0.36	0.91	0.84	0.52	0.92	2,216
In-facility skill attended delivery	0.76	0.8	0.81	0.79	0.36	0.90	0.63	0.50	2,219
Received gift for ANC	0.06	0.04	0.05	0.04	0.16	0.99	0.49	0.46	2,211
Received gift for in-facility delivery	0.04	0.06	0.03	0.03	0.23	0.06*	0.42	0.26	1,728
Received gift for PNC	0.01	0.01	0.02	0.02	0.34	0.55	0.61	0.41	1,051
Growth monitoring of children 6-59m in past 6 months	0.55	0.47	0.49	0.50	0.40	0.60	0.80	0.43	1,549

[a] Treatment arms: T_D denotes demand-side in-kind transfers; T_{CHW} denotes cooperative performance payments; T_{CHW+D} denotes the combined intervention and C denotes the control arm.

[b] P-values of t-tests for the difference between the treatment arms and control, and for the F test of joint significance of the differences. The tests are based on OLS regressions with randomization block dummies and standard errors clustered at the sector level.

[c] Reported by the community health workers in the village.

*significant at 10% level, ** significant at 5% level, *** significant at the 1% level.

Table A2: Baseline Characteristics of the sample of CHWs in charge of maternal and neonatal health and cooperatives by Treatment

	Treatment Arm [a]				P-values of Balance Tests[b]				
	T_D	T_{CHW}	T_{CHW+D}	C	T_D -C	T_{CHW} -C	T_{CHW+D} -C	Joint	Obs.
i. Community Health Workers									
Female	0.87	0.86	0.87	0.84	0.20	0.40	0.32	0.61	2,000
Age	38.0	39.7	39.6	38.9	0.21	0.38	0.33	0.08*	1,990
Married	0.89	0.87	0.86	0.86	0.11	0.42	0.85	0.36	2,002
Education above primary level	0.38	0.4	0.34	0.4	0.54	0.83	0.07*	0.26	1,970
Years of experience as CHW	2.40	2.95	2.48	2.99	0.06*	0.92	0.10	0.11	1,993
Households in charge of	107	123	112	115	0.27	0.32	0.75	0.22	1,849
Households visited in the past month	26.9	30.0	26.8	27.1	0.96	0.55	0.95	0.93	1,990
Hours per week spent on health activities	18.6	18.2	15.7	16.6	0.26	0.38	0.58	0.30	1,977
Training in the preceding 12 months	0.78	0.76	0.77	0.76	0.59	0.95	0.72	0.94	1,962
Topics of training									
Antenatal and postnatal care	0.56	0.51	0.53	0.47	0.06*	0.26	0.16	0.26	1,978
Referral for delivery or danger signs	0.56	0.54	0.54	0.49	0.14	0.22	0.27	0.48	1,978
Newborn care	0.44	0.41	0.38	0.38	0.22	0.51	0.94	0.51	1,977
ii. Cooperatives									
Cooperative located at the health center	0.84	0.88	0.8	0.85	0.82	0.75	0.47	0.76	196
Number of villages in catchment area	32.57	33.37	45.88	34.35	0.81	0.90	0.12	0.22	189
Population in catchment area (In thousands)	18.03	19.20	21.68	20.67	0.38	0.60	0.71	0.61	109
Active cooperative members	98.02	117.6	113.55	91.45	0.64	0.07*	0.11	0.20	183
Recruited members in past 12 months	33.95	39.92	35.67	32	0.82	0.37	0.66	0.83	167
Dismissed members in past 12 months	1.82	3.17	1.98	1.69	0.90	0.13	0.76	0.43	156
Resigned members in past 12 months	1.76	2.43	1.64	1.66	0.93	0.50	0.99	0.89	158
Cooperative meetings in past 12 months	7.35	7.56	7.02	8.17	0.36	0.50	0.20	0.63	196
Total income for 2009 (in 1000 RWF)	773	747	1347	1152	0.35	0.31	0.62	0.34	184
Total expenditure for 2009 (in 1000 RWF)	321	433	283	294	0.80	0.21	0.92	0.50	182

[a] Treatment arms: T_D denotes demand-side in-kind transfers; T_{CHW} denotes cooperative performance payments; T_{CHW+D} denotes the combined intervention and C denotes the control arm.

[b] P-values of t-tests for the difference between the treatment arms and control, and for the F test of joint significance of the differences. The tests are based on OLS regressions with randomization block dummies and standard errors clustered at the sector level.

*significant at 10% level, ** significant at 5% level, *** significant at the 1% level

Table A3: Characteristics of the follow-up sample by Treatment Arms

	Treatment Arm [a]				P-values of Balance Tests [b]				
	T_D	T_{CHW}	T_{CHW+D}	C	T_D -C	T_{CHW} -C	T_{CHW+D} -C	Joint	Obs.
Women with pregnancies shortly prior to the survey									
Household members	5.08	5.33	4.98	5.22	0.23	0.39	0.05*	0.04**	2,343
Age	29.0	29.1	28.7	28.9	0.81	0.63	0.54	0.75	2,321
Married	0.90	0.88	0.90	0.89	0.60	0.58	0.68	0.67	2,324
Education Level									
No School	0.15	0.14	0.12	0.11	0.06*	0.11	0.59	0.20	2,312
Primary	0.72	0.71	0.72	0.76	0.12	0.04**	0.11	0.18	2,312
Secondary	0.13	0.15	0.16	0.13	0.98	0.33	0.11	0.28	2,312
Covered by Mutuelle	1.05	1.05	1.06	1.04	0.54	0.61	0.12	0.48	2,340
Number of lifetime births	2.99	3.22	2.94	3.18	0.11	0.76	0.07*	0.10	2,343
Number of living children	2.74	2.93	2.74	2.93	0.08*	0.97	0.13	0.16	2,343
Children 6-59 months old of the women with pregnancies shortly before the follow-up survey									
Female	0.55	0.56	0.50	0.54	0.76	0.52	0.41	0.49	1,185
Age (in months)	38.5	37.0	36.9	37.2	0.19	0.82	0.73	0.27	1,195

[a] Treatment arms: T_D denotes demand-side in-kind transfers; T_{CHW} denotes cooperative performance payments; T_{CHW+D} denotes the combined intervention and C denotes the control arm.

[b] P-values of t-tests for the difference between the treatment arms and control and for the F test of joint significance of the differences. The tests are based on OLS regressions with randomization block dummies and standard errors clustered at the sector level.

[c] Reported by the community health workers in the village.

*significant at 10% level, ** significant at 5% level, *** significant at the 1% level.

Table A4: Attrition of baseline women

	Re-interview of Women of the original sample [a]		
	(1)	(2)	(3)
T_D: Demand-side incentives	-0.015	-0.012	-0.012
	(0.013)	(0.014)	(0.013)
T_{CHW}: CHW cooperative incentives	-0.036**	-0.041***	-0.043***
	(0.015)	(0.016)	(0.016)
T_{CHW+D}: Demand-side and cooperative incentives	-0.040**	-0.041**	-0.041**
	(0.016)	(0.016)	(0.016)
Control group mean	0.937	0.937	0.937
Strata Dummies	Yes	Yes	Yes
Controls [b]	No	Yes	yes
Interactions of treatment arms with controls centered at sample mean [c]	No	No	Yes
p-value: $T_D = T_{CHW} = T_{CHW+D} = 0$	0.034	0.016	0.013
p-value on joint F-test for interactions (T_D)			0.503
p-value on joint F-test for interactions (T_{CHW})			0.536
p-value on joint F-test for interactions (T_{CHW+D})			0.480
Number of observations	2,376	2,259	2,259

Standard errors are clustered at the sector level and are reported in parentheses.

[a] Women that gave birth shortly before the baseline survey.

[b] Controls included**:** age, marital status, number of household members, educational level, number of births, mutuelle (Community based health insurance).

[c] Comparison of attrition patterns across treatment arms following the standard operation procedure described by Lin (2015)

* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.