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Impact of Performance Based Financing in Rwanda: Health Facility Level Analysis.

Paulin Basinga, Paul J. Gertler, Agnes Binagwaho, Agnes L.B. Soucat, Jennifer R. Sturdy and Christel M.J. Vermeersch

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Impact of Performance Based Financing in Rwanda: Health facility level analysis.

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Abstract

As a post-conflict country, the human resource crisis is more critical in Rwanda. In the public health system, the few personnel that are available are poorly motivated, which can explain in part an increasing shift of physicians from public health to the private sector. This lack of motivated and sufficient human resource in health facilities contributes to the poor quality of services delivered. The Ministry of Health has taken great lengths to accomplish the goal of motivating health workers and retaining them in rural areas through a unique policy known as "Performance-Based Financing for health services (PBF)". This study assesses the impact of the Performance-Based Financing intervention the maternal and child health services in Rwanda. Results show that higher payments provide more high-powered incentives. In addition, activities that are more in the control of providers and depend less on patient decision responded to the incentives.

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1 INTRODUCTION

1.1 BACKGROUND

Rwanda is a small, landlocked country in Sub-Saharan Africa with a population of approximately 9 million and a per capita GDP of approximately US$250. Population density is very high with over 345 inhabitants per square kilometer [1]. The 1994 genocide decimated Rwanda's fragile economic base, destroyed a large share of the country's human capital, and eroded the country's ability to attract private sector investment. Close to one million people died and a large number of people became refugees. Following the genocide, poverty dramatically increased—particularly among women—reaching 78% of the population in 1994 [2].

In the health sector, the genocide destroyed Rwanda's heath infrastructure. By 2005, the county was in a health crisis for lack of critical human resources, with only 1 doctor for every 50,000 inhabitants and 1 nurse for every 3,900 inhabitants [1]. The crisis also impacted the quantity of health care workers available, where a huge disparity exists between urban and rural Rwanda, but the country has made a remarkable transition from reconstruction to development over the past fifteen years. During reconstruction, the Government of Rwanda focused on rebuilding institutions, which led to significant improvements in economic outcomes and social indicators. Rwanda has also made substantial progress toward the Millennium Development Goal (MDG) targets.

Impressive results have been achieved in the social sectors: primary school enrollment reached 92 % in 2006 and completion rates increased to 55 percent in 2005. HIV prevalence is at 3% and is decreasing [3] . Rwanda does have a good record on childhood vaccination. Only 3% of children receive no vaccines, yet 25% of children ages 12-23 months are not fully vaccinated. There is a 10% dropout rate for DPT and 13% for polio vaccination [4]. Infant mortality has declined since 1980, but the 1994 genocide and its aftermath complicated the situation. Infant mortality rate increased from 85 deaths per 1,000 live births in 1992 to 107 deaths per 1,000 live births in 2000. Between 2000 and 2005, many proven and effective interventions to decrease infant mortality have been implemented in Rwanda, and by 2005, the situation has improved. The infant mortality rate dropped to 86 deaths per 1,000 live births.

Before 1990, the maternal mortality ratio was declining (from 611 deaths per 100,000 live births to 500 in 1992) in response to the full implementation of primary health care in Rwanda [5]. Maternal mortality has declined since the 1994 genocide. However, the level of maternal mortality is still high compared to other developing countries. Between 1995 and 2000, there were approximately 1,071 maternal deaths per 100,000 live births [6]. Current estimates indicate that between 2000 and 2005 the maternal mortality rate in Rwanda was 750 per 100,000 live births (DHS unadjusted ratio). The ratio has dropped substantially compared with the 2000. Most maternal deaths occur during child birth, and there is substantial evidence to suggest that if delivery is assisted by a trained health attendant, the impact on maternal health is improved significantly [7-10].

1.2 STATEMENT OF THE PROBLEM

1.2.1 Human Resource for Health Crisis

As a post-conflict country, the human resource crisis is more critical in Rwanda. During the genocide of 1994, much of health infrastructure was destroyed, and there was a massive loss of human resources (many were killed while others left the country). The reconstruction process after the genocide has faced many challenges, the health sector being one of the more major ones. In the public health system, the few personnel that are available are poorly motivated, which can explain in part an increasing shift of physicians from public health to the private sector. This lack of motivated and sufficient human resource in health facilities contributes to the poor quality of services delivered.

The number of qualified doctors and nurses across the country is insufficient. Available data on the distribution of health care providers in Rwanda shows a large disparity between districts (regions) and between rural and urban areas, a phenomenon that can be explained by low basic salaries and the lack of an effective incentive structure to favor rural areas. Currently, only 17% of nurses are working in rural areas. There is a concentration of health professionals within the richest region of the country. The capital, Kigali City, accounts for 75 percent of all doctors and about 60 percent of all nurses in the country, even though it accounts for only 15% of the population. There is 1 nurse per

2,000 Kigali habitants and 53% of all nurses in the city work at the "Centre Universitaire Hospitalier de Kigali.

Another issue is the growth of the private health care sector—especially in urban areas—which has resulted in an "internal brain drain" of health workers from the public sector. Competition for scarce, skilled human resources has resulted in an unstable labor market, with many providers moving from the public to the private sector or donor-funded projects where they can earn higher salaries and benefits. Results from a recent evaluation revealed that physicians employed by NGOs to delivery HIV/AIDS services are paid almost six times as much as physicians employed by the Ministry of Health [11].

To improve the provision of quality maternal and child health services for the quest of attaining the Millennium Development Goals, the government of Rwanda had the challenge to adopted and implemented keys strategies that will improve coverage of keys services and also improve provider's motivation.

1.2.2 Government Response to Problem

On the supply side of health services, the Government of Rwanda, through the Ministry of Health (MoH), has tried to identify different methods for increasing the availability of health care workers to ensure adequate staffing of health facilities, especially in the rural areas. Since the genocide in 1994, Rwanda has scaled-up the training of nurses by reopening the nursing school and creating the Kigali Health Institute which trains A1 nurses.

Unfortunately, there was an over production of A2 nurses[1] in the last few years, and the government has not been able to absorb them into the health workforce. The Rwandan Nurses Association has documented over a thousand unemployed A2 nurses [11]. However, other important cadres of workers, namely doctors, laboratory technicians and pharmacists, remain scarce in the Rwandan health system. The only medical school in

[1] In the Rwandan health system, healthcare providers are classified according to their level of training and experience. A3 nurses have limited or no secondary education and minimal health training. They work primarily as auxiliary nurses. A2 nurses, who make the majority of the health workforce, have completed secondary education in a nursing school. A1 nurses are the most highly trained, having completed high school and taken three additional years of nursing training.

Rwanda at the National University of Rwanda reopened in 1995. Since 1999, the faculty has produced on average 20 medical doctors per year.

Due the fact that the government has a limited budget to cover staffing the entire health sector, it has allowed contractual mechanisms for employing health personnel. The MOH hires approximately 62% of the health workforce, and pays their salaries directly through the health district offices [12]. The remaining 38% of employees at public health sites are paid through a variety of mechanisms, including direct contracts with religious-based health centers (24%), and contracts with NGOs, volunteer organizations, or districts (14%).

As a critical underlying cause of health workers' lack of motivation has been the salary and incentive structure. The government has since adopted a human resource policy which aims to decrease the number of unskilled care providers and increase the skilled by providing them good salaries, incentives, and other work benefits. The Ministry of Health has taken great lengths to accomplish the goal of motivating health workers and retaining them in rural areas through a unique policy known as "Performance-Based Financing for health services (PBF)". The Rwanda PBF scheme involves the transfer of conditional funds to public health care clinics to supply a package of basic health services to the population. The health facility is totally autonomous to use the funds received from the PBF at its discretion without any interference from the district or central level. Each health center has a management committee representing all providers and which provides guidelines for the use of the funds.

Also, improving financial access of the population, especially the poor, to proven, cost-effective health and nutrition interventions was one of the main challenges reported by the government in reducing mortality and reaching millennium development goals. Great efforts have been put into risk-pooling mechanisms since 1999 through the design and implementation of pilot community health insurance schemes (mutuelle). Presently, all health centers have a *mutuelle,* and nation-wide coverage is around 85% (in 2008) compared to 7% in 2003. This resulted in an important increase in health service utilization. Nonetheless, the quality of health services remains an important issue.

1.2.3 Why the present study?

The shortage of qualified and motivated health providers has had a significant impact on the availability of quality maternal and child health services in Rwanda. The low uses of available health services by the population within the catchment area of health facilities and the low quality of services provided by these health facilities in Rwanda are two factors that contribute to high maternal and child mortality. One of the key objectives of the PBF program is to improve not only the quantity of services but also their quality. There is substantial evidence to suggest that the quality of services produced is related to the well being of the population receiving the services. Some studies have measured both the structural and process components of the quality of services and predicted their use [13,14] and the health status of the population [15,16]. It can be argued that if Performance-Based financing increases the quality of health services, then the utilization of services will increase in the catchment area of contracted facilities. And if PBF has contributed to an increase in the use of keys maternal and child health services, there is reason to believe that PBF will have an impact on maternal mortality in the long run. Also, as Rwanda is scaling up the PBF intervention nationally, the impact evaluation will provide concrete recommendations to the Ministry of Health for program improvement. The purpose of the present study is to assess the impact of the PBF intervention on the maternal and child health service in Rwanda.

1.3 OBJECTIVES OF THE RESEARCH

This study assessed the impact of the Performance-Based Financing intervention the maternal and child health services in Rwanda. The study will add to the existing literature by providing strong evidence from a rigorous impact evaluation design on the net effect of PBF intervention on the quantity and quality of maternal health services in poor country settings.

Estimating both the net effect of quantity (structural quality measured by the staffing of health facilities and the availability of drug, equipment, infrastructure, and laboratory tests) and keys maternal and child services will fill an important gap in the scientific literature as no study has yet been published on this specific topic.

2 LITERATURE REVIEW

The present chapter provides a literature review which will serve as a foundation for the analysis and interpretation of the results of the present study. Five main sections are discussed in the chapter. The Rwanda health system is first described, followed by an extensive description of the PBF program as implemented in Rwanda. A review of the available evidence on the impact of PBF on health outputs and outcomes in developing countries is also presented, especially those which have addressed maternal and child health.

2.1 RWANDA HEALTH SYSTEM

This section provides a context in which to view the findings of the impact evaluation of the Performance-Based Financing intervention/initiative and will guide the formulation of recommendations to the Ministry of Health. Health services in Rwanda are generally provided through the public sector, government-assisted health facilities, private health facilities, and traditional healers. The private sector is not quite developed in Rwanda. Of all available private services, 70% are located in Kigali city. We will describe here the district and health center levels as they are the ones providing more than 90% of health care services and are directly impacted by the Performance-Based Financing intervention.

Just after the war and genocide, Rwanda immediately started to rebuild and reform its health care system and to train health care professionals. In February 1995, the Ministry of Health launched its health sector reform initiative according to the declaration of Lusaka, which was adopted in 1996 by the Government of National Unity. The objective of this initiative was to improve the well-being of the population by ensuring that the health care system provides quality services throughout the country and that these services are accepted by and accessible to a majority of the population [17].

2.1.1 Government Decentralization 2006-2008

The health system in Rwanda was organized in a pyramidal structure. At the base of the pyramid is the health care center; the intermediate level comprises district hospitals, and at the top of the pyramid is the referral hospital. In 2006, the government undertook major reforms to increase the coverage of primary health care. Those actions included:

Administrative reforms which led to the disappearance of the 'Health District' and creation of "administrative districts" which are autonomous from the central level and effectively operational in all development sectors, including health. Public administrative reforms led to a strong reduction of manpower at the central Ministry of health and emphasis of district level activities. Expanded coverage of the community health insurance scheme with a national subsidy for those too poor to pay. Rolling out of performance-based financing for health centers and district hospitals and an introduction of community performance-based financing. Following the decentralization policy, there are currently a total of 30 administrative districts, each with at least one district hospital. The health centers provide primary health care including out-patient and in-patient services, preventive services such as immunizations, and supervision of community health workers. At the intermediate level, district hospitals offer a complementary package that includes most in-patient services, surgery, and management of complicated cases such as severe malaria. The highest level is the national referral hospital, which has high-skilled health workers such as specialists and manages most referred cases that cannot be handled at the district level. By the end of 2007, there were 38 operational district hospitals, 4 national referral hospitals, and 4 health centers being upgraded to become district hospitals. At the same time, there are 401 health centers, of which 38 are adjacent to each of the district hospitals. The current distribution of facilities results in about 85% of the population living within one and half hours of a primary health care unit [17].

The decentralized level consists of 30 administrative districts. The Health, Family Promotion, and Protection of Children's Rights Unit of the administrative district is responsible for establishing a district administrative counsel that oversees health

institutions in the district such as the district hospital, mutual health insurance, district pharmacy, and HIV/AIDS control committee. Each administrative district has at least one district hospital. The principal function of district hospitals is to provide care for patients referred by the primary health care facilities. Although the essential roles of a hospital are treatment and rehabilitation, the district hospital is also responsible for implementing and supporting disease prevention in its catchment area. The hospital management team participates in planning activities for the health district and supervising district health personnel.

Districts hospitals play an important role in the implementation of the PBF at the health-center level as they are responsible for technical supervision. As described later in the document, district hospital supervisors perform evaluative and formative supervision of health centers at least once each quarter during the course of the program. Clinical/technical supervision of the health center is carried out by a team from the district comprising physicians, midwives, and registered nurses. While administrative supervision is undertaken by teams that include administrative and financial supervisors.
At the third level of the public health sector are several primary health care facilities (health center, health post, and dispensary).

Health centers are responsible for providing what the government has defined to be the Minimum Package of Activities at the peripheral level (MPA), while the district hospitals provide the complementary package of activities (CPA)[1].

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[1] The minimum package of activities (MPA) offered at the health center level includes: Promotional activities, such as information, education, and communication (IEC), psychosocial support, nutritional activities related to small farming and food preparation, community participation, managing and financing of health services, home visits, and hygiene and sanitation in the catchment area around the health center. Preventive activities cover premarital consultation, antenatal care, postpartum care for the mother and child, family planning counseling and services, school health, and epidemiologic surveillance activities. HIV services (counseling, etc..) are being integrated in the package as well. Curative activities, comprising consultations, management of chronically ill patients, nutritional rehabilitation, prescription or administration of medicines, observation.

The complementary package of activities (CPA) for district hospitals includes activities 1 and 3 of the minimum package of activities for the peripheral level but emphasizes treating referred cases. Additional activities under the CPA include the following: Prevention, including preventive consultations for referred cases and ANC consultations for at-risk pregnancies; family planning, with the provision of all methods for referred cases, including female and male sterilization; curative care, including management of referred cases, referrals for tertiary-level care, management of difficult labor, medical and surgical emergencies, minor and major surgical interventions, inpatient care, laboratory testing, and medical imaging and management, including the training of paramedical personnel in district schools and collaboration with the district work group for continuing education and supervision activities.

The MPA includes complete and integrated services. These encompass curative, preventive, promotional, and rehabilitative health services. The PBF program was implemented at the health center level and at the hospital level (supervision of health center). Each participating health center was responsible for contracting health posts and privates health centers in its catchment area for specifics services offered. We describe later that our sample comprises only health centers.

Health posts are health facilities with a package of activities reduced from that offered at health centers and are assigned a catchment population similar to that of a health center (approximately 20,000 on average). Health posts tend to be established in areas that are far from main health centers and provide services limited to curative out-patient care, certain diagnostic tests, child immunization, growth monitoring for children under five years, antenatal consultation, family planning, and health education.

2.2 PERFORMANCE-BASED FINANCING PROGRAM IN RWANDA

Performance-Based Financing (PBF) started in Rwanda as early as 2001[2] [18]. The concept was developed by nongovernmental organizations (NGOs) working in the health sector in Rwanda who felt that, although they paid health workers a 'bonus' salary supplement, the outputs of the health services were stagnating and in some cases even deteriorating. In addition, NGOs were tempted to implement the published successful experience of Cambodia and other countries in contracting health services [19]. This led to the introduction of PBF for health services in Rwanda, an initiative that links measurable indicators with financial incentives for health workers who are paid according to their actual performance, rather than fixed bonuses [20] .

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[2]The present description of the Rwanda experience is based on numerous works done by keys implementers of the Rwanda PBF program, but mainly: Louis Rusa, (National PBF Coordinator-Ministry of Health Rwanda), Gyuri Fritsche, (Health Care Financing Specialist-Management Sciences for Health), Bruno Meesen (Institute of Tropical Medicine Antwerp/ Belgium), Musango Laurent (Rwanda School of Public Health / WHO Africa Region), and others. We borrow most of the information from "Gyuri Fritsche Musango Laurent. Provider Payment Mechanisms using Performance-based Financing/Performance-based Contracting. 2008.

2.2.1 National Model (2006-2008)3

There were 3 different pilot models implemented by NGO's between 2001 and 2005. In South-west Rwanda, the NGO Memisa/Cordaid started a PBF scheme in Cyangugu province in 2001 and its results were published [21].

The National PBF model was rolled out by the Rwanda Ministry of Health in 2006. The national PBF model for health centers was designed during the first quarter of 2006 through an extensive consultative process involving all key stakeholders (World Bank, Management for Health Sciences (MSH), Health Net International and Cordaid, the World Bank, Belgium Technical cooperation and the Ministry of Health).

The PBF scheme for general health services[4] has fully transferred to the government's budget, and there is a direct link between service delivery, results, and payment. A steering committee has been established in each district to independently monitor the performance of the health centers using Lot Quality Sampling and satisfaction surveys techniques. The results of the independent verification directly affect the amount of funding received by the center. Quantity of Health Services[5]

The payments for performance are based on the quantity of outputs achieved (through case-based remuneration) conditional on the quality of services rendered. The outputs are measured monthly while the quality is measured quarterly through the use of an elaborate supervisory checklist. Health centers staff can increase their performance, and hence their earnings, by increasing the quantity of outputs, increasing the quality of services delivered or both. When both quantity and quality increase earnings will be highest.

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[3] Adapted from "Gyuri Fritsche Musango Laurent. Provider Payment Mechanisms using Performance-based Financing/Performance-based Contracting. 2008.

[4] The PBF scheme for HIV/AIDS services followed the same roll out as the general health services, however PBF payments were made directly by donor agencies and not through the government payment mechanism.

[5] This study only studies the general maternal health indicators excluding HIV related services.

The formula used for payment is:

$$Payment_{it} = \left(\sum_{j} P_j U_{jit} \right) \times Q_{it} \quad , \quad 0 \le Q_{it} \le 1$$

where P_j is the payment per output unit j (e.g. institutional delivery or child preventive care visit), U_{jit} is the number of patients receiving output j in facility i in period t, and Q_{jt} is the quality index of facility i in period t bounded between 0 and 1. If the overall quality index for the facility is one, then health facilities are paid the maximum possible bonus for the services provided; by contrast, if the quality index is less than one, PBF payments are discounted for all services.

There are 14 maternal and child health PBF output indicators (U_{jit}), each with an associated payment rate (Table 1). Note PBF paid also additional 10 HIV-related indicators, but we focus on general health related indicators in the present study. The first 7 indicators consist of the number of visits to the facility for various types of service including curative care, prenatal care, family planning, institutional delivery, and child preventive services, including immunization and growth monitoring. The second set of 7 indicators consists of a number of aspects of the clinical content of the care provided during visits [22,23].

They include the number of children who were fully vaccinated during preventive visits, the number of pregnant women who received tetanus vaccines and malaria prophylaxis during prenatal care, the number of at-risk pregnancies that were referred to hospitals for delivery during prenatal care, the number of severely malnourished children who were referred to treatment facilities during preventive visits with a proof of a counter reference at the facility level, and the number of general emergencies that were referred to the appropriate place for care.

Table 1: Quantity Indicators and Unit Payments for Performance Based Financing Formula

	Indicator	Amount paid by PBF per case (US$)
	Quantity indicators: Number of...	
1	curative care visits (New cases)	0.18
2	First prenatal visits	0.09
3	women who completed 4 prenatal care visits	0.37
4	first time family planning visits (new users: IUD, pills, injections, implants)	1.83
5	contraceptive users at the end of the month (monthly protection)	0.18
6	deliveries in the facility	4.59
7	growth monitoring visits	0.18
	Output indicators: Number of…	
8	women who received tetanus vaccine (2nd to 5th dose) during prenatal care	0.46
9	women who received 2nd dose of malaria prophylaxis during prenatal care	0.46
10	at risk pregnancies referred during prenatal care to the hospital for delivery	1.83
11	emergency transfers to hospital for obstetric care during delivery *	4.59
12	children who completed vaccinations on time	0.92
13	malnourished children referred for treatment during preventive care visit*	1.83
14	other emergency referrals*	1.83
	* A proof of counter referral (patient arrived in the hospital and seen by a medical doctor / treated is needed for the payment to be made.	

Adapted from « Cellule d'appui à l'approche contractuelle. Guide de l'Approche contractuelle pour les Centres de Santee. Manuel de l'Utilisateur. Mai. 2008. Ministère de la santé. p 41-42".[6]

[6] Available at : http://www.pbfrwanda.org.rw/index.php?option=com_docman&task=cat_view&gid=24&dir=DESC&order=date&limit=5&limitstart=10 on 15th March, 2009.

Unit fees were determined through a consensual process between the Ministry of Health and all participating partners and took into account the past pilot experience of PBF pilots, expected increase of volume of services, and available budget.

2.2.2 Quality of Health Services

While data on the quantity of services is collected monthly, health facility quality is assessed quarterly by a group of supervisors nominated by the district hospital. Health facility quality is assessed using an elaborate instrument measuring quality across 13 characteristics described in the table below.

Table 2: Services (*S's*) and Weights (ω*'s*) Used to Construct the Quality Score (Q) for PBF Formula

	Service	Weight	Share of weight allocated to structural components	Share of weight allocated to process components	Means of assessment
1	General administration	0.052	1.00	0.00	Direct observation
2	Cleanliness	0.028	1.00	0.00	Direct observation
3	Curative care	0.170	0.23	0.77	Medical record review
4	Delivery	0.130	0.40	0.60	Medical record review
5	Prenatal care	0.126	0.12	0.88	Direct observation
6	Family planning	0.114	0.22	0.78	Medical record review
7	Immunization	0.070	0.40	0.60	Direct observation
8	Growth monitoring	0.052	0.15	0.85	Direct observation
9	HIV services	0.090	1.00	0.00	Direct observation
10	Tuberculosis service	0.028	0.28	0.72	Direct observation
11	Laboratory	0.030	1.00	0.00	Direct observation
12	Pharmacy management	0.060	1.00	0.00	Direct observation
13	Financial management	0.050	1.00	0.00	Direct observation
	Total	1.000			

Adapted from Contractual Approach Unit. Quarterly Quality Assessment grid for Health Centers. 2008. Ministry of Health.

The quality index component of the payment formula is a function of structural and process measures of the quality [15], which are themselves identified by Rwandan preventive and clinical practice guidelines [22,23]. Structural measures are the extent to which the facility has the equipment, drugs, medical supplies and personnel necessary to be able to deliver a specific medical service, while process measures are the clinical content of care provided for specific services. The formula for the quality index is:

$$Q_{it} = \sum_k \omega_k S_{kit} \quad \text{with} \quad \sum_k \omega_k = 1 ,$$

where S_{ikt} is the share of indicators for service k that are met by facility i in period t, and ω_k is the weight for service k. Note that the weights sum to one. Therefore, if a facility has perfect structural and process quality, then all the S_{ikt} take on value one and the overall quality index is equal to one. Each of Sikt‘s refer to the quality of a particular service such as prenatal care, curative care, delivery, etc..

Table 2 details the quality indicators, their weights, the extent to which they are structural or process-based, and the method by which the indicators are measured. Each S_{ikt} is the proportion of the structural and process indicators recommended in the Rwandan clinical practice guidelines necessary to deliver that service that the facility has (structural) or does (process).

Each month, PBF controllers visit the facilities and control the activities registries and bring approved invoice for the 14 general indicators and 10 HIV related (for facilities providing the service) to the steering committee for payment authorization.

In the other hand each district hospital sends supervisors to the facilities in their catchment area on a quarterly basis. . The auditors review the utilization registry and patient medical records, and directly observe facility operations, care and record keeping. After the evaluation process, the evaluators discuss the results (and the quality score) with health facility personnel, providing practical recommendations to improve the quality of services where needed.

2.3 IMPACT OF PERFORMANCE-BASED FINANCING PROGRAMS

Even though the Performance Based Financing has been recently implemented in poor setting countries, it is a strategy developed and tested originally in developed countries. Up to now there are few rigorous evaluations of the impact of PBF and, to our knowledge, none in lower and middle-income countries.

A recent review of the evidence of the evaluations of P4P in developed countries recognized that to-date little formal evaluation of hospital P4P has been carried out, and most of the 8 published studies have methodological flaws [24]. There are only 3 evaluations that assessed hospital and providers performance and had control hospitals [25-27] . These studies demonstrate that surveyed hospitals participating in a P4P program had a 2- to 4-percentage point greater improvement than the improvement observed in control hospitals [24]. Other available evaluations in middle and high income countries suggest that P4P is associated with improved hospital quality, and an increase in the use and quality of primary health care services [28-33]. However, a study conducted on P4P in England did not find an impact on the quality of management of chronic disease management [29].

The present review will focus on the experience of evaluating the effectiveness of PBF in poorer countries. In a review of 14 studies (including 1 randomized control trial and 5 studies with before-and-after evaluation designs), contracting programs appear to deliver effective primary health and nutrition services [34]. The studies were done in the following countries: Cambodia, Bangladesh, Afghanistan, Pakistan, India, Costa Rica, Bolivia, Guatemala, Haiti, Rwanda (pilot interventions), Madagascar, and Senegal.

After a reviewing the different interventions, it appears that 12 of the 14 projects are contacting out services and their evaluation compared the contracted to private sector performance to the facilities run by the public sector. The selected NGOs just signed a contract with the government to provided services to the population. These cited example from Cambodia, Bangladesh (rural), Bangladesh (urban), Bolivia, Afghanistan, Guatemala, Pakistan, Madagascar, Senegal, and India.

One experience in Costa Rica has quite a different contracting-out mechanism as they established a “worker-controlled health care cooperatives” in facilities previously

managed by the government. Again, no special formula in estimating performance and the results was compared to other public run facilities.

The Haiti experience was a contracting out with NGOs to provide service was done and the government was reimbursing their actual expenses. The government decided to shift to a lump sum payment to NGOs with an additional performance-based contract where NGOS receive bonuses worth 10% of the total contract amount if they achieve agreed-on targets for service delivery. The targets were set for keys indicator such as vaccination, prenatal, and use of rehydratation therapy[34].

All the studies found that contracting programs were associated with positive results comparing private sectors contracted organization to public run facilities (except Rwanda). In six studies, it was possible to estimate the double difference[7]; the median double difference ranged from 8.3 to 26 percentage points. All the median double differences were positive [34].

Quality of care was measured in four case studies: Afghanistan, urban Bangladesh, Cambodia, and Pakistan. In three of the four settings, contracted services performed significantly better on quality of care, and in the fourth there was little difference. Using scores derived from health facility assessments, the double difference was 24 percentage points in Afghanistan and 19 percentage points in Cambodia. The single difference in Bangladesh was 11 percentage points. In Rwanda, the results of the Cyangugu and Butare models compared with provinces with similar characteristics that did not implement PBF at the time suggested that the strategy held promise. The authors reported a very large increase in the number of curative consultation and institutional deliveries, but a very small increase in measles vaccination and new family planning acceptors[8].

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[7] The single difference is the difference between the pre-test and post test for a given outcome, obtained from pre- and post-test designs. When there is baseline and follow up for both control and treatment, the double difference = difference between follow-up and baseline results in the experimental group minus the difference between follow-up and baseline results in the control group

[8] Soeters, R., L. Musango, et al. (2005). Comparison of two output based schemes in Butare and Cyangugu provinces with two control provinces in Rwanda, Global Partnership on Output Based Aid (GPOBA): 45.

From the two Rwandan pilot evaluations, there are reasons to think that Performance-based Financing has the potential to:

Increase provider budgets by as much as 50 percent, if health facilities/providers meet a good performance target. In the pilot provinces, facilities' budgets increased by close to 45 percent. The largest single use of the performance based funds was for staff compensation, with between 40% and 95% of the subsidies channeled to staff. Comparison of health worker income between PBF health facilities and non-PBF health facilities show that workers under the PBF scheme have a 22.7% higher compensation.

The facilities noted that these providers started showing up to subsequent meetings [35,36].

Nonetheless, all of the cited evaluation studies in Rwanda and others discussed in the literature review did not use a rigorous design to produce an estimate of the "net effect" of the PBF intervention, meaning an estimate uncontaminated by the influence of other interventions or events that also may affect outputs and outcomes targeted by the PBF, especially in developing countries. There are many potential biases in the studies as well, including the lack of randomized controlled trials and, in most cases, of a control group; differences in the types of intervention and study design; confounding; not controlling for possible effects of known threats associated with the PBF schemes; and possible publication bias. The only randomized study done in Cambodia did not make a distinction between the incentive effect and the effect of an increase in resources for the health facilities [37]. This means that, even though there was a set of control districts, only the intervention districts received the payment and their performance was compared to the control districts without discarding the income effect. More money will necessarily produce more output.

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3 RESEARCH DESIGN AND METHODOLOGY

3.1 IDENTIFICATION STRATEGY

This study makes use of baseline and follow up data collected for the purpose of evaluating the impact of "Performance Based Financing" (PBF) in Rwanda", and focuses on the impact of PBF on maternal and child health services. From 2005-2008, the World Bank and Government of Rwanda Ministry of Health (MOH) worked in collaboration on an impact evaluation of the Rwanda MOH PBF scheme for basic preventive and curative care services. The objective of the evaluation identification strategy was to produce an equivalent sample between treatment and control districts.

If the treatment and control districts are equivalent on all relevant factors at baseline, then differences at follow-up for health outcomes and other indicators can be attributed to PBF rather than to some pre-existing difference between the two groups. For the 30 administrative districts in Rwanda, which ones had PBF in health centers and which did not was first determined as of September 2005. The areas that had PBF in health centers (11 districts) were excluded from the impact evaluation because it was not possible to measure their health situation before the pilot PBF. The 19 remaining districts were then mapped and overlaid with information on relief, rainfall, and population density for the Rwanda demographic atlas. The districts were paired in groups of 2, where the two districts had similar characteristics for relief rainfall and population density from the general population census [38]. In addition, it was verified from Rwanda MOH staff that there were no important differences in livelihoods within the pairs. For example, areas where agriculture is the dominant livelihood were not paired with areas where livestock raising was dominant. The following variables, which have been shown to be indicative of household well-being, were used to match districts: main housing characteristics (floor material, wall material, roof material), main drinking water source, education levels, literacy levels, ownership of radio and television (TV)

For reasons of equity and fairness, it was determined that areas would be assigned to treatment or control through use of a lottery. For all district pairs, a coin was flipped to

decide which area would be randomly assigned to treatment, and which to control. The randomization across similar areas ensured that:

There was a mix of characteristics among the areas that were incorporated in the program in 2006. Both the treatment and control samples included worse-off and better-off regions. Through the randomization process, areas of the country had equal chances of participating in Phase I (Intervention). This was a more transparent and equitable mechanism than alternative methods of choosing the Phase I areas. One less efficient and less equitable alternative would be to assign all districts within a province to either treatment or control.

Table 3: Performance based financing with health centers: randomization of districts

Pair numbering	Treatment	Number of facilities	Control	Number of facilities	Total facilities
1	Kibungo	10	Kirehe	11	
2	Nyanza	2	Kamonyi	9	
	Huye	1			
3	Gakenke	9			
4	Rwamagana	3	Nyagatare	12	
	Gatsibo	8			
	Kayonza	11			
5	Nyamasheke	1	Kibuye	18	
	Ngororero	5			
6	Rutsiro	9	Nyabihu	10	
7	Nyaruguru	9	Gikongoro	13	
8	Burera	12	Ruhengeri	12	
Total facilities		80		85	165

Source : Christel Vermeersch, Damien de Walque, Jennifer Sturdy. Roll-out Plan Performance Based Contracting Rwanda (General health and HIV/AIDS services). World Bank. 2005

During the decentralization process, new administrative districts became a composite of several old districts. For several new districts, half of the district had PBF

from the original piloting and the other half had been randomly assigned into the control group. The strategy of random assignment of districts to treatment and control groups was modified in August 2005 for a subset of couples, whereby pair numbers 3 and 4 (7 couples) were purposely switched on request of the government to "treatment" because some facilities in those districts had PBF during the pilot intervention. There was only one control district remained for both pair 3 and 4.

Thus, districts with "remaining" localities were purposely assigned to treatment at rollout. This allowed the government to make sure that in one district all facilities were either "control" or "intervention" in order to ensure that the planned PBF implementation could be monitored at "district level". In order to determine whether or not the incentives-based approach had a more positive impact on health services than lump sum payments, health centers located in Phase II districts (control) received "input based" funding relatively equal in size to the amount dispersed to Phase I health centers as "output based" funding. Each trimester, the Ministry of Health calculated the average amount received by treatment facilities based on their performance and allocated the same amount to control district conditional on the total number of health providers. In this manner, no financial resources were withheld from any group, and the intervention was politically and ethically accepted while discarding the "income effect" from the intervention district.

Even though the study design lost the "full randomization", the "quasi-experiment" which resulted from the collaboration with the government had the potential to work. This is because the PBF being implemented by the government through the administrative districts, it was preferable that all facilities in a given district receive the same treatment (either PBF or control). This allows the integration of PBF activities into the overall national and districts activities. Later, we present the results of the baseline analysis showing that despite losing the randomized experiment, descriptive results from the two baseline surveys (General Health Facility) indicated that the quasi-experimental design produced a well-balanced sample at both the facility level and the household level.

3.2 SAMPLE SIZE

The health facility survey was administered to all health centers in districts assigned to Phase I and Phase II which were identified in the previous section. This resulted in a total of 165 health facilities (out of around 400 existing health facilities in Rwanda in 2005). All health centers in the intervention and control districts were automatically selected and sampled.

3.3 DATA COLLECTION AND MEASUREMENT

The health facility questionnaire collected information on the main characteristics and services provided by the health facilities. The following modules were included in the health care facility survey:

- General characteristics of health centers
- Available services and pricing
- Equipment/infrastructures
- Human resources, with a focus on the skills, experience, and motivation of the staff
- A set of vignettes measuring health provider knowledge of and competency in different type of services, for example pre-natal care and child care
- An exit interview, which assessed the quality of services as perceived by the users of the facility for the corresponding services for which vignettes were collected.

The design of the facility survey was modeled on the structure of the Service Provision Assessment survey regarding health indicators and health facilities.

Additionally we complemented our data collection with the routine Health Management Information System (HMIS) to allow a trend analysis. The data is available for some indicators from 2001 to 2008. HMIS data were abstracted for all 165 health facilities included in the impact evaluation.

We decided to measure the same quality indicators as the ones paid for by the PBF intervention. The structure quality indicators, only items monitored by the PBF during the quarterly quality evaluation were taken into account while constructing the scores.

Structural Quality measurement: We measure structural quality at the facility level for five different services: curative care, deliveries, and prenatal care, immunization, and laboratory services. For each service, we compute an index that consists of the proportion of types of equipment and drugs that are available at the facility that are necessary to provide the service according to the PBF quality assessment protocol. The services and items are:

- *Curative care*: thermometer, stethoscope, blood pressure cuff, auriscope, examination table, adult and child scale. The drugs comprised: Amoxicillin, Cotrimoxazole, Ampicillin, Penicillin Procain, Penicillin benzatin, Metronidazol, Mebendazol, Aspirin, Coartem, Quinine, Rehydration Serum, measles vaccine, water for syringes, and needles
- *Delivery*: obstetrical stethoscope, aspirator, baby scale, ocular antibiotics, Amoxycillin, Ampicillin, Penicillin Procaine, Penicillin benzatin, BCG vaccine, polio vaccine , water for syringes, and needles
- *Prenatal care*: thermometer, stethoscope, blood pressure cuff, examination table, vitamine A, folic acide, and Tetanus vaccine
- *Immunization*: refrigerator, cold box, thermoter, tuberculosis vaccine, diphtheria–tetanus–pertussis- *Haemophilus influenza* type b and hepatitis B vaccine, polio, and measles and tetanus vaccines
- *Laboratory*: pregnancy, urine, malaria, and hemoglobin tests.

The Cronbach alpha test of reliability of the structural quality scores ranges from 0.65 to 0.90 indicating that items within each score are measuring the same dimension [39].

Table 4 : Item reliability coefficient (Cronbach's alpha)

	Cronbach's alpha	Number of items in the scale
Curative Care structure quality score	0.906	23
Delivery structure quality score	0.765	11
Prenatal Care structure quality score	0.871	6
Immunization structure quality score	0.882	8
Laboratory structure quality score	0.654	4

3.4 METHODS OF ANALYSIS

The availability of panel data from health facilities allows for the estimation of a difference-in-difference model appropriate for a quasi-experimental design. We are comparing changes in outcomes between treatment districts and control districts before and after the implementation of the program for the treatment group. The treatment group difference controls for time-invariant facilities and environmental characteristics that might be correlated with both treatment status and outcomes. By differentiating the difference in the control group from the treatment group, we control for time-varying factors common to both the control and treatment groups.

In a simple way, the impact of the program is the difference in the change in outcomes and was evaluated using the equation below:

PBF_Impact (double difference) = $(Yt_{2008}-Yt_{2006}) - (Y_{c2008}-Y_{c2006})$

Y is a study outcome

t indicate the treatment facilities

c indicate the control facilities

3.4.1 Modeling the impact of PBF

Despite that fact most of the facilities were randomized into treatment and comparison groups at the district level, we view the evaluation design as quasi-experimental. As a result, we use difference in difference methods to estimate the

program impact. This method compares the change in outcomes in the treatment group to the change in outcomes in the comparison group. By comparing changes, we control for observed and unobserved time-invariant characteristics as well as time-varying factors common to both comparison and treatment groups. The change in the comparison group is an estimate of the true counterfactual, i.e. what would have happened to the treatment group if there were no intervention. Another way to state this is that the change in outcomes in the treatment group controls for fixed characteristics and the change in outcomes in the comparison group controls for time-varying factors that are common to both comparison and treatment groups.

Formally, we estimate the following regression specification of the difference-in-difference model for individual outcomes:

$$Y_{ijt} = \alpha_j + \gamma_{2008} + \beta\ PBF_{j,2008} + \sum_k \lambda_k X_{itk} + \varepsilon_{ijt}$$

where Y_{ijt} is the outcome of interest for individual i using facility j's in year t; $PBF_{j,2008}$ = 1 if facility j was paid by PBF in 2008 and 0 otherwise; the α_j are facility fixed effects; γ_{2008} =1 if the year is 2008 and 0 otherwise; the X_{itk} are time varying individual characteristics; and ε_{ijt} is a zero mean error term. We compute robust standard errors clustered at the district by year level to correct for possible heteroskedasticity and correlation of the error terms across facilities within districts.

The models were estimated using STATA version 10.01 software. For the analysis of HMIS data, a dummy time variable was created by aggregating times before the intervention starts (2001- 2006) and after the treatment start (2007-2008). The coefficient of the interaction of the time *treatment provided the impact of the program after controlling for trend over time. Several models were constructed to estimate the impact of PBF on different outcomes of interest.

3.4.2 Fixed or Random effects and clustering

For the present study, analysis was done at the facility-level analysis because the PBF program was implemented at that level. Also the data collection was done using the facility as the reference point (for providers, exit pools, and households). In order to

decide between fixed and random effects, the Hausman test was proposed. Nonetheless, the assumption for the Hausman test was not meet here because of the clustered nature of the data sets used[9]. (Lee C. Adkins, R. Carter Hill, Using stata for Principles of Econometrics, 2008).

The nature of the intervention setting and the data collected for this study guided the choice between the fixed effects.

Both facilities and time fixed effect were used for the purpose of controlling the effect of unobservable characteristics.

3.4.3 Clustering

Because districts—containing a number of facilities—were randomly assigned to either intervention or control, it is likely that within a given district that error terms will be auto-correlated over time, meaning that, for example, some unobserved characteristics (such as facility leadership) will be correlated within a district between baseline and follow up conditional on PBF. This is because facilities within a district will more likely to receive the same quality of supervision and caching over time and will have more likely the same observed and unobserved patterns.

This is why the clustered standard error was used in this study as they allow the errors to be correlated within a same cluster. The more conservative approach would be to cluster the standard errors at the at the districts level (19 clusters). But taking into account the fact that the potential unobservable will be more likely auto-correlated within a cluster at the follow up round, that is after the intervention have been implemented, we

[9] The Hausman test compares the coefficients estimates from the random effect model to those from the fixed effect model. Because the random effect assume that the error terms u_i are randomly distributed with a mean of zero and a constant variance. This mean that the random effect considers the correlation between the error term and any of the covariates is 0. The Hausman test is used to check for any correlation between the error component u_i and the covariates in a random effect model. If they are correlated, the fixed-effects model should be used rather than the random-effects model (otherwise the coefficients are biased). One of the key assumption of the test is that one of the estimators is efficient (i.e., has minimal asymptotic variance).

propose to cluster our standard error at the interaction of district with post intervention level (=38 clusters)[10].

4 RESULTS

4.1 DESCRIPTION OF THE SAMPLE

In total, 165 facilities were surveyed for the impact evaluation study distributed evenly between treatment and control. Faith-based facilities represented 35% of the whole sample. The facility status being one of the most important characteristics discriminating between the potential lower and the better performing facilities, Table 5 shows that randomization yielded a balanced number of faith-based facilities in treatment and controls districts. It's important to note that 63 facilities also had HIV services, 35 of which (55%) were in the treatment districts and 28 of which (44.4%) were located in the control districts.

Table 5: Health facilities surveyed for both waves by status and intervention phases

	Treatment facilities	Control facilities	Total
Public facilities	52 (65.8%)	56 (65.1%)	108 (65.5%)
Faith-based facilities	27 (34.2%)	30 (34.9%)	57 (34.5%)
Total	79	86	165

All planned facilities were visited at baseline, and all questionnaires modules were implemented. The study team visited the same facilities at follow up, and the plan was to collect the same information as at baseline. Unfortunately, for 9 out of 165 facilities, the general information module (containing the facility services, prices, human resources, and finances) was not implemented or was incomplete. For the general

[10] If " time" is the variable taking the value 1 if follow up, we generate the "cluster" variable as district by year.

information, panel data were available for 156 facilities. Nonetheless, all other modules (vignettes and exit interviews) were collected for the total of 165 facilities.

4.2 BALANCE BETWEEN TREATMENT AND CONTROL FACILITIES

The purpose of this section is to confirm that the evaluation design achieved balance of observed characteristics between the treatment and comparison groups.

Table 6 reports the means of facility-level characteristics in 2006 before treatment facilities began the PBF program. The treatment and comparison samples are completely balanced in terms of total expenditures and allocation of budget across medical personnel, medical supplies, and non-medical purposes.

Table 6: Baseline characteristics of health facilities (2006)

	Treatment		Control		Difference	p-value*
Observations	75		70			
Expenditures and Budget Shares						
Log Total Expenditures (2006)	15.81	(1.04)	15.61	(1.01)	0.200	0.418
Log Total Expenditures (2008)	16.91	(0.71)	16.99	(1.08)	-0.083	0.568
Personnel Budget Share	0.46	(0.23)	0.49	(0.26)	-0.031	0.555
Medical Supplies Budget Share	0.22	(0.19)	0.20	(0.19)	0.013	0.705
Non-medical Budget Share	0.32	(0.25)	0.30	(0.22)	0.018	0.726
Staffing						
Medical Doctors	0.05	(0.23)	0.05	(0.27)	0.003	0.940
Nurses	6.31	(6.90)	5.48	(3.30)	0.826	0.409
Other Clinical Staff	4.13	(3.09)	4.47	(4.05)	-0.335	0.554
Non-clinical Staff	5.25	(3.56)	5.33	(5.09)	-0.076	0.901
Structural Quality (Baseline 2006)						
Curative Care	0.80	(0.07)	0.81	(0.07)	-0.01	0.575
Delivery	0.78	(0.11)	0.79	(0.10)	0.00	0.840
Prenatal Care	0.96	(0.15)	0.97	(0.11)	-0.01	0.285
Immunization	0.94	(0.17)	0.94	(0.15)	0.00	0.897
Laboratory	0.49	(0.32)	0.43	(0.32)	0.06	0.402

All of the data, except Log Expenditures 2008, are measured at baseline prior to the intervention.

Data are n (%) or mean (SD). Sample size varies slightly according to characteristic measured

*P-values are for cluster-adjusted t-test (continuous variables).

The first step in the analysis is to confirm that the evaluation design and program implementation achieved the objective of isolating the incentives effect. Using baseline and follow-up data, we compare the difference in means of the total log expenditures between the treatment and control facilities in Table 6. Although total log expenditures increased from 2006 to 2008, the increase occurred in both treatment and control facilities and there was no statistically significant difference between the baseline and follow-up means. This validates the primary assumption that subsequent analyses estimate the impact of the incentives effect of the PBF payment, rather than the increase in financial resources. Also this validates the assumption that the level of expenditures was the same between treatment and control facility considering that HIV facilities received additional funding.

The second step in the analysis of results is to validate the evaluation design by confirming balance at baseline in key outcome and control variables related to quality of care and maternal care utilization. With regard to staffing, nurses represented the majority of staff, while there were few or no medical doctors since all our facilities were rural health centers. At baseline, facilities were highly equipped to offer curative, delivery, prenatal, and immunization services; however, in the area of lab services, they were lacking, with facilities holding only half of necessary equipment and drug supplies.

In summary Table 6 demonstrates that the two groups of facilities have the same number of physicians, nurses and other types of personnel. They are also well balanced in terms of their structural quality for the provision of curative care, deliveries, prenatal care, immunizations, and laboratory services.

4.3 ESTIMATING THE IMPACT OF PBF ON MATERNAL AND CHILD HEALTH SERVICES

As mentioned above, we use difference-in-difference methods to estimate PBF program impact. This method compares the change in outcomes in the treatment group to the change in outcomes in the comparison group. By comparing changes, we control for observed and unobserved time-invariant characteristics as well as time-varying factors

common to both comparison and treatment groups. The change in the comparison group is an estimate of the true counterfactual, i.e. what would have happened to the treatment group if there were no intervention.

The regressions tables presented in this section report the coefficients and the robust standard error for difference-in-difference regression models of the impact of PBF on maternal health and child health studied services. The coefficient assessing the impact of the program is the interaction of the dummy variables for the treatment and control group and the baseline-follow up (or pre and post intervention for the HMIS data analysis). The standards errors are adjusted for clustering at the district and wave level. The models for continuous variables outcomes are estimated using a linear probability model with facility and time fixed effects.

4.3.1 IMPACT OF PBF ON THE STRUCTURE QUALITY OF CARE

We analyzed the impact of PBF on the structure quality of three key maternal health-related services: the availability of immunization, prenatal care, and delivery care services. The difference-in-difference between treatment and control facilities for baseline and follow up observations did not show any impact on the structure quality for maternal health related services. The resulting coefficients in table 8 were not statistically different from zero suggesting that control and treatment facilities had similar levels of change in structure quality. Looking at change over time in structure quality, regardless of the PBF intervention, there is instead a decrease in the availability of components of vaccine, prenatal, and delivery services.

These findings suggest that PBF had no potential to increase the availability of equipments and drugs at the health facilities. This may be explained by the fact that most facilities had a quite satisfactory level of structure quality at baseline leaving the PBF with little room for improvement. Another explanation may be related to the use of PBF payment by facilities. The size of PBF payments to facilities is large in relation to their budgets and there is no restriction on the use of these funds. We analyzed data from of 86 facilities from the PBF process evaluation and showed that performance-based payments for 2008 amounted to approximately 5 million Rwandan Francs (approximately 10,000 US$). While this raw figure may not be meaningful in absolute terms, it corresponds to

about 18% of the health facility total expenditures for that year and about 22% of the health facility total expenditures, if performance payments for that year are excluded. On average the health facilities allocated 77.5% of performance-based payments to salaries. This may contribute to insufficient funds for investment in drug or equipment purchases. The available additional funds received are channeled to address low provider salary. We expect further analysis to reveal an increase in provider motivation and, therefore, an increase in provider effort.

4.3.2 IMPACT OF PBF ON MATERNAL AND CHILD HEALTH SERVICES

Maternal health

We found that PBF was statistically significant and had a large impact on the number of delivery at the facility. For facilities receiving PBF intervention, we see an increased monthly mean of 4 on institutional delivery, which represents an 11 percent increase from baseline each month. From before 2006 to 2008, facilities in our sample increased the mean of institutional deliveries by 15 regardless of PBF. The table below shows an important increase over time of the proportion of institutional delivery for both control and treatment facilities. There was also a modest but significant increase of women referred at the hospital for obstetrical problem. Even though this indicator is paid by PBF at the same rate as delivery, we see that the magnitude of the increase due to PBF is not the same; facilities tend to have women deliver at their facilities and send those who really need the transfer.

Child health

Child growth monitoring is one of the indicators remunerated by the performance based financing. We evaluated the impact of the intervention using HMIS data from 2001 to 2007 to estimates the change over time the mean number per quarter of child 0-11 months who received a growth monitoring. The average quarterly number of child monitored for growth increase by 14 in PBF facility than in the control facilities. While the average quarterly number of children who are lost to follow up for growth monitoring significantly decreased by 15 in PBF facilities compared to the control facilities.

Vitamin A administration is one of the key interventions implemented in Rwanda to improve the life of child and mothers. The Rwandan national prenatal protocol on

vitamin A administration integrates the administration of vitamin A with the immunization and child monitoring. The protocol starts that every child should receive each 6 months one pill of vitamin A starting at 6 months of age up to 5 years. The present analysis found that PBF had an important impact on Vitamin A administration for kids aged 0-11 month (age when child come for immunization). It appears that in the PBF facilities, the monthly mean of child receiving vitamin A per facility higher (plus 13) than in the control facilities. While overtime the administration of vitamin A seems to have deceased. This impact could be even bigger if we consider the age ranges bigger than 0-11 months because in this age range there is only one expected dose of vitamin A. This finding shows again the important of conditioning PBF payment of quantity on quality of service produced. The availability of vitamin A in the health facility is one of the indicator measured quarterly by district health officer while monitoring quality of services produce at the health center.

We also found a significant but modest decrease of the number of underweight baby in favor of facilities receiving PBF intervention. We can explain this by the fact that PBF is paying for keys interventions such as the prevention and treatment of malaria among pregnant women, management of anemia during pregnancy, and treatment of sexually transmitted diseases which can significantly improve fetal outcomes and maternal health. The impact of PBF in those interventions is being evaluated in another paper.

5 DISCUSSION AND RECOMMENDATIONS

Rwanda implemented PBF at the national scale in 2006 for maternal and child health care services. This study provide evidence that the incentives in the Rwandan PBF program increased the use of a number of highly recommended maternal and child health care services including child growth monitoring, vitamin A and institutional delivery [7,8,10,40-42].

In general, we can attribute the PBF impact to two mains factors. First, the systematic implementation of the quarterly quality supervision checklist to the treatment

facilities made a difference as opposed to the classical supervision applied to the control districts. It has been proven that the systematic supervision of facilities providing primary health care using clearly defined and quantifiable indicators can improve service delivery considerably [43]. It's crucial to mention an important contextual factor which explained the impact of PBF: the design and implementation of the PBF system itself.

Although our analysis isolates the incentives effect of PBF on changes in provider and patient behavior, we do not want to understate the importance of establishing a PBF system with the necessary checks and balances to prevent gaming and misreporting. In the case of the Rwanda PBF scheme, by separating out the purchasers, controllers and providers and establishing a data reporting and auditing function within the health information system, the program was able to successfully introduce an incentives package at the facility level. In Rwanda this supervision was done by the district hospital personnel, an activity which was also linked to the hospital PBF. The correct use of the health facility quality checklist was contracted under the PBF hospital scheme. Both the complementary national programs aimed at improving health service delivery and the establishment of the PBF system is important contextual factors to consider when discussing the results. We believe that providers responded to the PBF incentive by increasing the quantity and quality of services in an integrated primary health care system setting.

Better global quality in maternal and child health services facilitates subsequent care. When patients present at a health facility, they meet the health care provider who, using available equipment and medical supplies, evaluates their status. And once a presumptive diagnosis has been made, the health care provider can order laboratory tests to confirm the diagnosis or, as a matter of routine procedure, prescribe a medicine, and provide professional advice and recommendations to the patient [44,44].

Utilization of maternal services

The impact of PBF on institutional delivery can be explained by the fact that deliveries have the highest unit payment rate at $4.59. During discussions with providers, they reported that they found deliveries to be so lucrative that they not only encouraged

women to deliver in the facility during prenatal care, but that they also commissioned community health workers to search the community and bring in pregnant women to deliver in the facility. This was done by a tacit contract between the facility and the community health workers, stating that for each women brought by a community health worker to a facility for delivery, the later would receive an equivalent of 1-2 US$.

The impact of PBF on institutional delivery can be partially explained by the advice and support to the woman and her family during prenatal care in developing a birth and emergency preparedness plan.

Comparing the results with other studies

The magnitude of impact of PBF in the present study varies compared with other published contracting out studies. This is mainly due to the fact that the PBF in Rwanda takes quite a different contracting approach than those implemented in Cambodia, Haiti, Bangladesh, etc.. In Rwanda government support to public and faith-based facilities was tied to performance while in the other countries, governments contracted out the services to independent NGOs to provide health services to the population. In the Cambodia contracting out initiative, the change in the proportion of infants delivered in a health facility was around 18% after four years, which is comparable to what we found in Rwanda given the exposure time of 2 years.

National level interventions

In general, the health sector in Rwanda has improved during the PBF intervention [20,45]. While this study isolates the impact on health outcome that can be attributed to PBF, there is an overall increase in most of the outcomes estimated in both controls and treatment. This secular trend increase can be attributed to other effective interventions being implemented simultaneously with PBF namely the community health insurance scheme. We strongly believe that the mutuelle increased the utilization of services over the past two years for both control and intervention facilities by removing cost-related demand-side barriers.

Also, the government performance-based contracts—Imihigo[11] has played an important role in increasing the overall coverage of key contracted health indicators. We believe that the "Imihigo" contract explained a large share of the increase in assisted delivery and family planning use in both control and intervention facilities. The fact is that the Imihigo provides important incentives for districts authorities "to be seen as who performs" [46]. We were able to isolate the PBF effect by having a control group in our intervention; this was also possible because the imihigo contracts were implemented national wide.

The government coordination of child survival and safe motherhood strategies bringing together several key child and maternal health stakeholders was key to improving the availability and affordability of quality health services. It is important to note that the funding for HIV/AIDS in Rwanda has led to general improvements in the infrastructure for primary health care, including family planning [46].

The integration of PMTCT services into the existing package of care offered by facilities has been one of the important strategies to increase the availability and use of all services. According to the Rwandan national PMTCT protocol, women are offered voluntary HIV counseling and testing at their first prenatal visit and counselors encourage partner testing. Pre-test counseling is generally done in groups, while all women receive one-on-one post-test counseling [47]. This program contributed to increase PBF indicators as HIV-infected women are strongly encouraged to deliver in a health facility and all women are also provided family planning methods counseling after delivery.

5.1 Policy implications

A number of lessons are apparent from the results. First, you get what you pay for in that higher payments provide more high-powered incentives. Second, activities that are more in the control of providers and depend less on patient decision responded to the

[11] *Imihigo:* traditional Rwandan practice, in which an individual publicly states and demonstrates what he or she can do and is committed to, and then be held accountable to his words, actions and deeds.

incentives. Higher incentive payments are warranted for services that are more important in terms of leading to better health outcomes and where more provider effort is necessary to improve those services is high.

Since there is still to not be an impact of PBF on structure quality measure, the program might consider paying more for process as opposed to structural indicators of quality of care.

PBF program should be a dynamic tool contributing to strengthen the health system where needed. It's important to get the price s of indicators right and change the list of indicators annually or bi-annually to reflect the country need.

The collaboration between health providers and community health workers seems to work informally. It will be intersting to give community health workers a financial incentive to detect pregnant women in the community and convince them to seek their first prenatal care visit during the first trimester and deliver in the health centers. This has potential, as there is already a well-developed network of community health workers with which facilities have started to work to increase the number of institutional deliveries.

5.2 Limitation and Implications for future research

There are a number of limitations to this study. First, the original randomized designed was changed due to the political decentralization process. This may have inadvertently caused some confounding bias in the estimates. However, the sample appears to be well balanced on observable characteristics and outcomes at baseline. This is one of the problems that effectiveness studies face when conducting evaluations in the context of programmatic scale-up, those operational problems can compromise the evaluation design. However, while efficacy studies are better controlled, they only inform us about what is possible; whereas, efficiency studies are important to assess external validity and inform us about what is likely.

There is also a need for a qualitative study to help understand the "how" of the present findings. Focus groups and in depth interviews with managers, providers and

clients will lead to better understanding of how the program was implemented and how to forge a path to the future success of the program.

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6 APPENDICES

Table 7: Estimated PBF Impact on structure quality elements

	Availability of vaccins			Prenatal care service			Delivery service		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Treatment 2008 (=1)	0.228*	0.227	0.703**	-0.023	-0.023	0.062	-0.040	-0.040	0.239
	(0.122)	(0.169)	(0.355)	(0.095)	(0.146)	(0.426)	(0.088)	(0.126)	(0.286)
2008 (=1)	-0.512***	-0.514***	-0.514***	-0.659***	-0.659***	-0.659***	-0.484***	-0.484***	-0.484***
	(0.075)	(0.122)	(0.122)	(0.067)	(0.106)	(0.100)	(0.052)	(0.081)	(0.083)
(Treatment 2008) X (Faith Based)			-0.360*			-0.064			-0.210
			(0.198)			(0.278)			(0.179)
Observations	308	308	308	310	310	310	310	310	310
Number of healthfacility	155	155	155	155	155	155	155	155	155

Note: Robust t statistics in parenthesis , T-statistic in brackets , *** p<0.01, ** p<0.05, * p<0.1

Model 1 : Base model with Fixed Effect (No control variables) ,

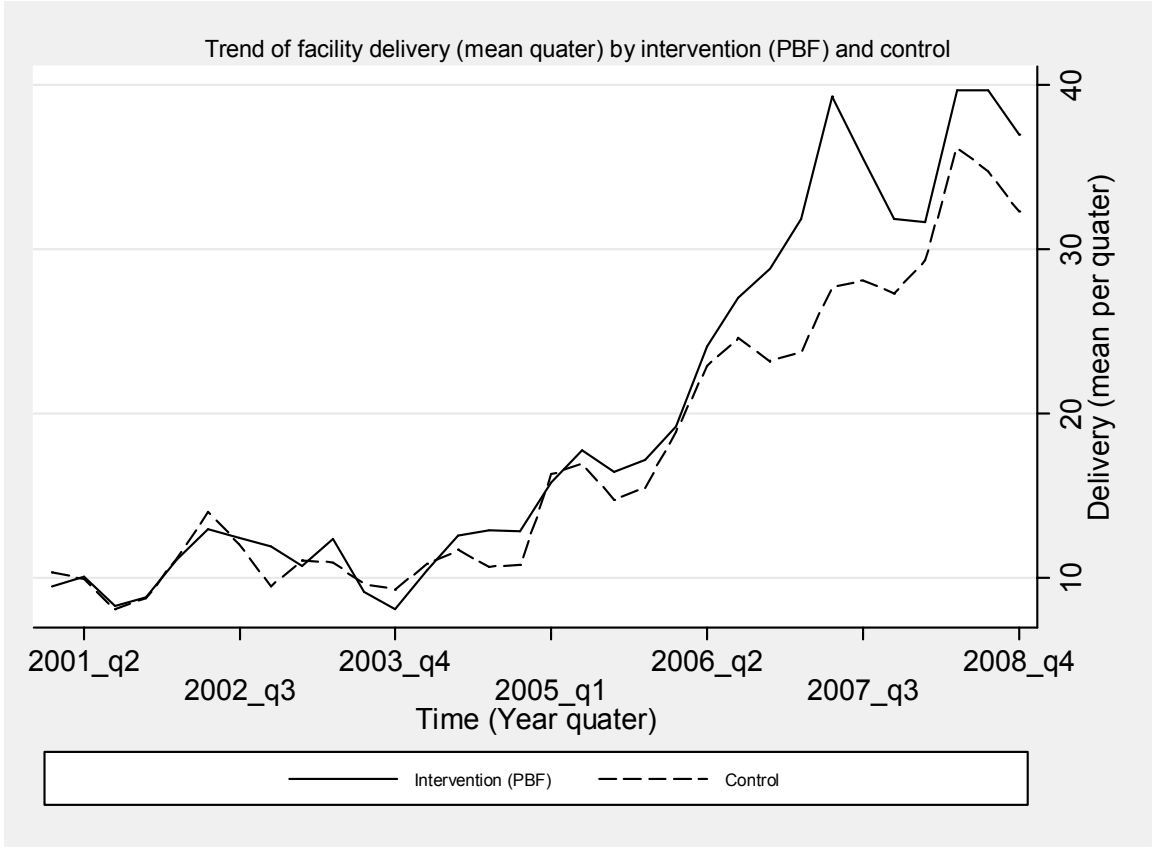
Model 2: Base model with Random Effect (No control variables) ,

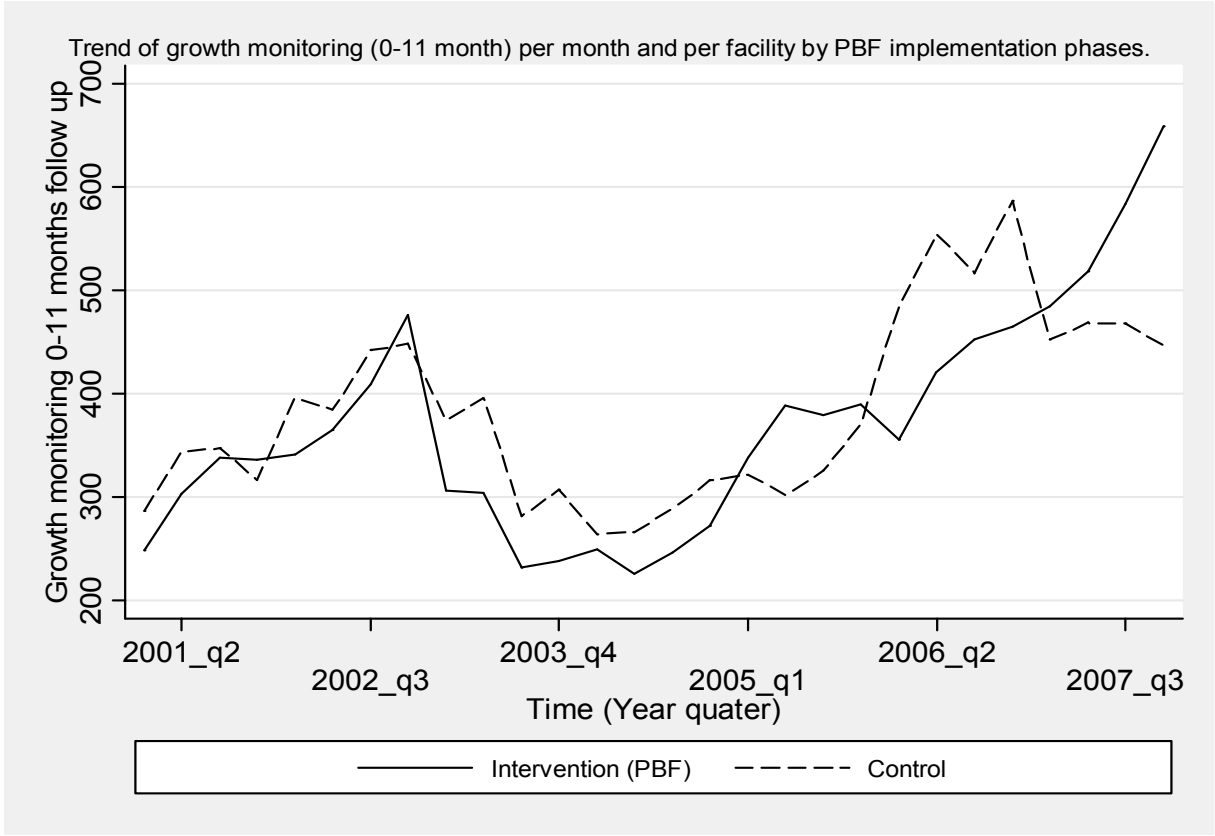
Model 3 : Base model interaction with facility status (RE)

Table 8: Impact of PBF on Utilization of health services (Health Management Information System)

	Base Model						
		Impact of PBF			Time Trend		
	N	β	(95% C.I.)	p-value	β	(95% C.I.)	p-value
Maternal and related health services							
Number of delivery at the health facility	13351	4.40	(4.14 - 4.65)	<0.0001	15.70	(15.57-15.93)	<0.0001
Number of referral of women with complications	13351	0.35	(0.303 - 0.388)	<0.0001	2.26	(1.23 - 1.24)	<0.0001
Number of baby born with < 2.5 Kg	11659	-0.04	(-0.055, -0.021)	<0.0001	0.32	(0.31 - 0.32)	<0.0001
Child Care services							
Number of growth monitoring for 0-11 months	13860	14.520	(14.52 - 14.521)	<0.0001	158.30	(158 - 158.3)	<0.0001
0-11 months lost to follow up for growth monitoring	13860	-15.430	(-15.43 - -15.44)	<0.0001	14.76	(14.76 - 14.74)	<0.0001
Vitamin A distribution to 0-11 months	13860	13.320	(13.32 - 13.3)	<0.0001	-6.02	(-6.02 - -6.03)	<0.0001

**Each estimate was obtained from a separate regression. The HMIS data was complete for 158 facilities from 2001 - 2008. Coefficients for the treatment effect were estimated by the interaction between time (2001-2006 versus 2006-2008) and treatment. Robust standard errors and fixed effect were used.


Trend of facility delivery (mean quater) by intervention (PBF) and control
Delivery (mean per quater)
10
20
30
40
2001_q2
2002_q3
2003_q4
2005_q1
2006_q2
2007_q3
2008_q4
Time (Year quater)
Intervention (PBF)
Control


Trend of growth monitoring (0-11 month) per month and per facility by PBF implementation phases.
Growth monitoring 0-11 months follow up
200
300
400
500
600
700
2001_q2
2002_q3
2003_q4
2005_q1
2006_q2
2007_q3
Time (Year quater)
Intervention (PBF)
Control

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