The London School of Economics and Political Science

An analysis of health service delivery performance in Rwanda

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Declaration

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I confirm that Chapter 4 was co-authored with Prof. Bruno Meessen, Dr. Agnes Soucat and Dr. Paulin Basinga who provided guidance on the Rwandan context and the structure of the paper. The introduction, literature review, econometrics analysis, discussion and conclusion were all written and carried out by me.

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ABSTRACT

Health systems worldwide fail to produce optimal health outcomes, and successive reforms have sought to make them more efficient, more equitable and more responsive. The overarching objective of this thesis is to explore how to motivate healthcare providers in improving performance in service delivery in low income countries. The thesis explores whether financial incentives for healthcare providers raise productivity and how they may affect equity in utilization of healthcare services and responsiveness to patients' needs. The thesis argues that, as performance-based financing (PBF) focuses on supply side barriers, it may lead to efficiency gains rather than equity improvements. It uses data from a randomized controlled impact evaluation in Rwanda to generate robust evidence on performance-based financing and address a gap in the knowledge on its unintended consequences. Statistical methods are used to analyze four aspects: the impact on health workforce productivity; the impact on health workforce responsiveness; the impact on equity in utilization of basic health services; and, the impact on spatial disparities in the utilization of health services. Findings indicate that performance-based financing has a positive impact on efficiency: it raises health workforce productivity through higher workload and lower absenteeism; and, it encourages healthcare providers to be more responsive which positively impacts the quality of care perceived by patients. Findings also indicate that the impact on equity is uncertain as PBF can deter equity in access for the poorest in the absence of a compensating mechanism; however, PBF is a powerful reform catalyzer and can reduce inequalities between regions and households when combined with appropriate reforms that control for its potential perverse effects. This thesis advocates that strategies aiming to raise healthcare providers' motivation should be used to raise performance in service delivery in low-income countries with particular attention to their effect on end users.

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LIST OF ACRONYMS

CHRH	Composite Human Resource for Health index
CSI	Composite Services Indicator
CV	Coefficient of Variation
DD	Difference in Difference
DEA	Data Envelopment Analysis
DRC	Democratic Republic of Congo
DHS	Demographic and Health Survey
FE	Fixed Effect
FP	Family Planning
HIC	High Income Country
HIV	Human Immunodeficiency Virus
ID	Institutional Delivery
IMR	Infant Mortality Rate
IPD	Inpatient
LIC	Low Income Country
LPM	Linear Probability Model
MCH	Maternal and Child Health
MDG	Millennium Development Goal
MOH	Ministry of Health
NGO	Non-Governmental Organization
NPM	New Public Management
OLS	Ordinary Least Squares
OP	Ordered Probit
OPD	Outpatient
P4P	Pay-For-Performance
PBF	Performance-Based Financing
PCA	Principal Component Analysis
PNC	Prenatal Care
Q	Quintile
QOF	Quality and Outcomes Framework

SE	Standard Error
SFA	Stochastic Frontier Analysis
SURE	Seemingly Unrelated Regression Equation
TB	Tuberculosis
U5MR	Under 5 Mortality Rate
UK	United Kingdom
US	United States of America
VCT	Voluntary Counseling and Testing
WHO	World Health Organization
WHR	World Health Report
WPI	Workforce Productivity Index

NOTE ON THE STRUCTURE OF THE THESIS

This thesis conforms to the requirements of a doctoral thesis from the London School of Economics and Political Science. Guidelines state a minimum of three papers of publishable standard—in addition to introduction and conclusion chapters—not exceeding 100,000 words. Accordingly, this thesis presents an introduction chapter which gives the overview, motivation, objectives and background on Rwanda as well as a presentation of data and methodology used followed by research questions. Chapters 2, 3, 4 and 5 are presented in the style of journal articles and form the main body of the thesis; these chapters are currently under consideration by various journals. Chapter 6 and 7 bring together the key findings and present policy recommendations, a future research agenda as well as the limitations of this study.

PART 1: INTRODUCTION

1. INTRODUCTION

1.1. BACKGROUND

1.1.1. HEALTH SYSTEMS' PERFORMANCE

Undeniable worldwide health improvements have been observed in recent history. In two centuries, world life expectancy rose from 25 to 65 years for men and to 70 years for women. Before 1950, reductions in death rates at younger ages explained most of the gain in life expectancy. Survival improvements after age 65 drove life expectancy, lengthening in the second half of the 20th century (Oeppen and Vaupel 2002). Improvements in health systems' performance drove such reductions in mortality and morbidity. Nevertheless, large inequalities remain. Africa has the lowest worldwide life expectancy, although it rose significantly from 38 years in 1950 to 56 years in 2012. Mortality reduction among children under-five represents 59% of Africa's life expectancy gains since 1950, while 12% of the gain is due to better survival rates of children aged 5 to 14 (African Development Bank 2013). In-country inequalities also prevail with the poorest quintile suffering from higher infant and under-five mortality rates than any other quintile in low and middle income countries (Wagstaff 2000).

Why are there variations in health outcomes among countries which seem to have the same resources and possibilities? What causes in-country variations? These questions are at the center of the first World Health Report (WHR) of the 21st century dedicated to improving health systems' performance. The 2000 WHR argues that the provision of health cannot be left to markets. As health is a merit good, one cannot assume that demand and incentives from the market will lead to optimal health. Unlike other goods, health is an inalienable asset, subject to large and unpredictable risks, which are generally independent of one another (World Health Organization 2000). Further, Sen (2002) distinguishes health achievement and the capability to achieve good health, which may not be exercised. He argues that health achievements and failures depend on a variety of factors such as

genetics, income, life style, food habits, working conditions or epidemiological environment. This calls for interventions that go beyond healthcare and take into account, for instance, resource allocation and social arrangements. Understanding the role of health systems and raising their performance is critical to sustain and improve health achievements worldwide. The WHR 2000 claims that health systems must be more efficient, more accessible and more responsive. In other words, besides improving health, health systems must cut inequalities and respond to people's expectations with regard to healthcare services.

Health system reforms over past decades have aimed to strengthen health systems and to raise their efficiency, fairness and responsiveness. The foundation of national healthcare systems and social insurance systems were the first major reforms, which began in high income countries (HIC) to ensure universal access to basic health services and ensure financial protection for the population. This wave of reform was not implemented uniformly or at the same pace across different countries; implementation arrangements also varied. Tax and social health insurance continues to prevail in many HIC, but the reform fails to ensure universal access to care in poorer countries as financial and human resources and infrastructural limitations have also hampered progress. As a response, some countries like China and Mexico have put in place mechanisms to reach uninsured populations. In Mexico, the Seguro Popular scheme aims to provide financial protection to the 50 million uninsured Mexicans excluded from social insurance schemes. It offers free access to care for an explicit package of services. A randomized assessment of the program revealed that it was effective in reducing catastrophic and out-of-pocket expenditures among the poorest, but did not reduce spending on medication nor lead to increased healthcare use (King et al. 2009). In China, the New Cooperative Medical Scheme was put in place to protect the uninsured rural population from catastrophic health expenditures. An evaluation of the scheme revealed that out-of-pocket expenditure remained an issue for rural households, although the catastrophic severity of payment dropped (Sun et al. 2009).

The second wave of reforms encouraged primary healthcare services to ensure cost-effective, equitable and accessible health services. The primary healthcare strategy

for achieving 'Health for All' was adopted in 1978 in formally Alma-Ata (Lawn et al. 2008). This strategy did not achieve expected results as funding was inadequate, human resources insufficient, and care was of poor quality. The most recent wave of reforms, now under way, reflects the political and economic changes observed worldwide and characterized by the move toward market motivation including extrinsic (financial) motivation. Current reforms rely on market mechanisms, individual choice and responsibility rather than on public sector service provision, state regulation and control (World Health Organization 2000). These reforms aim to raise performance by borrowing market concepts and applying them to the provision of health services. Although the major focus is on health system efficiency, some attention is given to fairness and responsiveness. As discussed in section 1.1.4, there is a risk that fostering extrinsic motivation can harm intrinsic motivation, particularly within healthcare.

1.1.2. HEALTH SYSTEMS' CHALLENGES IN LOW INCOME COUNTRIES

Low income countries (LIC) are characterized by health challenges that differentiate them from HIC and result in very poor health outcomes. Insufficient and inequitably distributed resources hamper service delivery while access to, and utilization of, services remains poor, particularly for the most vulnerable (Palmer et al. 2004). In an analysis of 54 countries, Barros et al. (2012) show that the ratio that measures the magnitude of inequalities by intervention between the poorest and richest quintile can reach up to 3.2 for insecticide-treated bednets for children and 4.6 for a skilled birth attendant. Quality of care stands as another critical issue.

The Millennium Development Goals (MDGs) have brought the poor performance of health systems in LIC to the attention of the international community as maternal and child mortality and communicable diseases continue to plague LIC; however, effective interventions exist to address most health challenges of LIC. The price of treatments is falling and resources made available to LIC health systems have grown significantly over the past decades (Travis et al. 2004). Donor funding for reproductive, maternal and child health has doubled since 2000 but progress has been slower than expected and most countries remain off-track in achieving the MDGs (Lawn et al. 2014). The poor performance of health systems explains such poor outcomes (Travis et al. 2004). Table 1-1 summarizes constraints hampering

health systems' performance resulting in poor health outcomes in LIC as well as the responses that were developed to address them. It shows that one needs to address a range of constraints to raise health systems' performance including constraints at the community and household level, service delivery level, policy and strategic management level and globally.

Table 1-1: Health systems' constraints and responses

Level	Constraints	Responses	Adressed:
Community and household level	Lack of demand for effective interventions	Financial incentives to encourage use of services	Chapter 4
	Barriers to use of effective interventions (financial, physical, social)	Expand services close to clients Remove financial barriers (prepayment) Increase responsiveness of providers	Chapter 3 and 4
Service delivery	Shortage and poor distribution of qualified staff at primary care level	Increase number of health workers, implement task shifting, increase allowances to work in remote areas	Chapter 2
	Low staff pay and poor motivation	Increase pay, improve supervision	Chapter 2
	Weak technical guidance, program management and supervision	Strengthen training and supervision, contract management	Chapter 2
	Inadequate drugs and medical supplies	Strengthen public systems of supply, make use of private retail systems	Chapter 2
	Lack of equipment and infrastructure, including poor accessibility to services	Renovate, upgrade and expand public facilities, contract non-governmental organizations to provide services	Chapter 2

Level	Constraints	Responses	Adressed:
Policy and strategic management in the health sector	Weak and overly centralized systems for planning and management	Decentralize planning and management	Chapter 5
	Weak drug policies and supply systems	Introduce new supply mechanisms	
	Inadequate regulation of pharmaceutical industry and other segments of the private sector	Strengthen regulation through legal mechanisms and incentives	
	Lack of cooperative action and partnership for health between government and civic organizations	Engage with civic organizations in planning and service oversight	
	Weak incentives to use inputs efficiently and to respond to user needs and preferences	Use output-based payments and external assistance programs	Chapter 2, 3, 4 and 5
	Fragmented donor funding which reduces flexibility and ownership. Low priority given to systems support	Implement reforms to aid management and delivery, provided increased financing for systems support	
Government policy	Bureaucracy	Make greater use of private sector in financing, management and service delivery, and move health management into autonomous agencies	
Political and physical environment	Governance and overall policy framework (corruption, weak government, weak rule of law, political instability, social sectors not given priority in funding decisions, weak accountability, etc.)	Encourage improved stewardship and accountability mechanisms	Chapter 3

Level	Constraints	Responses	Adressed:
Global	Fragmented governance and management structures for global health	Improve global coordination (e.g. Paris Declaration, Accra Agenda for Action)	
	Emigration of doctors and nurses to high-income countries	Seek voluntary agreements on migration of doctor and nurses	

Source: Mills (2014) p. 554

This thesis explores the impact of some of the proposed responses to remove health systems' constraints as presented in Table 1-1. Chapter 2 focuses on constraints at the service delivery level, including shortages of qualified staff, poor motivation, weak management, inadequate availability of drugs and equipment and assesses the effect of increasing the number of healthcare workers, providing financial incentives and improving supervision for staff motivation and performance. Chapter 3 focuses on constraints found at the community and household level, in particular on barriers to effective interventions whether financial, physical or social. It also pays attention to the environment of healthcare services, in particular, to the governance framework and accountability mechanisms. Chapter 3 thus assesses the effect of increased responsiveness to patients' needs and improved healthcare management on removing those constraints. Chapter 4 focuses on community and household level constraints that lead to inequalities in the use of basic healthcare services due to the lack of demand for effective interventions, in particular among the most vulnerable. It assesses the effect of removing financial barriers to healthcare for households and of financial incentives for healthcare workers on using healthcare services. Finally, Chapter 5 looks at constraints at the policy and strategic management level in the healthcare sector that lead to poor service delivery at the local level due to overly centralized systems. In particular, it assesses the impact of more efficient uses of human and financial resources in the context of decentralization on effective use of healthcare services and a reduction in disparities.

This thesis also explores whether health financing reforms can contribute in removing systemic constraints. Health financing reforms that address constraints

related to financial access to healthcare services, which stand for a major impediment to demand, are probably the most common set of health financing reforms in HIC and LIC, and include risk-pooling mechanisms and exemptions. Health insurance mechanisms were developed in LIC to cover basic packages of healthcare services with varying degrees of success to reduce the financial burden on households and cut the risk of catastrophic expenditures. Rwanda and Ghana achieved remarkable progress in expanding health insurance both in terms of population covered and package of services. However, the limited tax base in LIC ensures progress toward universal health insurance remains slow in most countries.

To respond to the increased demand for healthcare services, health financing reforms also looked into raising performance in the supply of healthcare through reforming providers' payment mechanisms. Section 1.1.3 reports how such reforms can influence a health system's performance. This thesis particularly focuses on performance incentives targeting healthcare providers to address the lack of demand for effective interventions, poor responsiveness and inadequate motivation of providers.

1.1.3. REFORMING PROVIDERS' PAYMENT MECHANISMS

Reforming the way providers are paid can create incentives for providers to change their behavior. Incentives generated by payment mechanisms affect the way healthcare providers produce services and can influence efficiency, equity, consumer satisfaction and health status (Barnum, Kutzin, and Saxenian 1995). Provider payment mechanisms vary in the incentives they generate and in their potential adverse effects. In countries where the health sector is predominantly publicly-funded and services are provided by public providers, budgets are the most common mechanism. They take the form of line-item allocations from the Ministry of Health (MOH) to healthcare facilities. Health workers are paid on a salary basis, whatever the quality and quantity of healthcare services they provide. In this payment mechanism, the state finances, manages and provides health services. This creates no incentive for efficiency, cost reduction or quality.

The need to separate health system financing functions has progressively emerged as a key principle and was conceptualized by Kutzin (2001). The theoretical flow of

funds include: the collection of funds from various sources including the government, employers and citizens; pooling of funds; purchasing of services by a ministry or a health fund holder such as an insurance fund; and, the provision of services by public or private hospitals, practitioners or pharmacies that are paid by the fund holder according to specific provider payment arrangements. Several arrangements exist but the tendency is to move away from input-based financing. Payments can be either retrospective, when incurred costs are reimbursed after the service has been provided, or prospective, when the payment is agreed upon prior to the service being delivered. Under a line-item budget arrangement, which is characteristic of centrally directed health systems; governments determine budgets according to specific line-items such as salaries, equipment or drugs. Public managers do not have the flexibility to switch funds across line-items but they are not accountable for the performance so long as the budget is executed. They have no incentive to improve efficiency in budget spending or to reduce costs. As a result, productivity is low. Despite the negative effect on efficiency and cost minimization, line-item budgets are common in low income countries as they often lack trained managers, particularly at the local level. Central management oversight thus appears to be the most workable option. Global budgets consist of an aggregate fixed advanced payment to cover expenditures during a given period, and are often used in decentralized health systems. Healthcare providers have flexibility on resource use, but they are accountable for the way resources are spent, which creates incentives for performance. With a global budget, providers have an incentive to apply fewer inputs and produce fewer services to reduce the costs. The downside is that a global budget can result in access problems and in providers exceeding their budget. Global budgets are used for the Department of Veterans Affairs in the United States. Some forms of global budgets are also in use in Canada and Western European countries. Under capitation, providers are paid a fixed amount per insured person to deliver a given package of services. It incentivizes providers to deliver cost-effective services to reduce the cost of treatment per person. The downside is that providers have an incentive to select low-risk patients to lower the costs and to reduce the quantity and quality of services. Under fee-for-service mechanism, providers are reimbursed for the exact services delivered; a fee schedule can be fixed (e.g. France) or unregulated (e.g. in the US). This creates a

perverse incentive for supplier-induced demand so that the volume of services and the earnings of providers will increase. This mechanism can raise health system productivity but also lead to cost escalation. Finally, under case-based reimbursement, the provider is paid a predetermined figure that covers all services associated with an illness. Providers have the incentive to more efficiently produce thus lower the cost per case. Coding bias and case selection are important perverse incentives under this provider payment arrangement. The incentive to lower costs also raises concerns about the quality of care (Kutzin 2001, Barnum, Kutzin, and Saxenian 1995). The main advantages and disadvantages of each provider payment mechanism, as well as strategies to overcome perverse effects, are summarized in Table 1-2.

Table 1-2: Advantages and disadvantages of provider payment mechanisms

Payment method	Advantages	Disadvantages	Minimization of disadvantages
Line item budget	Central control appropriate with weak management capacities at local level.	No incentive for efficiency. No flexibility in resource use. Under-provision of services.	Monitor performance for better use of resources.
Global budget	Predictable expenses. Low administrative costs.	No incentive for efficiency.	Monitor performance. Link global budget to performance/bonuses.
Capitation	Predictable expenses. Incentives for efficiency. No supplier-induced demand.	Financial risk for provider. Enrolment of low-risk patients (cream-skimming). Under-provision of services.	Adjust capitation to risks of population enrolled. Contracts to ensure services are provided.
Fee for service (no fee schedule)	Incentive for efficiency.	Unpredictable expenses. Cost escalation and supplier-induced demand.	

Payment method	Advantages	Disadvantages	Minimization of disadvantages
Fee for service (with fixed fee schedule)	Incentive for efficiency.	Unpredictable expenses. Cost escalation and supplier-induced demand. Higher administrative costs.	Cap total expenditures and adjust prices to keep expenditures within the limit.
Case-based	Incentive for efficiency.	Unpredictable expenses. Selection of low-risk patients. Less suitable for outpatient care.	Detailed case-mix category system. Mixed payment system.

Source: Adapted from Barnum, Kutzin, and Saxenian (1995)

1.1.4. SETTING INCENTIVES

This classification of provider payment mechanisms is mainly theoretical as none of the mechanisms have shown superiority over others. In the real world, most payment systems are mixed to counter adverse effects and create the right incentives to raise health systems' performance. The search for incentives capable to overcome health systems' inefficiencies can be sourced back to the 1980s. At that time, ministries of health progressively moved away from a bureaucratic public management model of direct health service provision, to follow new initiatives embedded in New Public Management (NPM) reforms. This shift was aimed to overcome inefficiencies in service delivery and toward creating incentives for good performance. This resulted in reforms of provider payment mechanisms, enhanced competition through the separation of functions, contractual relationships, market-based mechanisms for service delivery and a shift from universalism and equity to efficiency and individualism (Hood 1991, Russell, Bennett, and Mills 1999, Forder, Robinson, and Hardy 2005). In opposition to centralized management and control, NPM reforms promote hands-on professional management and explicit standards and measures of performance. They place emphasis on the control of outputs rather than on inputs and promote decentralization and competition. Contracting and other incentive mechanisms are put forward to raise performance. Finally, NPM reforms favor private sector management styles, in particular, in the management of

human resources as well as more accountability in resource use to raise efficiency (Table 1-3).

Table 1-3: New Public Management doctrine

Doctrine	Meaning
Hands-on professional management	Active, visible, discretionary control of organizations
Explicit standards and measures of performance	Definition of goals, targets, indicators of success
Emphasis on output control	Resource allocation and rewards linked to performance
Disaggregation of units in the public sector	Shift from centralized management systems to corporatized units operating on decentralized budgets
Greater competition in the public sector	Move to contracts and public tendering procedures
Private sector styles of management practice	Greater flexibility in hiring and rewards
More discipline and efficiency in resource use	Contain costs, better labor discipline

Source: Hood (1991) pp. 4-5

Expected outcomes of NPM reforms in health are greater efficiency and better quality health services, but the focus on efficiency may jeopardize equity (Preker, Harding, and Travis 2000). A review of NPM reform implementation in low income countries has shown that reforms have led to modest gains in technical efficiency and have had a limited or negative impact on equity. These results may be due to a significant cut in available resources and the parallel introduction of user fees (Batley 1999).

Health systems are now characterized by a greater specialization of actors and separation of functions. In these more complex health systems, incentive mechanisms are essential to define relations between actors and ensure the performance of systems. Incentives aim to affect motivation which determines the strength and direction of providers' behavior. Intrinsic motivation relates to the inherent satisfaction generated by activities, such as goals, motives and values, self-concept and expectations about the consequences of actions (Franco, Bennett, and Kanfer 2002). In contrast, extrinsic motivation relates to the attainment of a separable outcome (financial reward). The effect of incentives will vary according to

cultures. The conceptual framework developed by Franco, Bennett, and Kanfer (2002) on public sector health worker motivation shows the different ways in which motivation is influenced. In addition to the above individual level determinants of motivation, workers' motivation also depends upon the organizational context; including, structures, resources, processes and culture. Communities also influence health workers' motivation through their expectations, interactions with workers and feedback on health worker performance (Franco, Bennett, and Kanfer 2002).

The interaction between intrinsic and extrinsic motivation is debated in the theoretical literature. The efficiency wage theory argues that increased salaries and intensive monitoring will raise performance but others fear that extrinsic motivation may crowd out intrinsic motivation. Industrial psychologists and sociologists argue that extrinsic incentives can be perceived as distrust from the employer and therefore result in demotivation (Garcia-Prado 2005). The motivation crowding theory suggests that financial incentives may undermine or strengthen intrinsic motivation. It mediates the standard economic model and the psychological theory by demonstrating a systematic interaction between intrinsic and extrinsic motivation. Crowding out or crowding in intrinsic motivation can be generated by a change in preferences or a change in the perceived nature of the performed task in the task environment or in the worker's self-perception. External interventions may crowd out intrinsic motivation if perceived as controlling, or crowd in intrinsic motivation if perceived as supportive (Frey and Jegen 2001).

The effectiveness of incentives will also depend on the organizational culture in which they are developed. The organizational culture can be defined as a set of shared mental perceptions that guide interpretation and action in organizations by defining appropriate behavior for various situations. Organizational culture relates to the way individuals behave within an organization and to the organization's vision and values (Ravasi and Schultz 2006). If the organizational culture is strong, staff will align to the organizational values. In opposition, if the culture is weak, there will be less alignment and a need for more control. This will have an impact in the designing, implementing and enforcing of a performance management system as well as ensuring individuals adhere to it. The organizational culture is characterized by two competing values: control and flexibility, and the performance management

system of an organization needs to be adapted to the organization's values. Control values refer to predictability, stability and conformity and reflect an orientation toward efficiency and profit, whereas flexibility values refer to change, openness and responsiveness which reflect adaptability and a readiness to attain growth, innovation and creativity. As a performance management system cannot be compatible with all control and flexibility values, the organization will need to adjust its actions to ensure the success of the performance management system. The organizational culture literature thus recommends that managers be aware of their organization's values before designing a performance management system (Henri 2006).

1.1.5. AGENCY THEORY

Agency theory enables us to understand how financial incentives help align contradicting interests in the health sector as patients and providers, or fund holders and providers, have different preferences and objectives. In a perfectly functioning market, optimal outcomes are achieved due to atomistic competition and perfectly informed consumers. However, in the real world, market failures hamper the achievement of optimal outcomes. In the health sector, the main issue comes from an asymmetry of information between the agent, who has the information, and the principal, who does not. Agents are liable to moral hazard; they have an incentive to do as little as possible since the principal cannot verify their actions. For instance, the patient (principal) has little information on treatments, their efficacy and skills of the provider (agent) and thus must rely on the provider. The agent may adopt a behavior that is inappropriate from the view of the principal. The asymmetry of information between the healthcare provider and the patient can result in supplier-induced demand with the supplier holding the information and encouraging the patient to consume more services. This results in more demand for healthcare services than what would have occurred in a market with fully informed patients. A similar principal-agent relationship occurs between the purchaser of healthcare services (principal) and the provider (agent) (Milgrom and Roberts 1992b, Salanie 2005, Preker, Harding, and Travis 2000, Perrot 2004). Incentives can be used to control moral hazard; for instance, by rewarding good outcomes or outputs they ensure that the agent will take the expected action (Grossman and Hart

1983). Tying the agent's reward (or part of it) to the achievement of the principal's objectives enables an alignment with the agent's objectives with those of the principal, since agents are risk-adverse and do not want to have their income dependent on random factors (Eichler 2006, Milgrom and Roberts 1992a).

The predictive power of the principal-agent model relies on the assumption that providers behave rationally, that is to say, they make choices to maximize their earnings according to the incentive mechanism in place. However, behavioral economics shows that an individual's rationality is influenced by factors that make them differ from perfect economic agents and enables us to understand the strength of performance incentives. Behavioral economics explores the effect of psychological, social, cognitive and emotional factors on individual and institutional decisions. They show how individuals systematically diverge from the behaviors that rational utility-maximizing models predict for three reasons: first, there is a bias in estimating risks, since individuals tend to overestimate the probability of events they have heard about; second, there is a tendency for asymmetric treatment of gains and losses, where individuals tend to avoid penalties before trying to obtain bonuses; and third, there are time inconsistencies with individuals that systematically misjudge how they are going to experience decision-making scenarios in the future (Savedoff and Partner 2010).

1.2. PAYING FOR PERFORMANCE

1.2.1. PUTTING THEORY TO TEST

To understand how healthcare providers can be incentivized to modify their behavior and improve their performance, one must understand healthcare providers' behavior and the determinants of their performance. Results achieved (performance) depend on factors associated with demand, and factors associated with the characteristics of supply. Performance will increase with higher demand, but demand is determined by: the environment (such as geographical access); income of the population (financial access to health services); perception of the quality of healthcare providers, as individuals will be less likely to visit a healthcare facility if the service is poor; and, cultural factors (such as religious beliefs). Some of these determinants can be influenced to raise demand for healthcare services such

as removing financial barriers to healthcare services for the most vulnerable. Factors associated with characteristics of the supply depend on available human and financial resources; the know-how which results from providers' competences in the delivery of healthcare services; and, efforts made which are linked to sanctions, the level of professionalism, relative remuneration, work value, context and financial and non-financial incentives (Perrot et al. 2010).

Performance incentives result from the failure of the classical approach which hypothesized that the performance of a healthcare facility would be improved with more and better quality factors of production (input-based approach). All things being equal, it was assumed that providers would achieve better results with more and better staff, adequate equipment and technologies, available drugs at affordable prices and an efficient and accessible infrastructure. The rationale was that an adequate combination of those inputs would help achieve the best possible outputs. This approach was insufficient, particularly in low income countries, as they suffered from a critical lack of inputs. Furthermore, the practice showed that identical inputs did not translate into comparable results, illustrating that inputs are not the only determinants of healthcare providers' performance. Incentive mechanisms were thus proposed as a way to enhance performance of healthcare providers. Incentives encourage healthcare providers to raise performance by enhancing the efficiency of services delivered to the population. The incentive provider is also called 'purchaser' or 'financing agent' in the context of financial incentives. The incentive beneficiary is the healthcare provider who is stimulated to change its behavior to raise its performance. Incentives target the performance of an institution but implementation arrangements may, in practice, incentivize staff (Perrot et al. 2010).

1.2.2. CLASSIFICATION OF INCENTIVE MECHANISMS

Incentives can either target healthcare providers or users of healthcare services; they are respectively referred to as 'supply side' and 'demand side' incentives. On the demand side, incentives often target individuals and aim to stimulate demand for healthcare services and thus raise utilization of health services. Different forms exist, including: price related incentives to lower the price of services for the poorest or penalties for those consuming healthcare services in excess; voucher

systems which consist of distributing vouchers to a pre-identified population that can be used for accessing care for free or obtaining a fee reduction; insurance or user fee exemption scheme aiming to remove the financial barriers to healthcare services and encourage populations to use healthcare providers; and, conditional cash transfers that consist of a financier giving money to a pre-identified population conditional on achieving certain goals related to health or education (Perrot et al. 2010). Demand side incentives, such as conditional cash transfers in Mexico, benefited from the most rigorous evaluations (Eichler and Levine 2009b, Lagarde, Haines, and Palmer 2009).

Supply side incentives are incentives to healthcare providers that encourage them to change their behavior and practices to raise efficiency and quality. Incentive mechanisms vary according to their objectives, expected results, indicators, the entity receiving the reward, type and magnitude of the reward, proportion of the reward compared to the base salary, ancillary components associated with performance incentives, such as the availability of resources, supplies, technical support or training. Most approaches provide additional financial resources based on results and co-exist with input-based financing (Gorter, Por, and Meessen 2013). Three forms of supply side incentives exist: performance-based contracting (or contracting-out), which is a mechanism whereby the purchaser contracts a non-state provider (e.g. non-governmental organization) to provide a set of services in a specific area; performance-based financing (PBF) (or contracting-in) introduces a new provider payment mechanism with the performance contract existing between the Ministry of Health and healthcare facilities; and, results-based budgeting is a mechanism through which the government links budget funds to desired outputs rather than using inputs. Table 1-4 summarizes the principal forms of incentives that exist on the demand and supply sides.

Table 1-4: Performance incentive mechanisms according to the type of agent concerned

Type of agent	Type of incentive	Performance incentive	Objective
Individuals, families and households	Demand side	Conditional cash-transfers Vouchers Price related incentives (e.g. Health Equity Funds)	Increase demand for healthcare services Increase intake of preventive care Remove financial barriers
Healthcare providers	Supply side	Performance-based financing Performance-based contracting Performance-based budgeting	Raise health workforce productivity Increase quality of services Increase delivery of services (e.g. preventive care)

Source: Author (2015)

This thesis focuses on supply side incentives, and more precisely on performance-based financing in the context of LIC. Performance-based financing is the "transfer of money or material goods conditional on taking a measurable action or achieving a predetermined performance target" (Eichler 2006). A more recent and comprehensive definition states that "Performance-Based Financing is a system approach with an orientation on results defined as quantity & quality of service outputs and inclusion of vulnerable persons. This approach entails making facilities autonomous agencies that work for the benefit of health or education related goals and their staff. It is also characterized by multiple performance frameworks for the regulatory functions, the contract development & verification (CDV) agency and community empowerment. Performance-Based Financing applies market forces but seeks to correct market failures to attain health or other sector gains. PBF at the same time aims at cost-containment and a sustainable mix of revenues from cost-recovery, government and international contributions. PBF is a flexible approach that continuously seeks to improve through empirical research and rigorous impact evaluations, which lead to best practices" (Cordaid-SINA Health 2014).

The objective for the purchaser of health services is to increase the quantity and quality of services delivered through PBF. In HIC, performance-based financing is referred to as 'Pay-for-Performance' (P4P). It is predominantly used in the UK and US to link incentives to predetermined quality targets and promote evidence-based

medical care. Through improving the performance of providers, the final objective is to improve patients' health (Greene and Nash 2009, Bell and Levinson 2007). Sub-sections 1.2.3 and 1.2.4 briefly present Pay-for-Performance and performance-based financing in their contexts.

1.2.3. HIGH INCOME COUNTRIES

P4P programs are increasingly used in high income countries. P4P in the US began in the late 1980s but experienced exponential growth following the report entitled *Crossing the quality Chasm* from the Institute of Medicine (Corrigan 2005) which identified six challenges for the health system in the US: patient safety, effectiveness, patient-centeredness, timeliness, efficiency and equity. The report concluded that provider payment mechanisms were the best entry point for effective healthcare reform and recommended them to motivate and reward providers to address identified issues. Following this report, P4P schemes were largely diffused across the entire US health system (Elovainio 2010). Rosenthal et al. (2007) show that most P4P schemes in the US target primary care practitioners, specialists (in particular surgeons and cardiologists) and hospitals. Specific measures include patients' satisfaction, outcomes, processes, information technology and cost efficiency. In the UK, P4P has been in place since the 1990s for the remuneration of general practitioners. The Quality and Outcomes Framework (QOF) implemented in 2004 is considered the most comprehensive national primary care P4P program in the world. The QOF uses financial incentives to promote structured and team-based care in pursuit of evidence-based objectives. Payments are linked to clinical care, practice organization and patient experience (Gillam, Siriwardena, and Steel 2012). In Australia, the Practice Incentive Program has been implemented by Medicare Australia since 1998 and targets general practitioners for different clinical and organization practice indicators. In Catalonia (Spain), the health administration finances and regulates healthcare providers following contractual arrangements that control for the quality of care (Lopez-Casasnovas, Costa-Font, and Planas 2005). In France, the national health insurance organization introduced performance-based contracts for general practitioners to improve quality and efficiency for preventive care and for the follow up of chronic diseases. Other schemes are found

in Canada, New Zealand, Germany, Netherlands, Italy and Estonia, but the most rigorous evaluations relate to UK and the US (Elovainio 2010).

1.2.4. LOW INCOME COUNTRIES

Health systems of low income countries suffer large inefficiencies (Belli 2004). Health systems usually lack financial and human resources and are characterized by poor quality control and supervision, limited managerial skills, and, poor supply chains and information systems. As a result, health services are underused, particularly by the poor, the quality of care is low and service delivery is inefficient (Eichler and Levine 2009a). Technical and allocative inefficiencies result from unreliable and insufficient funding of the key inputs and inappropriate management and mix of inputs with salaries tending to supplant other inputs *(Levine and Soucat 2001)*.

Performance incentives where encouraged as early as 1993 by the World Bank's report on *Investing in Health* to overcome challenges in service delivery (World Bank 1993). Since then, PBF has been implemented in a growing number of countries. The rationale behind PBF in LIC is that well-designed incentives can help improve the production of healthcare and foster creativity (Filmer, Hammer, and Pritchett 2000). PBF is expected to introduce more flexibility in the use and management of resources, thus improving technical efficiency by a better use of inputs and allocative efficiency by minimizing costs (Meessen et al. 2006).

PBF is used for public sector contracting of health services and the pioneer countries were Cambodia (Soeters and Griffiths 2003) and Rwanda (Soeters, Habineza, and Peerenboom 2006, Meessen et al. 2006). With PBF, payments are made according to a pre-determined list of services, and payments are conditional on the quality of care. Increasing health facility autonomy and establishing effective planning, management and administrative systems is critical in implementing and supporting the schemes (Savedoff and Partner 2010). Table 1-5 summarizes the main evidence from LIC on the effect of PBF. More details are provided in Appendix 1. Findings from other countries are discussed in detail in section 1.3.

Table 1-5: Summary of main evidence from LIC

Country	Description/ target of incentive	Finding
Afghanistan	International and local Non-Governmental Organizations (NGO) contracted in 8 provinces.	Contracted facilities had large improvements in quality of care whereas quality worsened in facilities managed by the Government.
Afghanistan	EC, USAID and the WB implement different contracting mechanisms (with NGOs). WB incorporates performance bonuses and flexibility to use funds. EC and USAID apply input-based reimbursements.	All contracting schemes resulted in better access to services, better health outcomes and a reduction of inequities among provinces. Better results in PBF NGOs
Bangladesh	NGOs train, supervise, pay and support the community nutrition promoters within the Bangladesh Integrated Nutrition Project	Reductions in rates of moderate and severe malnutrition were slightly greater in project areas compared with control. Significant improvements in other health services. Results achieved at a high cost.
Bangladesh	NGO contracted to provide outreach services and to operate health centers.	Significant improvements in maternal and child health (except for immunization). NGO was able to provide more and better quality health services
Bolivia	Management contract with NGO.	Deliveries increased by 41% compared with 20% in the control district. Increase in outpatient services.
Burundi	Performance incentives with variable bonus for quality.	Improved quality of care during prenatal care but no improvement in timeliness. Increase in institutional deliveries among the better off. Increase in probability of a child being fully vaccinated.
Cambodia	Government contracts NGOs in 2 different ways: a service delivery contract (contracting out) and a management contract (contracting in).	Larger improvements in prenatal care coverage in contracting out and contracting in districts. The poor have benefited disproportionately from contracting. Cost of contracting higher but led to savings in OOP.

Country	Description/ target of incentive	Finding
Cambodia		Fully immunized children coverage increased for poorest and richest but the difference between rich and poor households decreased from 9.1% point to 5.7% before and after contracting.
Democratic Republic of Congo	Performance incentives with variable top-up for quality.	Positive effect only on knowledge of HIV and institutional deliveries. OOP increased in treatment areas.
Haiti	A total of 3 pilot NGOs.	All 3 NGOs exceeded the performance targets for immunization coverage. ORS increased in 2/3. Weak performance in ANC and contraceptive use. Availability of contraceptive increased.
India	2 contracts: one with NGOs for training, outreach and monitoring and subcontracts between NGOs and private providers for changing their proactive behaviors.	Large improvement in the management of childhood illnesses by private practitioners
Madagascar and Senegal	NGOs contracted to deliver community based nutrition interventions.	Modest effect on malnutrition rates.
Pakistan	NGO, Punjab Rural Support Program, given a management contract to run all the basic health units in Punjab.	Coverage of preventive services is low in both districts and the rates of progress are similar. However, contracting resulted in an improvement in BHU use, patient satisfaction, and reduced OOP for BHU services.
Philippines	Performance incentives.	Average number of monthly inpatients does not increase with bonus but increases with health insurance. Quality of care improved with PBF as well as patient outcomes.
Rwanda	Performance-based financing in pilot districts.	OPD, family planning, measles immunization and institutional deliveries increased in treatment districts. Better quality score.

Country	Description/ target of incentive	Finding
Rwanda	Performance-based financing in primary healthcare facilities to raise utilization and quality of basic health services (National model).	Coverage of any prenatal care visits, institutional deliveries, and child preventive care increases. Quality of prenatal visits also higher in treatment facilities.
Tanzania	Performance incentives.	Mission facilities saw a decline in inpatient stays, institutional deliveries and prenatal care compared to government facilities.
Vietnam	Performance incentives.	Improvement in case detection in intervention areas.
Zambia	Performance incentives.	Improvements in VCT in both groups. No change in institutional deliveries and ANC.

Source: Author, adapted from Loevinsohn (2008) and Witter et al. (2012).

The use of PBF in LIC is at the center of a heated debate in the literature. Supporters of the strategy claim that it can catalyze reforms and address structural problems in the health sector, such as low responsiveness, inefficiency and inequity (Meessen, Soucat, and Sekabaraga 2011, Basinga et al. 2011). Others highlight the lack of rigorous evidence and the bias in publishing as only positive results on PBF are published (Ireland, Paul, and Dujardin 2011, Witter et al. 2012, Ssengooba, McPake, and Palmer 2012). Most evidence concentrates on the impact of the strategy on the use of services and quality of care, but less is known of its cost-effectiveness, equity impact and potential adverse effects (Witter et al. 2012, Witter et al. 2013). It is however likely that the strategy will deter equity in access to services as it can encourage health workers to focus on targeted services at the expense of others (distortions) and to cherry-pick patients that are easier to reach (most likely the richest) (Ireland, Paul, and Dujardin 2011).

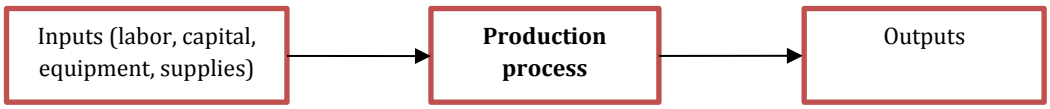
1.3. LITERATURE REVIEW ON PERFORMANCE INCENTIVES

Following the World Health Organization (2000) and because, by definition, performance incentives aim to improve performance, the below sections review the literature on the effect of performance incentives on performance, measured in terms of efficiency, equity and responsiveness to summarize the state of evidence and identify potential gaps in knowledge.

1.3.1. *EFFICIENCY*

As one may expect, most evidence on the impact of performance incentives relate to their effect on efficiency or productivity. The productivity of an organization is the ratio of the outputs that it produces to the inputs that it uses. The production function models the maximum output an organization can produce given its level and mix of inputs. The middle box in the production process (Figure 1-1) cannot be observed as it denotes what is happening in the organization and how the production process is organized, although this is what determines its efficiency (Street and Hakkinen 2009, Jacobs, Smith, and Street 2006). Three levels of efficiency can be measured: technical[1], allocative[2] and economic efficiency[3] (Jacobs, Smith, and Street 2006, Coelli, Rao, and Battese 1997, Liu and Mills 2007, Street and Hakkinen 2009). When applied to performance incentives, the efficiency of health facilities or healthcare providers operating under P4P or PBF schemes is measured in terms of efficient use of human and financial resources (inputs), efficient production of outputs measured by the quantity of health services produced and the utilization of and access to those services as well as the quality of those services.

Figure 1-1: Simplified production process



Source: Author (2015).

The evidence on the effect of P4P on resource use is mixed (Armour et al. 2001). There is evidence that P4P reduces the cost of support services but there is less evidence on its effect on clinical services (Mills and Broomberg 1998). In a review of 100 studies, Greene and Nash (2009) conclude that P4P leads to improved performance and better patient outcomes. A review of the evidence in the US also shows that financial incentives succeed in cutting the utilization of health services in managed care plans (Hellinger 1996). There is however a risk of an adverse selection for sicker patients (Peterson et al. 2006). Most assessments related to

[1] Technical efficiency requires the maximization of output for a given level of inputs or the minimization of inputs for a given level of output.
[2] Allocative efficiency looks at the minimization of the cost of producing an output.
[3] Economic efficiency is the product of technical and allocative efficiency.

quality focus on process measures: 12 out of 15 studies reviewed by Peterson et al. (2006) revealed a positive effect on the quality of care. For instance, in the US, P4P hospitals achieved greater quality improvements for acute myocardial infarction, heart failure and pneumonia (Lindenauer et al. 2007). In the UK, P4P resulted in improved quality of care of family practitioners but some evidence was found showing practices excluded more than 15% of patients as they were judged ineligible for quality indicators (Doran et al. 2008). Other reviews report more mixed results on the quality of care (Armour et al. 2001, Mehrotra et al. 2008).

The evidence on the effect of PBF on efficiency in low income countries is poor and shows mixed results (Liu, Hotchkiss, and Bose 2008). Witter et al. (2012) reviewed 8 studies which assessed the effect of PBF on resource use and concluded that facilities' revenues and staff pay increase with PBF, but that there is no evidence on other effects on resource utilization, such as patient payments or efficiency in service delivery. PBF experiences consistently lead to technical efficiency gains thanks to better flexibility in human resource management (South Africa), bonus payments to staff (Haiti, South Africa), better organization and innovations in service delivery (Haiti, Afghanistan) and greater managerial autonomy (Haiti, Cambodia, Afghanistan) (Mills and Broomberg 1998, England 2004, Eichler et al. 2009, Bloom et al. 2007, Palmer et al. 2006, Sondorp et al. 2009). In two PBF pilots in Rwanda, health center managers developed creative strategies to spend resources according to their priorities and perceived needs, such as salaries, infrastructure, equipment or drugs (Soeters et al. 2005, Meessen et al. 2006, Meessen, Kashala, and Musango 2007). The evidence on allocative efficiency gains is even thinner: in Cambodia, contracted districts have better cost-effectiveness ratios than control districts; in Costa Rica, expenditures per capita in contracted facilities are 30% lower than in traditional public facilities; in India, contracted NGOs achieve better results at a lower cost; and, in rural Pakistan, outpatient visits rose significantly with the same budget. However, in rural Bangladesh and South Africa, PBF had no impact on allocative efficiency (Loevinsohn 2008, Loevinsohn and Harding 2005, 2004, England 2004, Liu, Hotchkiss, and Bose 2007). In the absence of a clear result on the impact of PBF on productivity and efficiency, Chapter 2 will contribute to close a gap in knowledge. By its focus on the health workforce, it will

enable us to generate evidence on the availability of staff, absenteeism and productivity.

The effect of PBF on the utilization of health services is the aspect that is explored the most with findings supporting the idea that PBF is efficient in raising utilization, which is the main intended effect of the output-based formula of PBF schemes. In Burundi, PBF has led to improvements in the quality of prenatal care but the timeliness and number of visits did not change. PBF also resulted in an increase in utilization of institutional deliveries and in the probability of a child being fully vaccinated (Bonfrer, Van de Poel, and Van Doorslaer 2014). Witter et al. (2012) reviewed 9 PBF interventions in low income countries and suggest that the poor quality of the evidence and the limited number of published studies does not allow firm conclusions to be drawn. Besides, PBF schemes vary significantly in their design and approaches. Two studies report a highly uncertain effect on the utilization of prenatal care; 4 studies report unclear results on institutional deliveries as the effect varies substantially from one study to another; the effect on utilization of preventive care for children is also unclear as in one case, attendance to preventive care services doubled but in another, the impact on immunization was negative; and, the impact on utilization of outpatient services also generated inconsistent results. As far as the effect on quality is concerned, evidence shows mixed results for coverage of tetanus vaccinations among pregnant women. There was also no impact on tuberculosis case detection.

1.3.2. EQUITY AND RESPONSIVENESS

There is no sound evidence, but mainly hypotheses, on the negative and unintended side-effects of PBF (Gorter, Por, and Meessen 2013). It is however important to understand its effect on equity and responsiveness to ensure efficiency gains are not achieved at the expense of equity and patients' satisfaction.

There is no agreement on what constitutes equity. The most popular definition of equity in health is that it "implies that ideally everyone should have a fair opportunity to attain their full health potential and, more pragmatically, that no one should be disadvantaged from achieving this potential, if it can be avoided" (Whitehead 1991). Wagstaff, Van Doorslaer, and Paci (1989) distinguish equity in

the finance of healthcare with payments being related to the ability to pay, from equity in the delivery of healthcare. Further, equity in healthcare is defined as equal utilization, distribution according to needs, equal access and equal health outcomes (Culyer and Wagstaff 1993). In empirical studies on equity, the concept of health inequalities is preferred. It focuses on cutting inequalities related to an individual's economic status, gender, ethnic inequalities, education and occupation (Gwatkin 2002a, 2000). To overcome such inequalities, one should aim at tackling inequalities in access, that is to say both inequalities in the finance[4] and the delivery of healthcare[5] (Wagstaff and Van Doorslaer 1993, 2000).

Evidence from high income countries on the impact of P4P on equity is mixed. A systematic review conducted in 2006 suggests that access improves for vulnerable groups if they are explicitly targeted (Peterson et al. 2006) but several later studies from the US show that P4P may exacerbate disparities in healthcare (Greene and Nash 2009): P4P can increase racial disparities by disadvantaging hospitals with more than 20% of African Americans (Karve et al. 2008); and, it can worsen disparities between hospitals (Werner, Goldman, and Dudley 2009). Other studies show that P4P has no impact on equity in access to care: the quality of chronic disease management in England was generally equitable between socioeconomic groups before and after the P4P program (Crawley et al. 2009).

Evidence on equity from LIC is limited (Lagarde and Palmer 2006) and all studies present significant methodological flaws. In a review of 14 PBF experiences, the impact on equity was measured in only three cases (Loevinsohn 2008). In Cambodia, PBF resulted in increased utilization and lower out-of-pocket (OOP) payments by the poorest 50%. However, as control districts received significantly lower resources than contracted districts, it is impossible to ascertain that the positive impact on equity in access is related to contracting and not to increased resources (England 2004, Palmer et al. 2004). Witter et al. (2012) report only one study looking at the impact of PBF on equity measured in terms of households' payment and shows a positive impact on poorest household spending on healthcare

[4] Households with the same ability to pay should provide the same financial contribution.
[5] Individuals with the same needs should be treated similarly.

services. The literature insists on the importance of targeting the poor as the better-off could be the main beneficiaries of a rise in utilization (Gwatkin, Bhuiya, and Victora 2004). The experience shows that equity in access improved only when the poor were explicitly targeted, such as in urban Bangladesh and Cambodia. In Pakistan, where there was no targeting, no improvement was observed (Loevinsohn 2008). Finally, evidence from Burundi is mixed: PBF had a positive impact on institutional deliveries only among the better off women, but the positive effect of PBF on the probability of a child being fully immunized was observed particularly among the poorest (Bonfrer, Van de Poel, and Van Doorslaer 2014). Building on the evidence from HIC and LIC, Chapter 4 will contribute to the debate on the impact of performance incentives on equitable access to care in LIC. As PBF is increasingly implemented in LIC and the evidence base remains thin, the evidence presented in Chapter 4 will benefit other countries.

Health systems must be responsive to patients' needs to reduce the damage to dignity and autonomy and ensure patients' satisfaction with their interaction with the health system. Patients' satisfaction is an important aspect of quality of care assessment (Donabedian 1988). Knowing how performance incentives affect patients' satisfaction is thus central to the efficiency analysis. The integration of responsiveness opposes high and low income countries. HIC have extensive experience with patient satisfaction surveys. Overtime, measuring patients' satisfaction with healthcare has become a regular process that P4P schemes have internalized and utilize for calculating rewards (Peterson et al. 2006). Satisfaction with P4P schemes is however expressed from the providers' perspective in the literature, rather than from the patients' perspective (Greene and Nash 2009). In low income countries, measuring patients' satisfaction is not common and quality is mainly measured from a clinical perspective. PBF schemes in LIC generally do not tie performance incentives to patient satisfaction. Witter et al. (2012) report some evidence showing that patients' perception of the quality of care with PBF is mixed: there was no effect on satisfaction in Tanzania; satisfaction improved in the Philippines and Democratic Republic of Congo (DRC) but worsened in Burundi and Zambia. The evidence on the impact of PBF on the quality of care and on patient satisfaction in LIC is scarce. Chapter 3 proposes to use the patients' perspective to

measure the quality of care of providers receiving financial incentives as well as their responsiveness to patient needs. This will contribute in closing a gap in the knowledge by bringing some elements on the quality of care under PBF schemes in LIC. It is also interesting, from a methodological point of view, as it uses the patients' perspectives rather than clinical indicators to measure quality.

1.4. DECENTRALIZATION REFORMS

1.4.1. DEFINITION

The term "decentralization" is a general term and different forms of decentralizations have been developed with varying implementation arrangements. Overall, decentralization relates to the transfer of authority and responsibility for public functions from central government to the local level. Political decentralization aims to give more power in public decision-making to the lower levels of the state. It is assumed that decisions taken locally will better respond to needs and interests of the population. Administrative decentralization aims to delegate responsibility and financial resources for the provision of public services to lower levels of government. Three major forms of administrative decentralization exist. 'Deconcentration' is usually chosen in unitary states as responsibilities remain with central government and the local level remains under the supervision of the central level. With 'delegation', semi-autonomous organizations receive a transfer of responsibility from the central government. Finally, 'devolution' is the most advanced form of decentralization with central government transferring authorities to quasi-autonomous units. The latter can elect their own representatives, raise their own revenues and use resources according to their own decisions. Fiscal decentralization is a major component of decentralization as local entities must have adequate revenues to exert their new responsibilities. Fiscal decentralization can take many forms, including self-financing, co-financing, expansion of local revenues, intergovernmental transfers or borrowing (World Bank).

The economic argument in favor of decentralization is based on two assumptions: decentralization increases economic efficiency as local governments will deliver better public services; population mobility and competition at the local level will ensure that optimal services are delivered (Oates 1999). However, some dangers

are also associated with decentralization. Prud'homme (1995) highlights several of the potential pitfalls of decentralization: first, it can increase disparities as the reform can adversely affect income inequalities as well as regional disparities by generating destructive competition between entities; second, decentralization can jeopardize stability as it makes monetary and fiscal policies, two main instruments of macroeconomic policy, difficult to implement; and third, decentralization can undermine efficiency as local governments will have different tastes and require differential treatment. Further, if corruption is more widespread at the local than at the national level, decentralization will increase the level of grassroots corruption.

1.4.2. IMPACT OF THE REFORM

Over recent decades, most high-income countries have adopted some degree of fiscal decentralization and have converged to an intermediate level implying that extreme decentralization and extreme centralization both hamper economic growth. A long-run analysis of fiscal decentralization in HIC revealed that it is positively associated with per capita economic growth, capital formation and total factor productivity growth up to a certain level (Thiessen 2003). However, using data on 46 countries over a 20-year period, Davoodi and Zou (1998) found a negative relationship between fiscal decentralization and economic growth in LIC but not in HIC.

Decentralization has been promoted in developing countries as a way of increasing efficiency in the use of health sector resources. Decentralization was initially conceived as an administrative reform to raise efficiency and quality of services. More recently, advocates of the reform see it as a way to promote democracy and strengthen accountability mechanisms and therefore to ensure better quality services to the populations (Bossert 1998). Evidence from Colombia and Chile suggests that decentralization can improve equity of resource allocation. In Colombia and Chile, Bossert et al. (2003) found that local per capita financial allocations were equitable. Increased funding was also associated with increased utilization and could thus reduce inequalities in access to services. However the evidence base remains thin, although most countries, in particular in LIC, have embarked on decentralization reforms. Chapter 5 aims to generate some evidence on the impact of decentralization on regional inequalities and access to basic health

services. This will complement the analysis on the impact of PBF on equity by examining the joint effect of decentralization and PBF on the reduction of inequalities.

1.5. JUSTIFICATION OF THE THESIS

1.5.1. EXPLORING HEALTHCARE PROVIDERS' MOTIVATION

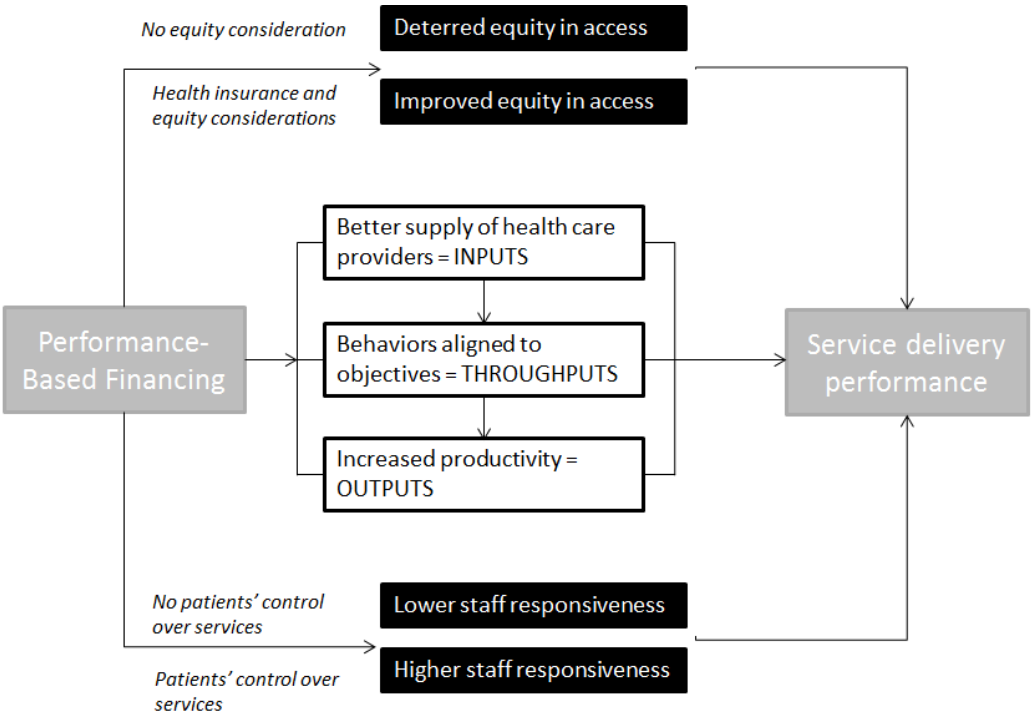
Human resource management strategies are key in improving an organization's performance (Huselid 1995, Mabey, Salaman, and Storey 1998). The human resource system is made of inputs, throughputs and outputs. Inputs are resources required for production, i.e. human resources (employees' knowledge, skills and abilities); they are transformed in the system by the throughput process (human resource behavior); and, the resulting outputs include productivity, job satisfaction, turnover and absence (Wright and Snell 1991, Wright and McMahan 1992). To achieve expected outputs, human resource management strategies must therefore focus on competence management (inputs) as well as on behaviors (throughputs) by encouraging certain behaviors and eliciting others (Wright and Snell 1991). In other words, human resource management strategies should aim to attract, develop, motivate and retain human resources (Jackson and Schuler 1999).

By its focus on performance incentives, this thesis contributes in answering a broadly-encompassing question: 'how can we motivate healthcare providers?' It explores how performance-based financing, as a human resource management strategy, succeeds in improving inputs, throughputs and outputs of the human resource system. Indeed, the strategy has the potential to influence all steps in the production process: first, evidence suggests that PBF can improve the supply of healthcare providers (inputs) both quantitatively and qualitatively; second, by essence, the strategy aims to align behaviors to set objectives (throughputs) with extrinsic motivation; and finally, the overarching objective of PBF is to raise health workforce productivity (outputs). By looking into different aspects of healthcare providers' motivations including its determinants, the mechanisms through which motivation generates expected results and how tangible rewards affect other motivations doctors have, this thesis contributes to knowledge on human resource management strategies and health workforce motivation in LIC.

1.5.2. *CONCEPTUAL FRAMEWORK*

The conceptual framework presented in Figure 1-2 describes the underlying assumption for performance incentives and how they are expected to impact on various components of service delivery performance. This conceptual framework guides the selection of hypothesis to be tested, the definition of research questions and provides a context for interpretation.

Figure 1-2: Conceptual framework



Source: author (2015)

This conceptual framework reflects the rationale of the human resource management strategy underpinning performance-based financing as presented in section 1.5.2. PBF is a strategy aiming at improving inputs, throughputs and outputs in the production process of health care services. The end result on service delivery performance, which can lead to more efficient, accessible and responsive health systems also depends on surrounding factors and accompanying strategies.

Service delivery performance primarily depends on inputs, throughputs and outputs delivered by the health system. As these aspects are directly targeted by the PBF

strategy, one can expect a positive impact on productivity. Service delivery performance will also depend on patients' control over healthcare services and thus on staff responsiveness to patients' needs. Finally, it will depend on the presence or not of equity considerations in the PBF scheme, and of other strategies such as health insurance. The more responsive and equitable healthcare services will be, the more performing service delivery will be. Deterred equity or poor responsiveness to patients' needs would generate suboptimal performance in services delivery.

1.5.3. GENERATING EVIDENCE ON PERFORMANCE INCENTIVES IN LIC

The review of the evidence on performance incentives in high and low income countries revealed five important findings. First, the strength of the evidence is weak. Most experiences of P4P in high income countries operate on a small scale and details of implementation vary significantly. Although the literature on P4P is abundant and many systematic reviews exist, the evidence on its impact is minor, as controlled evaluations are rare and findings are sometimes inconsistent (Khanduja, Scales, and Adhikari 2009). In low income countries, where there are only a handful of evaluations, the strength of the evidence is even poorer and results from only one randomized control trial in Rwanda are reported in the literature (Witter et al. 2012). Second, most evidence relates to high income countries for which the objectives of performance incentives differ from those of low income countries. The differences in contexts hamper the replication, thus the generalization, of findings from one setting to another. Third, most evidence focuses on the impact of performance incentives on efficiency. Evidence from high income countries (Greene and Nash 2009, Dudley et al. 2004) and low income countries (Witter et al. 2012, Gorter, Por, and Meessen 2013) reveals mostly positive results in terms of quality, efficiency and patient outcomes. Fourth, the evidence on the impact of P4P and PBF on the quality of outputs produced (efficiency) mostly uses clinical measures. Patients' satisfaction and health workforce responsiveness are seldom assessed and no conclusion can be drawn on the effect of performance incentives on the perception held by end users. Fifth, the evidence-base on performance incentives' perverse effect on equity is weak. Few studies suggest that P4P may induce perverse incentives that exacerbate inequalities in access to healthcare (Greene and Nash

2009), involve gaming strategies (Khanduja, Scales, and Adhikari 2009) or encourage adverse selection to avoid sicker patients (Karve et al. 2008).

This thesis aims to address a gap in knowledge about performance incentives in low income countries by exploring the most unknown dimensions of performance-based financing. This is important and timely as this strategy is increasingly being used in LIC. In Africa alone, PBF is implemented in more than twenty countries. The evidence-base remains thin, however, in particular with regard to aspects unrelated to efficiency (i.e. access, clinical quality or resource use). Evidence on equity and responsiveness, which are important to measure health systems' performance (World Health Organization 2000), is not conclusive and too limited to support policymakers.

Welfare economic theory suggests that an efficient allocation of resources is one from which no one can be made to feel better-off without making another person feel worse (Pareto efficiency). Resources can be allocated in a variety of Pareto efficient ways, but no attention is paid to the allocation that is the most socially desirable (Hurley 2000, Reinhardt 1992, 1998). Indeed, it is assumed that the market will allocate health resources in the most efficient way and that politicians can ex-post redistribute benefits if the market allocation is not adequate (Arrow 1963). This shows the tension between efficiency gains and equity considerations known as the 'equity-efficiency trade-off' in the literature (Okun 1975); however, this equity-efficiency trade-off is mostly theoretical.

Although the reviewed literature suggests that performance incentives may generate trade-offs between performance dimensions, it is more theoretical than empirical as no study has yet attempted to evaluate the impact of PBF on efficiency, responsiveness and equity altogether. The thesis proposes to narrow the gap in knowledge on performance-based financing by addressing the following research question:

Can performance-based financing raise productivity without hampering equity and responsiveness?

Based on the above, this thesis seeks to test the following hypotheses:

a) With performance incentives, healthcare workers receive financial incentives to deliver more services. As the focus is primarily on quantitative indicators, this may lead to increased supply of services but poorer quality of care.

b) Performance-based financing may not lead to increased demand among the poor and improved satisfaction with health services as the strategy focuses on suppliers of healthcare services. On the contrary, PBF may increase inequalities in access to incentivized services, as providers may focus on the easier to reach, that is to say - those who live closer to the facility and already visit it. Further, due to increased workload, responsiveness to patients' needs may be overlooked by providers.

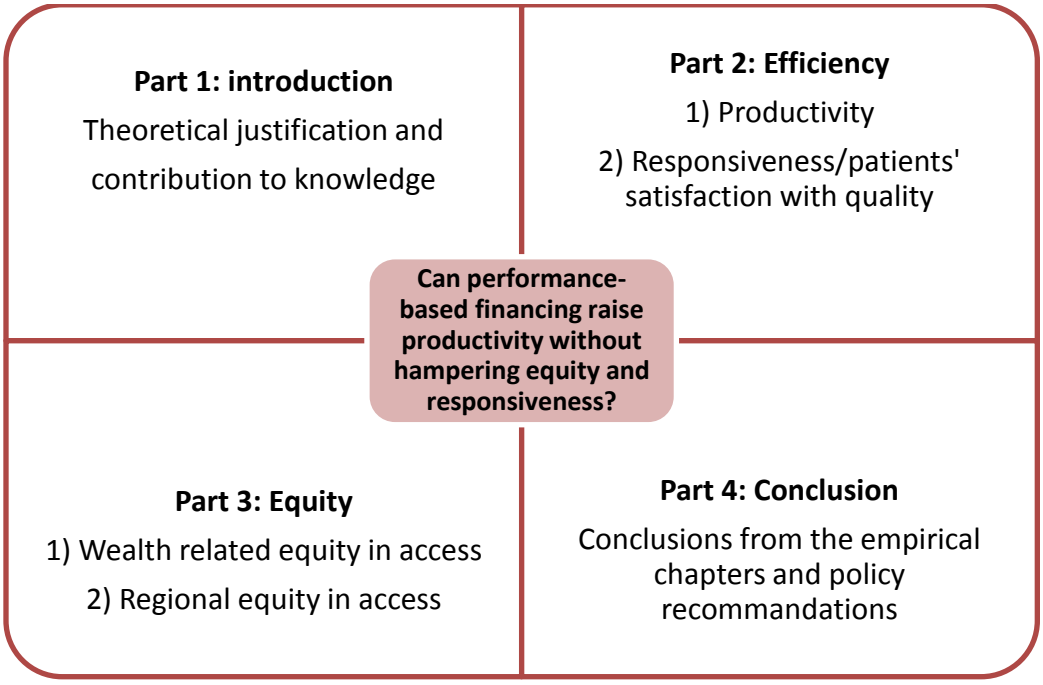
c) Performance-based financing may have limited impact on reducing regional inequalities in access to care because the strategy was not developed for that purpose and interactions with the decentralization policy were not explicitly explored.

d) The scale-up of health insurance in Rwanda and the fact that the uptake of some basic health interventions is tracked by political leaders led to exceptional improvements in utilization of basic health services in Rwanda, including among the poor. The impact of PBF may thus be only marginal unless synergies exist between strategies.

To address the broad research question and test the above hypotheses, the thesis investigates the impact of performance incentives on efficiency, focusing on the least documented aspects, as well as on equity. The proposed process to address this goal is summarized in Figure 1-3. This first chapter provides the theoretical justification for the thesis and highlights its contribution to current knowledge by identifying gaps in the literature. Part two explores the effect of PBF on efficiency, looking at aspects of efficiency that are not well documented. This is the case of systemic factors that drive productivity gains (Chapter 2) and of responsiveness that gives an indication of the efficient production of healthcare services from the patients' perspective (Chapter 3). Part three explores the effect of PBF on equity, looking at two major equity dimensions: wealth related inequalities in access (Chapter 4) and

regional inequalities in access (Chapter 5). Chapter 6 draws conclusions from the four empirical chapters to answer the broad research question. Chapter 7 formulates policy recommendations.

Figure 1-3: Proposed process to answer the thesis' research question



1.6. RWANDA

1.6.1. CASE STUDY

Rwanda is chosen as the country case study for many reasons. First, it was the first country to implement performance-based financing on a national scale and that decided to rigorously evaluate the impact of the strategy using a robust impact evaluation design. It thus provides the opportunity to attribute PBF with differences observed between treatment and control groups. This stands for a major difference with other evaluations of performance incentives in high income and low income countries of poor research design, generating weak evidence. In LIC, there is therefore a growing interest for evidence on the impact of PBF in Rwanda and potential lessons learned.

Second, as the Government of Rwanda have engaged in a series of structuring reforms over the past ten years, thus a case study on Rwanda enables an assessment of the effect of performance-based financing as well as its interactions with other

reforms. The 1994 genocide and war devastated the country on all grounds. The unprecedented efforts deployed by policymakers, the donor community, communities and individuals to rebuild the country provided an opportunity to test and implement innovative strategies as all infrastructures and social constructs had to be rebuilt from scratch. During the reconstruction period, many saw Rwanda as a laboratory to test new ideas. The health sector was particularly rich in innovations including performance-based financing, health insurance and decentralization. Exploring synergies with health insurance, which stimulates the demand for health services, and with decentralization, which aims to raise efficiency in service delivery, can be of great interest to researchers and policymakers.

Third, Rwanda is often cited as a success story on the African continent for its pace of reforms and results achieved. The Rwanda case study shows what can be achieved with strong enabling factors. External factors that contribute to good health system governance in Rwanda and the successful implementation of PBF include the country's receptivity to change, decentralization, availability of financial resources, political will and state-society relationships (Brinkerhoff, Fort, and Stratton 2009). The synergy between PBF and CBHI and the autonomy of health centers which have the capacity to hire and fire personnel also ease the implementation of PBF (Basinga et al. 2011).

Fourth, Rwanda is characterized by a strong performance-oriented culture that facilitates the implementation of PBF and production of quick results: there is great pressure, at all levels, to report on performance and reach targets. The Imihigo, a performance contract between the President of the Republic of Rwanda and Mayors of districts, tracks and publicly reports district performance related to service delivery. An Imihigo contains about 100 indicators, of which 15 are health indicators such as contraceptive prevalence rates, assisted deliveries at facilities, and, membership to community-based health insurance. Performance is reported quarterly and districts are ranked annually (Brinkerhoff, Fort, and Stratton 2009). District Mayors in turn sign performance contracts with health facilities to ensure the requirements of Imihigo are fulfilled. As a result of this performance environment, Rwanda has good quality information technology to collect and manage health information (Logie, Rowson, and Ndagije 2008). A major downside of

this performance-oriented culture and of the strong reporting mechanisms in place is that Rwanda is not a democratic regime. Rwanda is an authoritarian regime according to the Economist Intelligence Unit's Index of Democracy.[6] This index is based on five categories: electoral process and pluralism; civil liberties; functioning of government; political participation; and, political cultures (Economist intelligence unit 2008). The lack of civil liberties, political participation and political culture may influence individuals and communities' behaviors. It is an important factor to keep in mind when interpreting results of this thesis. In particular, the strong control and lack of liberty may influence healthcare providers' attitude, including their performance and presence at work as studied in Chapter 2. Similarly, patients' perception of the quality of care explored in Chapter 3 must be interpreted with caution. It is likely that the authoritarian environment prevents individuals from speaking the truth about public health services, despite the anonymous nature of the survey.

Fifth, the relatively low level of corruption in Rwanda facilitates the successful implementation of reforms, including PBF. Rwanda ranked first among Central and Eastern African countries in the 2009 Transparency International Corruption Perceptions Index and tenth out of 47 Sub-Saharan African countries (Transparency International 2009). The World Bank Worldwide Governance Indicators[7] also show that Rwanda is performing better than the SSA average, except for voice and accountability[8] (World Bank Institute 2010).

[6] Out of four regime categories: full democracy; flawed democracy; hybrid regime and authoritarian regime

[7] These indicators provide a summary of six aggregate governance indicators: voice and accountability; political stability and lack of violence/terrorism; governance effectiveness; regulatory quality; rule of law; and, control of corruption. They show the percentile rank of Rwanda, i.e. the percentage of countries worldwide that rate below Rwanda (with a 90% confidence interval).

[8] Rwanda has a 13 percentile rank whereas the SSA average is 32.6 for voice and accountability. However, Rwanda stands as a particular case in the African context for all other indicators, with a 48.3 percentile rank in 2008 for government effectiveness (against 26.3 for SSA average) and a 59.4 percentile rank for the control of corruption (against 30.8% for the SSA average).

1.6.2. OVERVIEW OF THE COUNTRY

Rwanda is a small landlocked African country. In 2012, there were 10.5 million inhabitants, a 2.4 million increase compared to 2002. Rwanda is a predominantly rural country with 83% of the population living in rural areas. Half the population is aged 18 or below. Rwanda has one of the highest population densities in the region with an average of 415 inhabitants per square kilometer, but the density varies from 2,124 inhabitants/km^2 in Nyarugenge (urban district) to 178 inhabitants/km^2 in Kayonza (rural district) (Rwanda Ministry of Finance and Economic Planning and National Institute of Statistics of Rwanda 2014).

The Republic of Rwanda has two layers of government (central and local). It is divided into 5 provinces, 30 districts, 416 sectors, 2,148 cells and 14,837 villages. The administrative organization is guided by the principle of subsidiarity. The central level formulates policies, regulations and provides support to local governments through capacity building, financing and monitoring and evaluation. The local levels implement government policies and deliver services. The province ensures that district development planning is aligned with national policies and programs and supervises districts. Districts are responsible for local economic development and planning as well as for coordinating service delivery. Sectors deliver services while cells are responsible for needs assessments, prioritization, and the mobilization of communities. The village is responsible for building cooperation, collaboration and solidarity among community members (Rwanda Ministry of Local Government and Social Affairs 2001, Rwanda Ministry of Local Government Good Governance Community Development and Social Affairs 2008). The district is the basic politico-administrative unit of Rwanda. All citizens living in a district are members of the District council which identifies, discusses and prioritizes problems and takes decisions for their resolution. The District Council elects the District Executive Committee which is in charge of administration and community development and is assisted by a technical committee (Rwanda Ministry of Local Government and Social Affairs 2001). One of the eight technical units in the district office deals with health, family promotion, and protection of children's rights.

The Government of Rwanda adopted the National Decentralization Policy in May 2000 to promote good governance, poverty reduction as well as efficient, effective and accountable delivery of services. The reform is implemented in three successive phases. The first phase between 2000 and 2005 aimed to establish democratic and community development structures and reinforced the core local government authority (district). The second phase (2006-2010) aimed to enhance effectiveness in service delivery to communities by increasing capacities at the lower levels of administration. More technically competent personnel and financial resources were made available at the district level to facilitate the implementation of fiscal decentralization. The third phase (2011-2015) aims to improve and sustain the achievements of the first two phases (Rwanda Ministry of Local Government and Social Affairs 2001, Rwanda Ministry of Local Government Good Governance Community Development and Social Affairs 2008). With fiscal decentralization (phase two) districts are responsible for coordinating lower administrative levels in the delivery of services to the population. Since 2006, the Ministry of Finance and Economic Planning transfers part of the health budget direct to the 30 districts.

Despite recent improvements, poverty is a critical issue in Rwanda. Consumption poverty remained stable between 2000/01 (58.9%) and 2005/06 (56.7%) but decreased in 2010/11 (44.9%). National averages hide regional disparities as the drop in 2010/11 was indeed driven by Northern and Western provinces. Extreme poverty fell from 40% in 2000/01 to 35.8% in 2005/06 and 24.1% in 2010/11 with the Northern Province experiencing the largest gains. Poverty rates vary largely from one district to another with the more rural and remote districts having the highest poverty rates. In 2005/06, district poverty rates ranged from 10% to 85%; in 2010/11 they ranged from 8.3% to 73% and poverty declined in only 13 out of 30 districts (National Institute of Statistics of Rwanda 2012).

Rwanda has achieved tremendous progress in health since 1994. More than 97% of Rwandan infants are now vaccinated against ten different diseases , 69% of women deliver their babies in a health facility, and deaths caused by HIV/AIDS, tuberculosis and malaria have significantly fallen (Binagwaho et al. 2014). Increases in the health workforce and their skill-sets, performance-based financing, health insurance, and

better leadership and governance has led to impressive results in service use. Births attended by skilled personal rose by 77% between 2006 and 2010 compared to 26% between 2000 and 2005. Similarly, contraceptive prevalence rose by 351% against 150% over the same time period (Bucagu et al. 2012). Rapid increases in use of essential maternal and child health services resulted in significant progress in health outcomes. The infant and under-five mortality rates fell drastically from 121 per 1,000 to 50 per 1,000 and from 217 per 1,000 to 76 per 1,000 respectively between 2000 and 2010. The maternal mortality ratio also decreased, although not significantly, from 1,071 maternal deaths per 100,000 live births in 2000 to 750 in 2005. The use of modern contraceptives rose from 10.3% in 2005 to 45.1% in 2010 and the percentage of children taken to healthcare providers in the event of diarrhea rose from 14.1% to 37.2% over the same period (National Institute of Statistics of Rwanda 2006, 2009, 2001).

1.6.3. HEALTH SYSTEM

From the second half of the twentieth century until 1994, Rwanda had a strong centralized healthcare system. Health services were theoretically provided free of charge. The civil war and 1994 genocide, which resulted in one million deaths, left the country with devastated political and social structures and very poor service delivery capacity. More than 80% of health personnel were killed or fled. Immediately after the genocide, Rwanda began rebuilding its primary healthcare system and human resources for health.

Following the Alma Ata declaration, Rwanda adopted a primary healthcare policy aiming to develop primary healthcare services for the population. In March 2005, the Government of Rwanda adopted the Health Sector Policy (2005) and Health Sector Strategic Plan (2005-2009) which focused on ensuring the availability of human resources for health; ensuring the availability of quality medicine, vaccines, and others medical supplies; and, providing affordable care and services.

There is at least one hospital (district hospital) and several primary healthcare facilities (health centers) per district. District hospitals are the first referral level and treat patients referred by the primary healthcare facilities. The 2007 service provision assessment survey showed significant variations between districts about

district hospital capacities and the population covered by a district hospital varied from 70,000 to 480,000 people. Health centers are responsible for providing primary healthcare that includes complete and integrated services. These encompass curative, preventive, promotional and rehabilitative services. In 2007, 85% of the population lived within one and a half hours of a health center (National Institute of Statistics of Rwanda, Ministry of Health of Rwanda, and Macro International Inc 2008).

1.6.4. HEALTH REFORMS

As in many SSA countries, the delivery of healthcare services in Rwanda suffers from large inefficiencies such as the scarcity and misuse of financial and human resources that make it difficult to address health problems, in particular those of the poor.

Three major health financing reforms, namely health insurance, fiscal decentralization and performance-based financing, have been implemented over the past 10 years in Rwanda with a significant impact on the supply and demand for healthcare (Sekabaraga, Diop, and Soucat 2011). In 1998, user fees were reintroduced, thus increasing the financial barriers to health services. Since 1999, community-based health insurance schemes have been piloted. The 2005 national health insurance policy made health insurance compulsory to all citizens and resulted in better financial protection. The coverage increased from 7% of the target population in 2003 to 85% in 2008 (Rwanda Ministry of Health 2009).

Since salaries were low, healthcare workers were not motivated to take on additional work resulting from increased demand (Rusa et al. 2009, Kalk et al. 2005, Logie, Rowson, and Ndagije 2008). Three PBF pilot schemes were thus run between 2001 and 2005 to motivate health staff to produce increased and better services. These schemes resulted in increased use of services, greater staff motivation and higher productivity. The impact on equity remains unclear (Rusa et al. 2009, Rusa and Fritsche 2007, Musango et al. 2007, Soeters, Habineza, and Peerenboom 2006, Meessen, Kashala, and Musango 2007).

1.6.5. *PERFORMANCE-BASED FINANCING NATIONAL MODEL*

In 2006, the Ministry of Health (MoH) decided to scale-up PBF nationally in all primary healthcare facilities and the scale-up plan included a rigorous impact evaluation. The design of the national model is extensively described by Basinga et al. (2011). This section reports the main features they present in the Lancet.

Performance payments in the Rwandan national model are based on the quantity of outputs achieved conditional on quality. Outputs produced are measured every month and quality of care is measured quarterly. Health workers can increase their earnings in different ways: by increasing the quantity of outputs; by increasing the quality of services; or by increasing both. Earnings are the highest when both quantity and quality increase. The formula used for payment is:

$$Payment_{it} = \left(\sum_{j} P_j U_{jit} \right) * Q_{it}, \; 0 \leq Q_{it} \leq 1$$

where P_j is the payment per output unit j (for instance delivery in the facility), 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. Therefore, if the quality index is equal to one, the health center receives the maximum possible bonus; in contrast, if the quality index is less than one, PBF payments are discounted for all services. PBF is applied to 14 maternal and child health output indicators (U_{jit}). Table 1-6 presents these indicators with their associated payment rate.

Table 1-6: Output indicators and unit payment for PBF formula

Output indicators		Amount Paid per unit (US$)
Visit indicators: number of…		
1	Curative care visits (new visits)	**0.18**
2	First prenatal care visits	**0.09**
3	Women who completed 4 prenatal care visits	**0.37**
4	First time family planning visits (new contraceptive users)	**1.83**
5	Contraceptive resupply visits	**0.18**
6	Deliveries in the facility	**4.59**
7	Growth monitoring visits	**0.18**
Content of care indicators: number of…		
8	Women who received tetanus vaccine during prenatal	**0.46**

Output indicators		Amount Paid per unit (US$)
	care (2nd to 5th dose)	
9	Women who received 2nd dose of malaria prophylaxis during prenatal care	**0.46**
10	At-risk pregnancies referred during prenatal care to 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 visits	**1.83**
14	Other emergency referrals	**1.83**

Source: Basinga et al. (2011)

At the health center level, quality is assessed by a complex instrument that measures quality across 13 characteristics. The quality index captures structural and process measures of quality from the Rwandan preventive and clinical practice guidelines. Structural measures of quality are concerned with the availability of equipment, drugs, medical supplies and personnel in the facility that are required to deliver a given service. Process measures assess the clinical content of care. The formula for the quality index is:

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

whereS_{kit} 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. The weights (Table 1-7) add up to one which means that a facility with perfect structural and process quality will have an overall quality index of one. The shares of structural and process indicators are those recommended in the Rwandan clinical practice guidelines.

Table 1-7: Services and weights used for the quality score

	Service	Weight	Weight for structural components	Weight for process component
1	**General administration**	0.052	1.00	0.00
2	**Cleanliness**	0.028	1.00	0.00
3	**Curative care**	0.170	0.23	0.77
4	**Delivery**	1.130	0.40	0.60
5	**Prenatal care**	0.126	0.12	0.88
6	**Family planning**	0.114	0.22	0.78

	Service	Weight	Weight for structural components	Weight for process component
7	**Immunization**	0.070	0.40	0.60
8	**Growth monitoring**	0.052	0.15	0.85
9	**HIV services**	0.090	1.00	0.00
10	**TB services**	0.028	0.28	0.72
11	**Laboratory**	0.030	1.00	0.00
12	**Pharmacy management**	0.060	1.00	0.00
13	**Financial management**	0.050	1.00	0.00
	Total	**1.000**		

Source: Basinga et al. (2011)

Evidence was already published on the positive impact of the national PBF model on the quality and quantity of maternal health services (Basinga et al. 2010, 2011). It shows that the incentive mechanism increased the probability of institutional delivery by 7.3%, of getting women to take the tetanus vaccination during their prenatal visit and had a positive effect on quality of care (competency of healthcare providers). The evidence also reports that the probability that a child visits a health facility for preventive care increases with PBF. However, there is no impact on the probability of a woman receiving prenatal care.

1.7. DATA

1.7.1. OVERVIEW OF RANDOMIZED CONTROL TRIALS

There are five main methods for evaluating a health intervention, which are, from the less rigorous to the most rigorous: descriptive evaluation, audit, before-after, comparative-experimentalist and randomized controlled experiment (Ovretveit 1998). Their objectives, strengths and weaknesses are presented in Table 1-8.

Table 1-8: Presentation of methods to evaluate health interventions

Type of evaluation	Purpose	Strengths	Weaknesses
Descriptive	Describe intervention and its environment.	Easy. Can clarify objectives and identify problems.	**Unscientific and biased. Does not evaluate efficiency.**
Audit	Compare results of the intervention and expected outcomes.	Easy. Can help understand reasons of success or failure.	**Does not evaluate efficiency.**

Type of evaluation	Purpose	Strengths	Weaknesses
Before-After	Judge value of intervention by comparing situation before and after.	Can be done rapidly and on a small scale.	**Outcomes may be due to factors other than the intervention.**
Comparative-experimentalist	Compare before and after outcomes of two groups with different interventions.	Shows the most effective intervention.	**Expensive. Difficult to prove that outcomes are only caused by the intervention.**
Randomized controlled experimental	Compare 2 groups that are similar in all respects except that only one receives an intervention.	Groups randomly assigned. No confounding factors. High scientific credibility.	**Expensive, time-consuming, requires expertise.**

Source: Adapted from Ovretveit (1998).

Comparing the same individuals before and after the intervention or enrolled and not enrolled individuals, leads to false counterfactuals as other factors may have been involved over time in the first case, and there is a selection bias in the second case. These weaknesses highlight the importance of a random assignment to treatment or control groups. The objective of randomized controlled experiments is to estimate the causal effect, or impact (thus referring to impact evaluation) of an intervention on an outcome, such as the impact of PBF on the utilization of maternal health services. The impact corresponds to the observed outcome with the treatment or intervention minus the estimated outcome in the counterfactual, which is used as a comparison or control.

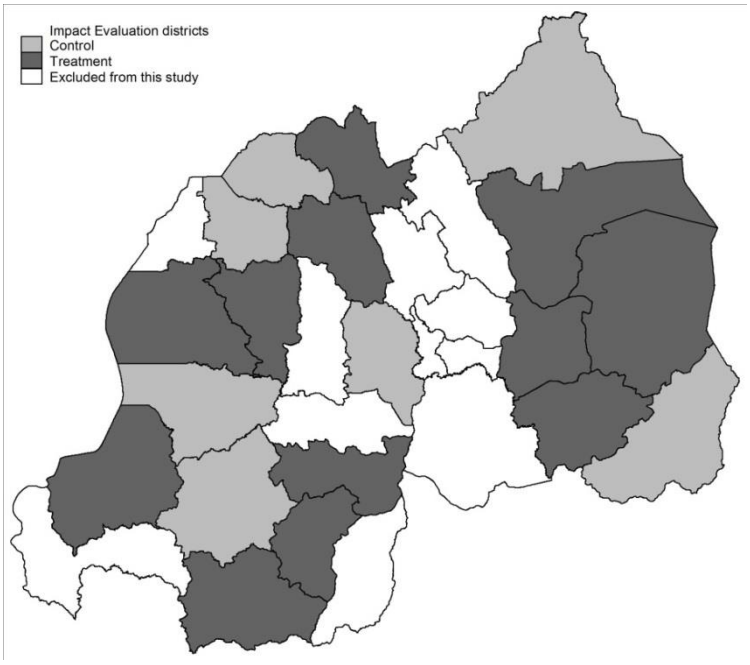
Randomized controlled experiments present many advantages over other types of evaluations: the intervention and surrounding conditions are specified and controlled; the intervention (treatment) is compared to a 'placebo' (control); the randomization reduces bias; and, the results are objective and measurable (Ovretveit 1998). This type of impact evaluation produces a counterfactual that shows what would have happened in the absence of a program (e.g. in the absence of PBF). A randomized controlled experiment was used to evaluate performance incentives in Cambodia (Bloom et al. 2007); however, the evaluation had limitations

as contracted districts received more resources than controlled districts; it had a small sample size; and, there were randomization issues.

1.7.2. DESIGN

This empirical work relies on data from the impact evaluation of the national PBF model in Rwanda. It is the first randomized experiment used to rigorously assess the impact of this strategy on a national scale. It took advantage of the phased implementation of PBF over a 23-month period between 2006 and 2008. The 19 rural districts that did not implement a PBF pilot before 2006 were paired and randomly assigned to treatment (12 dark-shaded districts) or control groups (7 light-shaded districts). The remaining 11 districts (white-shaded) that already piloted PBF were excluded from the impact evaluation (Figure 1-4). As the three urban districts of the country were not included, the study focuses on rural districts only.

Figure 1-4: Rwanda: Allocation of districts to treatment and control groups



Source: Author (2015).

The impact evaluation was designed as a randomized controlled experiment. However, because of the decentralization reform that occurred during the impact evaluation, some health centers that were in the control group had to be reassigned

to the treatment group. The evaluation therefore shifted to a quasi-experimental status but the descriptive analysis of baseline and follow-up surveys shows balance between treatment and control areas (Basinga et al. 2011). In addition, contrary to what was done in other countries such as Cambodia, budgets of control facilities were increased by the average PBF payment to treatment facilities. Therefore, differences observed between the two groups at the end of the treatment period can be attributed to PBF alone.

1.7.3. SAMPLING

The evaluation took advantage of the phased implementation of PBF over a 23-month period between 2006 and 2008, and consisted of the 12 treatment districts and 7 comparison districts with a total of 166 facilities and 2,145 households in the catchment area of those facilities. Districts were mapped and overlaid with information on relief, rainfall and population density. Using these characteristics, areas of the country without PBF before 2006 were paired. A coin was then flipped to determine districts assigned to treatment or control groups.

1.7.4. SURVEYS

The database contains baseline and follow-up rounds of health facility and household data collected in 2006 and 2008. The healthcare facility survey includes: a module on available services and pricing; an equipment module; a human resources module focusing on skills, experience and motivation; a set of vignettes to measure the practical knowledge of providers; and, an exit interview to assess the perceived quality of services. The household survey was administered to a sample of households and measured the basic socio-demographic characteristics of the population, its health status and utilization of health services.

1.7.5. ETHICS

The Research Ethics Commission at the Rwandan Ministry of Health validated the PBF evaluation plan and design. In addition, in both rounds of the evaluation, respondents who agreed to participate in the survey were asked to sign an informed consent declaration.

1.7.6. RELATIONSHIP TO THE DATA

This thesis relies on secondary data analysis. The author was not involved in the study design or in data collection. The raw data is in the public domain and the author had to clean and reshape the datasets to perform analyses presented in this thesis.

1.7.7. VARIABLES OF INTEREST

As illustrated in Table 1-6, PBF in Rwanda placed emphasis on maternal and child health services, as utilization of those services can significantly reduce maternal and child mortality. The largest financial reward was associated with institutional deliveries to ensure women deliver at health centers rather than at home with a traditional birth attendant. Institutional deliveries reduce the risk of maternal mortality and facilitate referral to a hospital in case of complications. The second most incentivized service was family planning as the Government of Rwanda aimed to lower fertility to reduce maternal and infant mortality and address the unmet need for modern contraceptive. Preventive care services were also rewarded to avoid complications during pregnancy (i.e. completion of four prenatal care visits and tetanus vaccine during prenatal care) and protect children from ill-health (i.e. immunization and growth monitoring).

The thesis logically focuses on the impact of PBF on maternal and child health services including:

- Institutional deliveries: the variable takes the value 1 if pregnant women aged 15-49 delivered at health center and 0 otherwise;
- Family planning: the variable takes the value 1 if married women use modern contraceptives and 0 otherwise;
- Four or more prenatal care visits: the variable takes the value 1 if a woman had at least four prenatal care visits during her last pregnancy (last two years) and 0 otherwise;
- Preventive care for children under 5: the variable takes the value 1 if children visited a health center for preventive care in the four weeks preceding the survey and 0 otherwise;

- Curative care for children under 5: the variable takes the value 1 if children visited a health center for curative care in the event of an illness during the four weeks preceding the survey and 0 otherwise.

For most analyses, control variables include individual characteristics (sex, age, education attainment and marital status), household characteristics (size, number of children, wealth and health insurance status) and facility characteristics (public or faith-based). Further details on dependent and independent variables are provided in subsequent chapters.

1.8. ORGANIZATION OF THE THESIS

Can performance-based financing raise productivity without hampering equity and responsiveness?

To address this broad research question, this thesis successively looks at the impact of PBF on efficiency (Part 2) and equity (Part 3). This section briefly outlines the sub-research questions addressed by the four empirical chapters, gaps in literature and how the chapter contributes in addressing the broad research question. Individual introductions, backgrounds, methods, results, discussions and conclusions are provided in the chapters.

1.8.1. CHAPTER 2: PBF AND PRODUCTIVITY

Efficiency gains are the main outcome expected from PBF and efficiency is one of the key dimensions of health sector performance. The evidence from high income and low income countries is rather unanimous on the positive effect of performance incentives on health workers' productivity and see it as a mechanical effect resulting from extrinsic motivation generated by financial rewards. However, little is known on the structural factors driving productivity gains and on the way health facilities and healthcare providers adapt their behavior to maximize their gains. Chapter 2 thus aims to address the following research questions:

a) Does PBF improve the availability of healthcare providers in primary healthcare facilities?
b) Are staff that are rewarded for their performance absent less?
c) How does PBF affect workforce productivity?

This chapter identifies systemic factors that drive higher productivity in PBF schemes. It provides evidence on productivity gains in Rwanda and on efficiency gains achieved due to improved management of human resources.

1.8.2. CHAPTER 3: PBF AND RESPONSIVENESS

Assessing the impact of performance incentives on efficiency entails measuring its impact on quality of care. The literature review showed that clinical measures on processes of care are the most largely used measures and little to no evidence exists on patients' perception of the quality of care under performance incentive schemes. Contrary to HIC, patients' satisfaction is not even used to calculate the rewards in LIC.

There is a risk that higher productivity will be at the expense of patients. Responsiveness to their needs, respect for dignity and autonomy can be hampered if providers, in their search for productivity, have no incentive to take them into account when delivering services. Chapter 3 aims to address the following research questions:

a) Are patients satisfied with services delivered at primary healthcare facilities?
b) What is the impact of PBF on satisfaction with clinical content of care?
c) What is the impact of PBF on satisfaction with non-clinical aspects of services?

To address those questions, Chapter 3 uses the unusual perspective of the patients' viewpoint to assess the effect of PBF on healthcare services.

1.8.3. CHAPTER 4: PBF AND EQUITY IN ACCESS TO SERVICES

As reported in the literature review, the effect of PBF on equity is not well documented and what evidence there is, is mixed. However, the risk that PBF will hamper equity in access stands for a major potential negative side effect of the strategy. This is supported by welfare economics theory that suggests that greater efficiency in healthcare may not translate to greater social welfare and thus, policymakers should be concerned, not only with the health policy being on the Pareto frontier, but also in which way it should move from this frontier (Reinhardt

1992, 1998, Lindholm, Rosen, and Emmelin 1996). Chapter 4 aims to assess whether efficiency gains presented in Chapter 2 and 3 were achieved at the expense of equity in accessing basic health services, in particular for the poor who are the most in need for primary healthcare services. Specifically, Chapter 4 addresses the following research questions:

a) Does PBF exert a differential impact on income subgroups of populations defined by their wealth status?
b) How does PBF interact with other health financing strategies, such as health insurance?

Chapter 4 aims to answer these questions by comparing increases in access to key maternal and health services according to household wealth status.

1.8.4. CHAPTER 5: PBF AND SPATIAL DISPARITIES

In addition to wealth related inequalities, low income countries are characterized by large regional disparities. In the past decade, significant effort has been made to reduce regional disparities in access to, and utilization of, basic health services, in particular through decentralization. Decentralization aims to improve efficiency in the use of resources and to narrow inequalities between regions by stimulating competition between regions and bringing decisions and resources closer to the end users.

Decentralization and performance-based financing thus share common objectives. In that context, it is important to investigate whether PBF has an impact on regional inequalities as well as how PBF and decentralization interact. Chapter 5 aims to address the following research questions:

a) How do spatial disparities change overtime?
b) What is the source of spatial variability in the utilization of basic health services?
c) What is the contribution of contextual factors to spatial disparities?

Chapter 5 will explore synergies between those two strategies to see whether they are mutually reinforcing and explore their effect on equity at the regional level.

PART 2: EFFICIENCY

2. FINANCIAL INCENTIVES, HEALTH WORKFORCE AVAILABILITY, PRESENCE AT WORK AND PRODUCTIVITY: EVIDENCE FROM AN IMPACT EVALUATION IN RWANDA

ABSTRACT

Of the different inputs involved in the production function for healthcare, human resources are the most important. Most countries are confronted with human resource shortages, skill mix imbalances, uneven distribution, inadequate work environment and weak knowledge base. This represents a major challenge as health systems' performance is directly linked to the availability and quality of the workforce. According to the World Health Organization (WHO), health workforce performance encompasses four dimensions: availability (distribution and attendance), competence (technical knowledge, skills and behaviors), responsiveness, as well as productivity (World Health Organization 2006).

Performance-based financing is increasingly implemented in African countries under the basic assumption that financial incentives motivate health facilities and their staff to increase productivity. This chapter examines the impact of PBF on health workforce availability, presence at work and productivity and how these different elements interact using data from a randomized control trial evaluating the impact of PBF in Rwanda. This chapter focuses on availability, through assessing the impact of PBF on the change in the number of healthcare providers and on absenteeism, as well as on the impact of PBF on productivity through outputs produced by staff.

Consistently with predictions, results show that PBF improves productivity of the health workforce. However, the novelty of results lies in the driver of productivity gains: they do not come from staff expansion, but rather from cutting absenteeism and putting a higher workload on staff. Results suggest that productivity gains can be achieved through improved supervision and rewarding systems, but this can be at the expense of a relaxed working environment.

This study illustrates the potential pitfalls of PBF. PBF, as a financial incentive, above all speaks to the extrinsic motivation of healthcare workers. Mechanisms should be put in place in parallel to ensure greater job satisfaction and working conditions, which are critical determinants of intrinsic motivation. According to the literature, this could include training opportunities, career advancement, recognition from the community and a better work environment. Also, individual incentives (as opposed to those targeting the health facility as in Rwanda) may be more effective in stimulating the productivity of staff. Results suggest that PBF should be adapted to the behavioral expectations of each country.

2.1. INTRODUCTION

Of the different inputs involved in the production function for healthcare, human resources are at the core of health systems' performance (Zurn et al. 2004, Chen et al. 2004, Serneels et al. 2007, World Health Organization 2000). Given the important information asymmetries between providers and consumers of healthcare, health workers' availability and motivation need to be acted upon.

It is not uncommon for LIC to be confronted with staff shortages, skill mix imbalances, uneven distribution and inadequate work environments (Chen et al. 2004). This represents a major challenge as health systems' performance is directly linked to the availability and quality of the health workforce: evidence shows that maternal, infant and under-five mortality rates decrease as the density of human resources for healthcare rises (Anand and Barnighausen 2004); indeed, achieving 80% coverage of measles immunization and of skilled attendants at births is more likely when the density of health workers exceeds 2.5 workers per 1000 individuals (Chen et al. 2004).

Well-designed incentives can help in improving the production of healthcare by better management of inputs (Filmer, Hammer, and Pritchett 2000). This article aims to explore whether performance-based financing can help improve the management of human resources and ultimately increase productivity. PBF is increasingly implemented in African countries under the basic assumption that financial incentives motivate the health workforce to be more productive. By topping up health providers' wages, PBF is expected to raise staff motivation, cut staff turnover and improve their availability (Meessen, Soucat, and Sekabaraga 2011). However, PBF can lead to some unintended effects that undermine a health workforce's productivity: it may crowd out intrinsic motivation and encourage gaming within the system (Ireland, Paul, and Dujardin 2011); it can also result in a drop in morale and undermine social relations and teamwork (Magrath and Nichter 2012). Lastly, it may add to an already heavy load of paperwork, cut time spent with patients and deter workforce productivity (Magrath and Nichter 2012).

This chapter uses data from the randomized control experiment in Rwanda to generate evidence on the impact of PBF on staff availability, presence at work and productivity, which are areas not well documented to date. Logie, Rowson, and Ndagije (2008) report on the lack of evidence on the impact of PBF on staff distribution and turnover. Similarly, evidence on its impact on absenteeism is scarce and non-conclusive (Pouliakas and Nikolaos 2009). The hypothesis of this chapter is that PBF improves productivity as health facilities will make better use of key inputs, in particular of human resources, to increase performance, and thus earnings. This should result in more staff working in the health facility to increase the volume of services delivered and in fewer staff being absent as they become more accountable and motivated.

More specifically, this chapter addresses four research questions:

a) Does PBF improve the availability of healthcare providers in primary healthcare facilities?
b) Are staff that are rewarded for their performance less absent?
c) How does PBF affect workforce productivity?
d) What is the importance of specifications on coefficient estimates?

To address these questions, this article proposes a new conceptual framework (Figure 2-1) to understand the drivers of health workforce productivity and explore the links between availability, presence at work and productivity. The conceptual framework suggests that productivity is first determined by whether providers are available, second by whether they are present at work, and third by how productive present providers are. This multistep analysis allows for us to identify bottlenecks in productivity in the delivery of healthcare services. This framework also highlights the importance of intrinsic motivation to ensure adequate productivity: the larger the bottom of the pyramid, the more likely staff productivity will be satisfactory. A suboptimal level in one or more of the different components will negatively affect staff productivity.

Figure 2-1: Conceptual framework

Source: Author (2015).

The chapter is organized as follows: a brief review of the literature on availability, presence at work and productivity of the health workforce as well as background information on human resources for health in Rwanda is first provided. Methods and results are then presented before a discussion of results and conclusions.

2.2. BACKGROUND

2.2.1. PRODUCTION FUNCTION

Workforce productivity relates more broadly to what is referred to as the production function in economics. The production function relates physical output of a production process to factors of production as follows:

$$Q = f(X_1, X_2, X_3, \dots, X_n)$$

where Q is the quantity of outputs and $X_1, X_2, X_3, \ldots X_n$ are the quantities of factor inputs such as labor, capital, raw material…

The most common form of the production function is the Cobb-Douglas production function which is:

$$Y = AL^{\beta}K^{\alpha}$$

where Y is the total production, L is labor, K is capital and A corresponds to total factor productivity. α and β are the elasticities of capital and labor. The above production function suggests that an increase in total factor productivity, capital or labor will lead to an increase in outputs (total production). Contrary to capital and labor which are tangible inputs, total factor productivity is not. It captures technology and human capital aspects such as knowledge and competences of the workforce (efficiency).

2.2.2. LITERATURE REVIEW

"A well-performing workforce is one that works in ways that are responsive, fair and efficient to achieve the best health outcomes possible, given available resources and circumstances" (World Health Organization 2006). Health workforce performance encompasses four dimensions: availability (distribution and attendance), competence (technical knowledge, skills and behaviors), responsiveness and productivity (World Health Organization 2006).

Most low income countries are affected by shortages in the health workforce that affect the efficiency and effectiveness of the healthcare delivery system. The availability of health providers (through recruitment and retention) depends on job satisfaction in a broad sense, but evidence based on interventions that improve retention is limited (Lu, While, and Barriball 2005). Job satisfaction depends on working conditions, adequate resources and proper infrastructures; relationships with patients, co-workers and managers; the work; the workload; job security; pay; self-growth, praise and recognition; control and responsibility; leadership styles and organizational policies (Lu, While, and Barriball 2005, Griffeth, Hom, and Gaertner 2000, Willis-Shattuck et al. 2008). On the opposite side, inadequate management, a

poor infrastructure and lack of resources are significant de-motivating factors (Willis-Shattuck et al. 2008).

Poor performance of health workers is often associated with absenteeism defined as the failure to report for scheduled work. Absenteeism of health workers is considered a major issue in developing countries but the evidence is scant. Lewis (2006) reports health workers' absenteeism rates around 35-40 % and in Uganda, 37 % of health workers were absent (Chaudhury et al. 2006). Besides personal reasons, poor management, higher workload, unfavorable working conditions and inadequate salaries are determinants of absenteeism (Kiwanuka et al. 2011, Isah et al. 2008). In a Nigerian hospital, Isah et al. (2008) found that absenteeism was significantly associated with age, gender and being married. Stressed health workers; those unsatisfied with the working environment or job, were also more absent. In a study conducted across five countries, Chaudhury et al. (2006) found that higher-ranking and more powerful providers were absent more often than in lower-ranking cases. Absenteeism was also associated with gender and working conditions; little evidence was found where pay affected absence. In Lao PDR, extrinsic and intrinsic motivations affected health workers' behavior (Yamada, Sawada, and Luo). Lastly, in the US, burnout was found to affect absenteeism (Parker and Kulik 1995).

Absenteeism undermines service delivery and results in fewer outputs, underperformance, lowering patient access to services and poor quality. As a result, absenteeism constitutes as a barrier to better health outcomes (Chaudhury et al. 2006). Goldstein et al. (2013) found that in Western Kenya, nurse absence on a female patient's first visit significantly cuts the probability that the woman tests for HIV over her entire pregnancy and results in poorer child and maternal health. Another effect of absenteeism is higher workload for co-workers, thus increasing stress and job dissatisfaction (Kiwanuka et al. 2011). Absenteeism is also associated with high costs to governments as undeserved salaries are paid to workers, regardless of their presence (Chaudhury and Hammer 2003).

Determinants of workforce productivity are numerous and their interconnectedness, complex. The review of evidence from low and middle income

countries by Rowe et al. (2005) suggests that interventions that improve motivation and job satisfaction as well as supervision and audit with feedback can improve staff performance. Knowledge, skills, motivation, job satisfaction, pay, experience, patient factors, attributes of the work as well as health facility, education, administration, work, community, sociocultural, economic and political environments are factors that can influence a health workforce's performance. In Uganda, health workers' productivity improved with the availability of drugs and equipment as well as with better management (Lutwama, Roos, and Dolamo 2012). In Ethiopia, the productivity of community health workers was determined by their work environment including workload, supportive supervision, supplies and equipment and respect from the community (Jaskiewicz and Tulenko 2012).

2.2.3. HUMAN RESOURCES FOR HEALTH IN RWANDA

In 2007 there were 0.03 doctors/1000 inhabitants and 0.48 nurses/1000 inhabitants in Rwanda. The decentralization reform resulted in an almost doubling of the health workforce in public facilities between 2005 and 2008 (from a total of 6,963 to 13,155), many of which were hired for rural facilities (Soucat, Scheffler, and Ghebreyesus 2013). Still, 75% of doctors and 60% of nurses work in the capital city where only 15% of the total population lives (Basinga et al. 2010). There are no doctors working in primary healthcare facilities. An A1 nurse manages the facility and several A2 nurses deliver healthcare services. They are supported by a social assistant, laboratory technicians, auxiliary staff, administrative staff and support staff (Table 2-1). All facilities report staffing levels below the national norms.

Table 2-1: Staffing norms for a primary healthcare facility in Rwanda (2007)

Staff categories	Norm	Tasks performed
Nurse A1	1	Head of the primary healthcare facility
Nurse A2	15	6 for curative care 1 for family planning 1 midwife 2 for prenatal care 2 for immunization and postnatal care 1 for inpatient care 1 for hygiene and sanitation 1 A2 nurse or 1 nutritionist
Auxiliary staff	2	1 for small surgery and curative care (A3) 1 for managing and distributing drugs (A3)
Social assistant	1	1 social assistant (A2)

Staff categories	Norm	Tasks performed
Laboratory technician	2	2 laboratory technicians (A2)
Administrative staff	2	1 assistant-accountant (A2) 1 cashier (A2)
Support staff	4	2 for cleaning and sterilization 2 guards

Source: Rwanda Ministry of Health (2007)

In 2006-2008, wages for health workers were partly delinked in Rwanda. Basic salaries were paid from the wage bill, while performance-based incentives were paid from block grants provided to district level authorities and facilities. Between 2005 and 2008, the fixed salaries grew from $6.4 million to $21.4 million, following a dramatic rise in the number of health workers. During the same period, performance-based pay grew tenfold, from $0.8 million to $8.9 million. In 2008, PBF represented 41.8 % of the funds paid as salaries (Soucat, Scheffler, and Ghebreyesus 2013). In 2008, the human resources for health reform decentralized hiring, management, and payment of health workers to primary healthcare facilities (Haji et al. 2010, Soucat, Scheffler, and Ghebreyesus 2013).

Performance-based financing in Rwanda began with small scale pilots in 2003. In 2006, the Ministry of Health decided to nationally scale-up the strategy to all primary healthcare facilities (health centers). In the Rwandan PBF national scheme, payments for performance were provided to health centers based on the quantity of outputs achieved through case-based remuneration conditional on the quality of services delivered. As in most countries, the bulk of PBF resources (77.5%) were allocated to extrinsic motivation (i.e. to salaries) although the facilities were free to decide on the use of additional resources (Basinga et al. 2010).

The implementation of PBF in Rwanda was accompanied by strong reporting and supervision mechanisms. Facilities in the treatment areas submitted monthly activity reports to a district steering committee. Each facility received an unannounced quarterly visit by a team from the district hospital (referral facility) to assess quality indicators. Findings were discussed with the staff at the end of the visit and recommendations were formulated (Basinga et al. 2011).

2.3. METHODS

2.3.1. MEASURING PRODUCTIVITY

As presented in section 2.2.1, estimating the production function requires data on labor, capital and an estimate of total factor productivity. In practice, analyses performed in LIC usually focus on outputs produced by hospitals (Anderson 1980, Mills, Hongoro, and Broomberg 1997, Barnum and Kutzin 1993) and both descriptive (ratios) and causal analyses of inefficiencies are performed.

Descriptive analyses relate to technical and allocative efficiency using staffing ratios, expenditure ratios and average costs and were performed with data on Sri Lanka (Somonathan et al. 2000), Senegal (Bitran 1995), Benin and Guinea (Soucat, Levy-Bruhl, De Bethune, et al. 1997, Soucat, Levy-Bruhl, Gbedonou, et al. 1997). However, they must be interpreted with caution as they may hide complex situations: for instance, high levels of labor productivity in understaffed facilities may indicate poor quality rather than high technical efficiency (Knowles, Leighton, and Stinson 1997).

Ratios and average costs show a deviation from the average whereas frontier analysis, by estimating a production or cost function, compares efficiency levels to a best-practice. The production function presents a locus of technically efficient output combinations an organization can produce. It takes into account the quantity of outputs and inputs, whereas the cost function introduces data on their cost (Worthington 2004). There are two main methods to define a frontier: data envelopment analysis (DEA) which uses mathematical programming techniques and stochastic frontier analysis (SFA) which is a statistical method. The main difference is that DEA is a non-parametric method that uses observations from the sample to define the frontier, whereas SFA uses a parametric method to assume a best-practice frontier (Jacobs, Smith, and Street 2006). SFA is less likely to overestimate inefficiency as, unlike DEA, it separates the random error (statistical noise) from inefficiency (Mortimer and Peacock 2002, Murillo-Zamorano 2004, Forsund, Lovell, and Schmidt 1980). Using panel data stochastic frontier model allows relaxing

assumptions that have to be made with cross sectional data[9]. Indeed, panel data approaches are recommended as they provide more robust estimates and can be estimated using ordinary least squares (Dor 1994, Skinner 1994, Sena 2003).

The choice between production or cost frontier analyses is often driven by the availability of data. As the data collected from the primary healthcare facilities in Rwanda was not complete enough and reliable enough, none of these methods could be used to measure productivity. Indeed, data on capital, labor and outputs was either missing or incomplete. As a result, this chapter proposes an alternative to productivity measurement using the conceptual framework presented in Figure 2-1 to allow estimate the drivers of health workforce productivity in Rwanda.

2.3.2. DATA

This chapter uses two rounds of health facility surveys that were collected before the implementation of PBF in treatment districts (the 'baseline' in 2006) and after two years of implementation (the 'follow-up' in 2008). The health facility surveys provide data on: i) the facility including type, infrastructure and finances; ii) health services available and 6-month utilization; iii) laboratory tests; iv) medical equipment; v) drugs; and, vi) human resources taking into account incoming personnel and leavers.

Data was collected from 166 primary health centers at baseline and from 154 health facilities at follow-up. Data on 1,621 staff were collected at baseline (793 in the treatment facilities and 828 controls) and on 2,724 at follow-up (1,298 in treatment facilities and 1,426 controls). For both rounds, the respondent was the Director of the health center.

The analysis uses three dependent variables to tackle the different elements identified in the conceptual framework. First, the variable DIFFERENCEA2 assesses the difference in the number of A2 nurses (healthcare providers) between the two waves. The variable is the ratio of the number of nurses during a given period over the number of nurses at baseline; equal to one at baseline. At follow-up, if the ratio

[9] Such as assumptions on the fact that inefficiency is uncorrelated with the level of inputs or on the distribution of the inefficiency effect.

is below one, fewer healthcare providers are working in the facility compared to the baseline. On the contrary, if above one, the facility has recruited and retained more staff. This variable aims to assess improvements in the availability of healthcare providers in health facilities and to see whether PBF facilities have attracted/recruited more healthcare providers, thus reducing the shortage of nurses. The variable is:

$$DIFFERENCEA2_{jt} = \frac{Number\ nurses\ A2_{jt1}}{Number\ nurses\ A2_{jt0}}$$

where t is the time dummy, t0 denotes the baseline, t1 the follow-up and j the health facility.

Second, dichotomous variable PRESENT is used to look at the impact of PBF on absenteeism. For that purpose, the response to the question "Is NAME here today?" was used. The reasons for absence were looked at to assess whether absences were authorized or not. However, for consistency with previous studies and because there is a tendency to under-report unauthorized absences, staff were considered absent if he/she was not in the facility on the day of the survey, regardless of the reason for being absent (Yamada, Sawada, and Luo 2012, Kiwanuka et al. 2011, Chaudhury et al. 2006). Indeed Chaudhury et al. (2006) highlight that it is difficult to assess the extent to which absence is authorized as facility directors may not answer truthfully. A sensitivity analysis was performed by removing 'authorized absences' and results did not change significantly from those presented in the next section.

Third, the variable WPI (Workforce Productivity Index) is an index to proxy health workforce productivity. Following Vujicic, Addai, and Bosomprah (2009), the WPI was computed to obtain a more comprehensive measure of health workers' productivity than those often used in the literature (simple ratios). It uses a Composite Services Indicator (CSI) which is a weighted sum of the volume of the main health services produced in primary healthcare facilities:

$$CSI_i = \sum_j \alpha_j S_{ij}$$

where CSI_j is the composite service indicator for primary healthcare facility j; S_{ij} is the volume of service i in primary healthcare facility j and α_i is the weight assigned to service i.

Services included in the CSI are inpatient services (number of stays), outpatient visits, prenatal care visits, institutional deliveries, family planning visits and immunization delivered in one month (averages of the 6-month or 7-month data provided in the survey). Weights used for the CSI are presented in Table 2-2. They reflect time and resources mobilized for delivering services. Although assigning weights is somehow arbitrary, the weights used in the analysis are consistent with those used elsewhere (Vujicic, Addai, and Bosomprah 2009). A sensitivity analysis was performed to check the robustness of results with a change in the weights to align them to those of the payment formula, giving more weight to higher payments. Comparable results were found and the decision was made to use weights already reported in the literature for comparison purposes.

Table 2-2: Weights used in the Composite Service Indicator

Services	Weights
Number of Inpatient stays (IPD)	3
Number of Outpatient visits (OPD)	1
Number of Prenatal care visits (PNC)	1 (similar to outpatient)
Number of Institutional deliveries (ID)	3 (similar to inpatient)
Number of Family planning visits (FP)	1 (similar to outpatient)
Number of Immunizations (Imm)	0.5

Source: Adapted from Vujicic, Addai, and Bosomprah (2009).

The WPI also uses a Composite Human Resources for Health (CHRH) index. The CHRH index is the total wage bill (in thousand Rwandan Francs) of primary healthcare facilities for staff working in each facility. Using this method is similar to weighting each health worker by average salary (Vujicic, Addai, and Bosomprah 2009). This places the greatest weight on higher salaries and is useful when performing a cost-effectiveness comparison across facilities, in this case, between treatment and control groups:

$$CHRH_j = \frac{total\ wage\ bill_j}{1000}$$

So the workforce productivity index in facility j is:

$$WPI_j = \frac{CSI_j}{CHRH_j}$$

For ease of interpretation, the WPI is normalized to one. The higher the WPI, the more productive the primary healthcare facility.

The decision to include control variables in the models was driven by theory and adjusted from fieldwork knowledge, institutional specificities and data availability. The literature suggests that infrastructure specificities, working conditions, workload, stress, availability of drugs and equipment and salary are important determinants of staff motivation, job satisfaction and ultimately of productivity, presence at work and retention. The inclusion of control variables was tested for each model and the most relevant variables (i.e. those that had an effect in other settings as reported by the literature) were kept.

For regressions on availability of healthcare providers and presence at work, controls include characteristics of the facility, such as its status (public or faith-based), the log size of the population in the catchment area, whether it is open on a 24 hour basis, the availability of communication means on a 24 hour basis, the availability of toilets and of adequate electricity. Staff controls include the number of A1 nurses (heads of facility), of A2 nurses, of laboratory technicians and gender. The log of the health facility wage bill and total expenditure were also added as variables on outputs produced by the facility (prenatal care services, deliveries and inpatient stays) to control for their activity and workload. Finally, scores for the availability of key equipment and essential drugs were computed and included to proxy working conditions and process quality.

For the regression on the Workforce Productivity Index, the variables PRESENT and DIFFERENCEA2 were introduced as explanatory variables along with the status of the health facility, the log of the health facility wage bill, equipment and drug scores, outputs produced by the facility and the availability of A1 and A2 nurses.

2.3.3. STATISTICAL ANALYSIS

Descriptive analyses including t-tests were performed for all dependent and independent variables in the models to compare the means in the treatment and

control groups at baseline. This checks whether the randomization worked as expected, and if treatment and control groups were balanced before implementing PBF in treatment districts. As data is randomized in clusters, t-tests were performed using clustering at the district-by-year level.

Further, regressions using the difference-in-difference model were run (Bertrand, Duflo, and Mullainathan 2004). The use of difference-in-difference model despite the randomized controlled trial design of the study is justified by the fact that with the decentralization reform that occurred during the impact evaluation, some control health centers were reassigned to the treatment group. As a result, the evaluation design shifted to a quasi-experimental one thus justifying the need for difference-in-difference model. This model first calculates the mean difference between the baseline and follow-up values of the variable of interest for the treatment and control groups; second, it calculates the difference between these two mean differences. This second difference isolates the impact of PBF. The difference-in-difference estimator assumes that unobserved heterogeneity is time invariant. Thus possible bias caused by unobserved heterogeneity (that is uncorrelated with the treatment) is cancelled out through differencing (Khandker, Koolwal, and Samad 2010).

The difference-in-difference is estimated using a Linear Probability Model (LPM) for the dichotomous dependent variable (PRESENT). Ordinary Least Squares (OLS) are used for the regressions on the Workforce Productivity Index (WPI) and the availability of healthcare providers (DIFFERENCEA2). The regression specification of the difference-in-difference model is:

$$Y_{it} = \alpha + DD.T_it + \beta T_i + \delta t_i + X_{it} + \varepsilon_{it}$$

where T is the treatment variable, t is the time dummy, X is a list of time varying individual characteristics and the coefficient of the interaction of T and t (DD) gives the estimate of the impact of treatment on outcome Y.

Robustness checks using fixed-effects and clustering were run to assess the robustness of regression coefficients. Fixed effects control the effect of unobservable characteristics that can influence the dependent variable (Bertrand, Duflo, and

Mullainathan 2004, Khandker, Koolwal, and Samad 2010). As performed in previous analyses using data from the same impact evaluation, but for household level data, facilities and time fixed effects were used to control for time and time-invariant locations (Basinga et al. 2011). This allows estimation for the inter-facility (within) variation rather than the intra-facility variation in the coefficient estimates. Further, clustered standard errors were computed. Clustering allows the error terms to be correlated within the same cluster. As facilities in the same district are more likely to share common observable and unobservable characteristics after implementing PBF, clustering was done at the interaction of the district with the post intervention level (38 clusters) (Basinga et al. 2011). The regression specification of the difference-in-difference model using clustering and fixed effects is:

$$Y_{ijt} = \alpha + \lambda_j + DD.T_{ij}t + \beta T_i + \delta t_i + X_{ijt} + \varepsilon_{ijt}$$

where T is the treatment variable, t is the time dummy, λ_j are facility fixed effects, X is a list of time varying individual characteristics and the coefficient of the interaction of T and t (DD) gives the estimate of the impact of treatment on outcome Y_{ijt} for individual i living in the catchment area of facility j in year t.

For the regressions on absenteeism (PRESENT) and on the availability of healthcare providers (DIFFERENCEA2), the model chosen assumes a linear relationship and is based on findings from the literature review on individual and health facility's characteristics that influence health workforce behavior. However, the potential nonlinear relationship was tested in regressions on the Workforce Productivity Index by including interaction terms as further explained below.

Different specifications were run for the Workforce Productivity Index to assess what best predicts the productivity of staff and how it interacts with absenteeism and the availability of healthcare providers: Specification 1 reports the base model. This simple specification assumes a linear relationship between WPI, absenteeism and availability of healthcare providers. This specification only includes the variables used previously as dependent variables (ABSENT and DIFFERENCEA2) as controls. Specification 2 adds an interaction between PBF and absenteeism and between PBF and the availability of healthcare providers to Specification 1 to assess

the contribution of PBF to productivity through its impact on absenteeism and availability of healthcare providers, thus assuming a non-linear relationship. Specification 2 enables us to describe the simultaneous influence of the two variables rather than the additive influence, as in Specification 1. Specification 3 serves as a robustness check for Specification 1 by adding a number of variables that might explain productivity as presented above. Similarly Specification 4 serves as a robustness check for Specification 2 by adding the same controls as in Specification 3.

2.3.4. LIMITATIONS

This study used the PBF impact evaluation data from Rwanda to assess the impact of the strategy on human resources management and behavior, as this data offers a unique opportunity to isolate the impact of PBF on variables of interest. However, using secondary data presents some limitations as one cannot choose questions to be included in the questionnaire. As outlined in section 2.3.1, due to data limitation, the production function could not be estimated and an alternative way of measuring productivity had to be proposed. This method, using the WPI, has limitations as weights are arbitrary and one cannot capture all dimensions of the production function. Further, some questions were not asked at baseline and responses to others were not complete (such as, the reason for being absent or age). The adjustment for quality, using equipment and drug scores, is also incomplete. Another limitation lies in the duration of the exposure to treatment. The 23-month exposure is enough to isolate the impact of PBF on utilization of healthcare services, but is probably too short to observe changes in human resource management and behavior, coping strategies or changes in working conditions. Finally, since understanding human resources behavior is complex, mixed methods with qualitative research would have provided some insight on the determinants of motivation and satisfaction, in particular in the context of PBF.

2.4. RESULTS

2.4.1. BALANCE CHECK AND PRIMARY HEALTHCARE FACILITY CHARACTERISTICS

The comparison of primary healthcare facilities in the intervention and control groups at baseline shows that the random assignment of facilities to intervention or control groups was successful in creating two comparable groups. The results from clustered t-tests show no statistically significant difference between treatment and control facilities on infrastructure and equipment, services delivered and staffing.

Most facilities in the sample (66% in total) are public facilities. Electricity is functional in only 30% of facilities, water in 56% and communication and waste disposal in about two-thirds of facilities. The availability of drugs is poor, with a drug score of only 29%. Equipment is better but still low (63%). Services provided by facilities (outputs) in one month are comparable in both groups. On average, a primary healthcare facility in Rwanda did 14 institutional deliveries a month in 2006, 646 vaccinations, 1,430 outpatient consultations, 17 family planning consultations and had 54 inpatient stays. Finally, facilities in both groups are below the norm for all staff categories. Only one fifth of facilities have an A1 nurse (head of facility) and facilities have an average of five A2 nurses to deliver healthcare services (Table 2-3).

Table 2-3: Baseline characteristics of treatment and control primary healthcare facilities (2006)

	Total		**Intervention**		**Control**		**Diff.**	**P-value**
	N	**% / #**	**N**	**% / #**	**N**	**% / #**	**% / #**	
Characteristics of primary healthcare facility								
Is a public facility	166	66%	80	67%	86	65%	2%	0.840
Has electricity	166	30%	80	28%	86	33%	5%	0.657
Has communication means	166	67%	80	64%	86	71%	7%	0.519
Has water	166	56%	80	59%	86	53%	6%	0.564
Has toilets	166	19%	80	18%	86	21%	3%	0.584
Has waste disposal	166	67%	80	73%	86	62%	11%	0.236
Equipment score	166	62%	80	60%	86	64%	4%	0.475
Drug score	166	29%	80	31%	86	27%	4%	0.590

	Total		Intervention		Control		Diff.	P-value
	N	% / #	N	% / #	N	% / #	% / #	
Outputs of the primary healthcare facility								
Deliveries	166	14	80	15	86	13	2	0.522
Vaccines	166	646	80	687	86	609	78	0.489
Outpatient consultations	166	1,430	80	1,622	86	1,251	371	0.206
Family planning consultations	166	17	80	20	86	14	6	0.235
Inpatient stays	166	54	80	60	86	46	14	0.308
Staffing of primary healthcare facility								
Number of nurse A1	166	0.2	80	0.2	86	0.3	0.1	0.251
Number of nurse A2	165	5.3	80	5.5	86	5.2	0.3	0.660
Laboratory technician	165	0.8	80	0.8	86	0.8	0.0	0.942

2.4.2. AVAILABILITY OF HEALTHCARE PROVIDERS

A total of 29% of staff working in health facilities at follow-up were new staff and 82% of those working in the health facility at baseline were still working there during the follow-up survey.

2.4.2.1. Ordinary Least Squares (OLS) regression

Results from the OLS regression on the difference in the number of A2 nurses between the two surveys show that facilities in the treatment area are less likely to fill in the shortage of healthcare providers compared to facilities in the control area. PBF has a negative impact on the increase in the number of healthcare providers as there are about 21% fewer nurses in treatment facilities compared to control facilities at follow up (probability of 99%). The coefficient on the time variable illustrates the rise in the number of nurses that occurred over that period and suggests an almost doubling of the number of nurses between the two waves (probability of 99%). Some characteristics of health facilities have an effect on the availability of nurses: public facilities have 16% more staff between the two waves compared to faith-based cases; the availability of toilets and of staff (presence of a head of facility, number of healthcare providers and gender) also positively influences the increase in number of A2 nurses in the facility. Working conditions related to the availability of drugs or equipment have no effect. Some negative

coefficients are difficult to interpret, such as those on salary and some facilities' characteristics (Table 2-4).

2.4.2.2. Robustness check

OLS do not enable us to capture the inter-variability due to PBF within a health facility. The following robustness check measures within-facility change as the main objective is to assess the change in health workforce behavior with PBF, and therefore to note variations within a facility. The same regression with clustering and facility fixed-effects shows a different picture. The coefficient associated with the impact of PBF and time are no longer significant suggesting that the relationship between the availability of healthcare providers in PBF facilities compared to controls is probably more complex than the one estimated with linear regressions. However, as for OLS, some facility characteristics (such as being a public health facility) and staffing characteristics are positively associated with the availability of healthcare providers (Table 2-4). As this robustness check did not allow confirmation of the OLS results, further specifications will be developed to better capture the relationship between PBF and availability of healthcare providers.

2.4.3. ABSENTEEISM

Basic descriptive analysis of data shows that about one third of staff are absent in primary healthcare facilities, both in baseline and follow-up surveys.

2.4.3.1. LPM regression

Results from the regression analysis on presence of staff at work using a linear probability model show that PBF has an impact on absenteeism, as staff in the treatment facilities are 6% more likely to be present at work compared to those in the control facilities (90% confidence level). Results also show that absenteeism worsened over time by 5%. Control variables include facility and individual characteristics that had an effect in other contexts, as revealed by the literature review. The fact that the facility operates on a 24-hour basis is significant and negatively associated with presence at work. Being a male health provider increases the probability of being at work by 3% (Table 2-4).

2.4.3.2. Robustness check

The same regression with clustering and facility fixed-effects confirms the results from LPM. The coefficient associated with the impact of PBF and time is significant and suggests that staff are 9% more likely to be present at work in the treatment facilities compared to the control group (95% confidence). Results also show that between the two surveys, staff were 16% more likely to be absent. As with LPM, neither the status of the health facility influences absenteeism level, nor does the characteristics of the infrastructure, except for the presence of toilets. The total expenditure of the facility (not salary) is positively associated with presence at work but the presence of a head of facility and higher scores for equipment are surprisingly negatively associated.

Table 2-4: Regression results on absenteeism and availability of nurses A2

	Difference in number of nurses		Presence at work	
	(DIFFERENCEA2)		(ABSENT)	
VARIABLES	**OLS**	**Clustering and FE**	**LPM**	**Clustering and FE**
Treatment*Post	-0.212***	-0.060	0.064*	0.094**
	(0.050)	(0.057)	(0.037)	(0.040)
Post	0.954***	0.182	-0.052*	-0.162***
	(0.055)	(0.108)	(0.031)	(0.046)
Treatment	0.034		-0.012	
	(0.020)		(0.025)	
Public (=1)	0.162***	0.241***	0.011	0.054
	(0.027)	(0.054)	(0.020)	(0.037)
Has medical staff on-duty 24 hours	-0.007	0.158	-0.089***	0.049
	(0.046)	(0.111)	(0.034)	(0.041)
Has communication means on a 24 hours basis	-0.098***	0.076	-0.024	0.037
	(0.035)	(0.062)	(0.023)	(0.034)
Has toilets	0.087**	-0.125	0.023	0.093***
	(0.036)	(0.079)	(0.021)	(0.027)
Has adequate electricity	-0.215***	-0.061	-0.016	-0.005
	(0.029)	(0.065)	(0.020)	(0.018)
People served by the facility (log)	0.323***	0.380***	-0.011	-0.047
	(0.034)	(0.072)	(0.021)	(0.042)
Number of Nurse A1	0.026**	-0.191***	-0.006	-0.042***
	(0.013)	(0.064)	(0.007)	(0.015)
Number of Nurse A2	0.081***	0.226***	0.001	0.008
	(0.006)	(0.022)	(0.003)	(0.005)

	Difference in number of nurses		Presence at work	
	(DIFFERENCEA2)		(ABSENT)	
VARIABLES	**OLS**	**Clustering and FE**	**LPM**	**Clustering and FE**
Number of laboratory technicians	0.009	-0.009	-0.004	-0.015
	(0.010)	(0.039)	(0.009)	(0.020)
Sex (male=1)	0.056**	-0.003	0.031*	0.026
	(0.025)	(0.005)	(0.018)	(0.017)
Total recurrent costs for salary (log)	-0.186***	-0.264***	-0.006	0.023
	(0.024)	(0.050)	(0.017)	(0.019)
Total expenditures (log)	0.011	0.178***	0.031*	0.035*
	(0.021)	(0.053)	(0.018)	(0.017)
Number of prenatal care consultations	-0.006***	0.000	0.000	-0.001***
	(0.000)	(0.001)	(0.000)	(0.000)
Number of deliveries	0.005***	-0.000	0.000	0.001
	(0.001)	(0.001)	(0.000)	(0.001)
Number of inpatient stays	-0.000	-0.003***	0.000*	0.002***
	(0.000)	(0.001)	(0.000)	(0.000)
Availability of medical equipment	-0.041	0.141*	-0.018	-0.050**
	(0.030)	(0.074)	(0.020)	(0.021)
Availability of essential drugs	-0.013	-0.145**	-0.002	-0.037
	(0.026)	(0.058)	(0.020)	(0.029)
Observations	3,205	3,205	2,981	2,981
Number of health facilities		164		167

Note: Robust standard errors in parentheses**.** *** p<0.01, ** p<0.05, * p<0.1

2.4.4. PRODUCTIVITY

Descriptive statistics on the workforce productivity index shows that the index ranges from 0.007 to 0.89 at baseline and from 0.017 to 1 at follow-up. The median WPI in 2006 was 0.277 and 0.116 in 2008. A clustered t-test of difference in means shows no statistically significant difference in the mean WPI (P=0.949) revealing a balance at baseline between the two groups.

2.4.4.1. Regressions

The regression analysis using the workforce productivity index shows interesting patterns. Results from the OLS and of the regression using clustering and fixed effect on Specification 1 (which assumes a linear relationship) highlight the downward trend between baseline and follow-up surveys for the value of the WPI (-18% to -

19%). The LPM finds a 4% increase in WPI due to PBF, but this result is not confirmed when focusing on the variation within facilities. Similarly, the OLS regression suggests that WPI increases with the availability of nurses but this is not confirmed with clustering and fixed effects.

Further specification using nonlinear relationships (interactions) provides more robust estimates to assess the impact of PBF on productivity. Specification 2 suggests that there is no direct effect of PBF on the WPI and confirms a negative trend in WPI (-17 to -19) over time. The coefficients associated with the interaction of PBF and presence at work (0.009) as well as PBF and availability of staff (0.068) are significant at the 90% confidence level in regressions using fixed effects and clustering (Table 2-5). Robustness checks will enable us to confirm the existence of an impact.

Table 2-5: Output from regressions on WPI

	Specification 1 Linear		**Specification 2 Interaction**	
VARIABLES	**OLS**	**Clustering + FE**	**OLS**	**Clustering + FE**
Treatment*Post	0.038***	0.057	-0.009	0.015
	(0.011)	(0.034)	(0.011)	(0.037)
Post	-0.178***	-0.199***	-0.172***	-0.190***
	(0.008)	(0.026)	(0.008)	(0.026)
Treatment	0.008		-0.070***	
	(0.009)		(0.015)	
Present (=1)	-0.003	0.000	-0.010	-0.004
	(0.005)	(0.003)	(0.008)	(0.004)
Present*PBF			0.013	0.009*
			(0.011)	(0.005)
Difference in number of nurses	0.017***	0.023	0.012***	0.013
	(0.001)	(0.016)	(0.001)	(0.013)
Difference in number of nurses*PBF			0.069***	0.068*
			(0.010)	(0.037)
Observations	3,581	3,581	3,581	3,581
Health facilities		164		164

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

2.4.4.2. Robustness check

Results from Specification 3, which adds controls to Specification 1 and assumes a linear relationship between availability of staff, absenteeism and productivity of staff, are comparable to those from Specification 1. Adding controls to the specification did not provide a clear picture on determinants of the WPI at the facility level (Table 2-6). As suggested above, non-linear specification is probably more relevant in estimating the impact of PBF on productivity.

Results from Specification 4, which adds controls to Specification 2, shows that the triple interaction effects are better predictors of the impact of PBF on productivity. Including control variables in the specification provided more robust coefficient estimates. Results from OLS on the inter-facility variation suggests that PBF has a negative impact on WPI (reduction of 4%) but that it is cancelled out by the positive effect that PBF has on WPI through improving the availability of healthcare providers (4% increase) (99% confidence interval). The OLS results also show that a higher salary and the presence of an A1 nurse have a negative impact on WPI, while the availability of drugs, equipment and healthcare providers as well as the quantity of services delivered are associated with higher productivity. Coefficients related to the within-facility variation (regressions using clustering and fixed effects) show that PBF has a positive impact on productivity: it increases WPI by 2% (99% confidence level) due to a reduction in absenteeism by 8% (95% confidence level) and through improved availability of staff. The availability of equipment has a positive effect on productivity; and, higher salary has a negative effect (Table 2-6).

Table 2-6: Robustness checks for regressions on WPI

	Specification 3		Specification 4	
VARIABLES	**OLS**	**Clustering + FE**	**OLS**	**Clustering + FE**
Treatment*Post	-0.015*	-0.012	-0.041***	-0.062
	(0.009)	(0.031)	(0.009)	(0.038)
Post	-0.026***	-0.012	-0.021***	0.008
	(0.007)	(0.029)	(0.007)	(0.033)
Treatment	0.047***		0.000	
	(0.007)		(0.012)	
Present (=1)	0.004	0.003	-0.001	-0.004
	(0.004)	(0.003)	(0.006)	(0.003)
Present*PBF			0.010	0.018***
			(0.008)	(0.005)
Difference in number of	-0.004	0.020	-0.009***	0.013

	Specification 3		Specification 4	
VARIABLES	**OLS**	**Clustering + FE**	**OLS**	**Clustering + FE**
nurses				
	(0.002)	(0.016)	(0.002)	(0.017)
Difference in number of nurses*PBF			0.040***	0.081**
			(0.008)	(0.035)
Public (=1)	0.018***	-0.043	0.017***	-0.050
	(0.005)	(0.031)	(0.005)	(0.031)
Costs for salary (log)	-0.112***	-0.117***	-0.111***	-0.118***
	(0.004)	(0.010)	(0.003)	(0.010)
Availability of essential drugs	0.002	0.004	0.002	0.004
	(0.004)	(0.017)	(0.004)	(0.018)
Availability of medical equipment	0.046***	0.043**	0.046***	0.051**
	(0.005)	(0.020)	(0.005)	(0.020)
Number of Nurse A1	-0.020***	-0.021**	-0.017***	-0.013
	(0.001)	(0.009)	(0.001)	(0.010)
Number of Nurse A2	0.005***	0.002	0.005***	0.000
	(0.001)	(0.003)	(0.001)	(0.004)
Number of Lab technician	-0.000	0.002	-0.002	-0.001
	(0.002)	(0.008)	(0.002)	(0.007)
Number of family planning consultations	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Number of deliveries	0.001***	0.001	0.001***	0.001
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	3,462	3,462	3,462	3,462
Health facilities		164		164

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

2.5. DISCUSSION

Performance-based financing aims at modifying health workforce behavior to improve performance in service delivery. There is growing evidence showing that PBF encourages healthcare providers to increase the volume of services delivered (quantitative aspect) and some evidence that shows it improves the quality of care (Basinga et al. 2011, Witter et al. 2012). However, evidence on the impact of PBF on absenteeism, availability of healthcare providers and resulting productivity is scarce and inconclusive.

This chapter uses a conceptual framework according to which the health workforce productivity is influenced by a number of human resource-related factors including:

the availability of staff (first level) and the effective presence of staff at work (second level). As the literature shows that both availability and absenteeism are affected by motivation and job satisfaction, it assessed whether the change in motivation and satisfaction, resulting from the implementation of PBF, influenced the availability of staff, presence at work and ultimately, the productivity and how these different parameters interact. Factors associated with absenteeism, availability of healthcare providers and activity of primary healthcare facilities were quantified to show the impact of PBF on the health workforce.

This chapter contributes to knowledge in at least three independent ways; it is the first to rigorously and wholly assess the impact of PBF on providers' availability, presence at work and productivity. Second, it contributes to the debate on the effect of PBF on intrinsic motivation by reporting sound evidence from Rwanda. Third, it reveals the importance of specification on coefficient estimates, since the comparison of linear probability model or OLS with regressions using clustering and fixed effects highlighted differences in inter- and intra-facility variation.

2.5.1. IMPACT OF PBF ON AVAILABILITY OF HEALTHCARE PROVIDERS

There is evidence that utilization of health services raises with the availability of staff (Chen et al. 2004). As facilities are understaffed in Rwanda, one can expect that health facilities in the treatment group will recruit more staff to increase the volume of services delivered. The literature also shows that job satisfaction, working conditions, management and leadership affect staff retention and hiring in underserved areas, but little is known about the impact of PBF on those determinants and therefore on the impact on the availability of healthcare providers.

Contrary to Soeters et al. (2011) who found that PBF health facilities recruited more staff in the DRC, this chapter shows, by using rigorous impact evaluation data, that the impact of PBF on the availability of staff is indeed negative when looking at inter-facility variation. The availability of nurses almost doubled during the study period as a result of the decentralization reform, but more nurses were recruited in control facilities. Further analysis is necessary to understand this pattern, but a possible explanation includes the fact that PBF facilities are more efficient in service

delivery and thus require fewer staff to perform the work. Another explanation could be, as suggested in the literature (Ireland, Paul, and Dujardin 2011, Magrath and Nichter 2012), that PBF worsens working conditions and demotivates staff, thus renders facilities less attractive to health workers. Within-facility variation does not show any impact of the strategy on the availability of staff suggesting that staff working in PBF facilities at baseline did not quit their job. The negative impact of PBF would therefore only affect new staff.

To some extent, the results confirm findings from the literature (not specific to PBF) in terms of staff retention determinants. They show that infrastructure-related determinants do not play a significant role in Rwanda, probably because the infrastructure remains poor in both groups. On the other hand, they reveal that determinants of working conditions and workload are associated with the availability of staff: staff availability improves in facilities that are more staffed and when the workload is smaller, in particular within complex and time consuming services (inpatient care). Salary is negatively associated with the availability of staff, suggesting that the higher the salaries (including incentives), the less likely health facilities will recruit more staff as facilities operate within a budget.

2.5.2. IMPACT OF PBF ON ABSENTEEISM

Results are consistent with previous studies showing that PBF cuts absenteeism (Kalk, Paul, and Grabosch 2010, Huilleryy and Sebanz 2014) but this chapter provides more robust evidence. In Rwanda, PBF cut absenteeism by 6% to 9% (95% confidence level) suggesting that financial incentives, but also increased accountability and better management resulting from PBF, are effective in making available staff go to work. Contrary to the literature (Chaudhury et al. 2006, Kiwanuka et al. 2011, Isah et al. 2008), most health facilities' characteristics have no impact on absenteeism. Further analysis is necessary to understand the negative coefficients associated with the availability of medical equipment as well as the reasons behind the rise in absenteeism (5% to 16% according to the specifications) between the two waves.

2.5.3. *IMPACT OF PBF ON PRODUCTIVITY*

In Rwanda, the workforce productivity index decreased over time, probably because of the parallel doubling in the number of staff in facilities. The above results on the availability of staff and presence at work show that there are fewer health providers available in treatment facilities, but that available staff are more likely to go to work. How does this translate in terms of productivity? Regressions on the WPI suggest that the relationship between PBF, availability of staff, absenteeism and productivity is not linear. Triple interaction effects provide the best coefficient estimates and show that PBF has a positive impact on productivity (i.e. on the WPI) through the improved availability of staff and reduced absenteeism. Firstly, this suggests that PBF facilities made a better use of additional healthcare providers recruited between the two waves as part of the decentralization reform compared to control facilities. Secondly, results reveal that productivity gains were achieved with fewer staff, but higher performing staff as the absenteeism rate was cut by 9%. In sum, PBF increased extrinsic motivation but did not deter intrinsic motivation as health workers were less absent and performed better. Further research is needed to understand other determinants of staff productivity and understand why the working environment does not play a significant role in Rwanda as in other settings. One reason may be that these changes require more time to produce results than the two-year window of the presented experiment.

2.5.4. *POLICY RECOMMENDATIONS*

Possible policy implications can be drawn from these empirical results. First, as low income countries often face difficulties in containing their wage bill, the case of Rwanda suggests that countries implementing PBF may recruit fewer additional staff since PBF can cut absenteeism of health workers and improve their productivity. In Rwanda, with PBF, productivity gains are achieved with staff already available through increased workload (as illustrated by the higher WPI), better management of human resources and responsiveness (through cuts in absenteeism) and stronger monitoring and supervision (key feature of the PBF scheme in Rwanda). In other words, the same health outputs can be achieved with fewer inputs.

Second, the findings suggest that in Rwanda, strategies aiming to reward performance and increase motivation have more impact on the productivity of health workers compared to working conditions and working environment. They also suggest that PBF encourages health workers to perform better, due to extrinsic, but also intrinsic motivation. It is important to note that in Rwanda, performance incentives were given to primary healthcare facilities. It is likely that individual incentives would have had an even greater impact than the case reported in this chapter.

Third, this chapter suggests that policymakers and designers of PBF schemes should pay attention to reporting mechanisms in the management of human resources and grant more autonomy in the use of resources to improve input-use. It is likely that in the case of Rwanda, more autonomy in the management of human resources and of financial resources, more accountability and the existence of rewards, motivated staff and health facilities to perform better. Indeed specificities of Rwanda, as highlighted in section 1.6, such as the strong reporting mechanisms in place, the performance culture, the low degree of corruption and the supporting reforms implemented at the same time, which could not be quantified in the models, might partially explain the results presented in this chapter. Generalization of results and policy recommendations must thus be done with caution.

2.6. CONCLUSION

Over the past twenty years, Rwanda's health system has gone through a series of major reforms which supported the country's major progress in access to basic health services and health outcomes. Approaches in rebuilding the health system after the genocide of 1994 were oriented toward improving access to services, performance and accountability (Binagwaho et al. 2014). The weaknesses of healthcare service delivery were addressed through major health financing reforms which aimed to increase the autonomy of health facilities (fiscal decentralization), foster performance and accountability in service delivery (performance-based financing), remove financial barriers to healthcare services (health insurance) and improve the availability of health workers (massive recruitments and a decentralization of human resource management). The country is now one of the

few countries in Africa which is on track to reach the health related Millennium Development Goals.

This chapter proposes a new conceptual framework to understand the determinants of productivity. It contributes to narrow a gap in knowledge by bringing robust evidence to the contribution of PBF to productivity and its different determinants. The novelty of findings lies in the drivers of productivity gains: they do not come from staff expansion, but from cutting absenteeism and providing higher workloads for staff. Productivity gains can be achieved through financial incentives, improved supervision and more responsiveness at the expense of a relaxed working environment. This suggests that PBF should be adapted to the behavioral expectations of each country.

This study sheds light on possible pitfalls of PBF, as this mechanism is increasingly adopted in Africa and elsewhere. PBF, as a financial incentive, above all speaks to the extrinsic motivation of the health workforce. Mechanisms should be put in place in parallel to ensure greater job satisfaction and working conditions, which are critical determinants of intrinsic motivation. This could include training opportunities, career advancement, recognition from the community and a better work environment. Also, individual incentives (as opposed to those targeting the health facility) may be even more effective in stimulating the productivity of staff.

3. IMPROVING HEALTH WORKER PERFORMANCE: THE PATIENT-PERSPECTIVE FROM A PBF PROGRAM IN RWANDA[10]

ABSTRACT

This chapter examines the effect of performance-based financing (PBF) on patients' perception of primary healthcare services and on health workers' responsiveness to patients' needs; one of the four dimensions of health workforce performance. Data from a randomized impact evaluation in Rwanda is used to explore patients' satisfaction with clinical and non-clinical services and quantify the contribution of individual and facility characteristics to satisfaction.

The majority of respondents declared overall satisfaction with prenatal care and curative care for children and adults, with the exception of waiting time. The empirical study shows that productivity gains resulting from performance incentives are not achieved at the expense of patients' satisfaction or perceived service quality. Improvements in productivity, availability and competences of the health workforce have a positive effect on patients' satisfaction with clinical services, even when patients' satisfaction is not tied to a reward. The positive effect of PBF on non-clinical dimensions of satisfaction also suggests that PBF incentivizes providers to raise patients' satisfaction with non-clinical services if associated with future financial gains. In particular, healthcare providers adopted a coping strategy to raise satisfaction among patients associated with the largest financial gains (pregnant women) by improving their satisfaction in terms of waiting time so that they may visit the facility again for prenatal care (rewarded service) and institutional delivery (the service tied to the largest financial reward).

It is recommended that low income countries build on the experience from high income countries to better listen to the patients' voice in general and to also include

[10] This chapter is based an article published in Social Science and Medicine (Lannes 2015)

an assessment of patients' satisfaction in incentive mechanisms as a way of increasing the benefits of the strategy.

3.1. INTRODUCTION

Over recent decades, paying healthcare providers against agreed performance targets has gained momentum in HIC and more recently in low income countries. Financial incentives aim to provide extrinsic motivation so as to improve health workforce performance and contribute to a health system's performance. Poor performance in health systems is a worldwide concern and greater investment in the health sector does not necessarily translate to better health outcomes (World Health Organization 2000).

Performance incentives are increasingly promoted to enhance health workforce performance. Performance-based financing can be defined as "a system approach with an orientation on results defined as quantity and quality of service outputs and inclusion of vulnerable persons (…)"(Cordaid-SINA Health 2014). PBF is increasingly adopted in LIC although the strategy has been criticized on several fronts (Ireland, Paul, and Dujardin 2011). Nevertheless the consensus on the positive effect of the strategy is growing and the potential of performance-based financing to address structural problems of health systems is increasingly acknowledged. As argued by Meessen, Soucat, and Sekabaraga (2011), PBF can be a reform catalyst. PBF is now recognized as a holistic reform approach comparable to the old paradigms of primary healthcare and the Bamako initiative. The innovative provider payment mechanism is only one dimension of PBF. The approach is indeed more comprehensive as it entails, among others, health facility autonomy, integrated management of funds, autonomous human resource management, more efficient management of drugs, better quality standards, strengthened governance and accountability (Fritsche, Soeters, and Meessen 2014).

As opposed to demand side interventions that incentivize the population to use healthcare services (such as conditional cash transfers or vouchers), this chapter focuses on a supply side mechanism that incentivizes healthcare providers to achieve quantitative and qualitative targets in the delivery of services. Such mechanisms usually rely on indicators related to providers' practice with the quality

of care traditionally being measured from a clinical viewpoint; patients' view on their interaction with the health system having often been overlooked. Patients' satisfaction is however a desired outcome of care and an indicator of process quality (Donabedian 1988). Emphasis is increasingly placed on a patient's perception of the quality of care (Andaleeb 2001) and responsiveness to patients is recognized as a critical dimension of health system performance (World Health Organization 2000) and of health workforce performance (World Health Organization 2006).

Satisfaction with health services is a multidimensional phenomenon and is categorized in various ways in the literature. Patients' satisfaction results from their perception of service quality including: interpersonal quality, which reflects the relationship between the service provider and the patient; technical quality, which relates to the outcomes achieved and the technical competence of the service provider; environment quality, which corresponds to environmental features that shape consumer service perceptions; and, administrative quality, which relates to facilitating (non-health related) services for the delivery and consumption of the health service (Dagger, Sweeney, and Johnson 2007). Existing evidence suggests that patients' satisfaction is predominantly determined by the quality of medical care (including competences, infrastructure, health services, diagnostic and therapeutic procedures); information; equity in access; costs; waiting time; cleanliness; and, participative approach of care (Mpinga and Chastonay 2011).

The patient-oriented perspective of this chapter is justified on three grounds. First, one cannot ignore the impact a strategy has on users' satisfaction as it stands for a critical component of service quality evaluation. Second, patients' satisfaction affects compliance with treatment and is therefore important from a public health perspective. Third, satisfied patients will continue using services and recommend services to others. As PBF in LIC primarily aims to increase utilization of health services, it is critical to ascertain that poor satisfaction with services is not hampering overall utilization.

PBF focuses on providers and sets clinical targets: thus, the hypothesis is that PBF will result in improved satisfaction from clinical aspects, but will have no effect on satisfaction with non-clinical dimensions. The potential downside of PBF is indeed

that providers will have no incentive to raise patients' satisfaction if they are not rewarded for it. However, as unsatisfied patients decide not to visit a facility again, providers may perceive the need to satisfy patients, even in the absence of a reward, in particular for dimensions that determine the most satisfaction and that they can influence. This hypothesis is tested with data from a randomized control trial of the national PBF scheme in Rwanda. In this scheme, targeting primary healthcare facilities, incentives were based on the quantity of outputs achieved, conditional on the quality of services delivered using 14 maternal and child health output indicators and 13 quality indicators (Basinga et al. 2011). Patients' satisfaction was not measured.

This chapter also aims to verify the reform potential of PBF with a particular focus on patients' satisfaction in quality assurance. The analysis covers satisfaction with prenatal care and with curative care for children and adults. In the subsequent sections, a brief literature review on patients' satisfaction and PBF is presented, followed by methods, results and a discussion with policy recommendations.

3.2. BACKGROUND

3.2.1. DEFINITION AND THEORIES OF PATIENTS' SATISFACTION

The review of the literature highlights two shortcomings: there is no clear definition of patients' satisfaction and most surveys have methodological flaws. In the literature, there is often confusion between responsiveness and satisfaction. Strictly speaking, this article addresses responsiveness defined as the "legitimate expectations of the population for their interaction with the health system" (World Health Organization). Responsiveness relates to the actual experience with health services in the recent past, while satisfaction with the health system is a broader concept that can be influenced by illegitimate expectations and factors outside the control of health systems (Busse 2013, World Health Organization 2006).

Attention paid to patients' satisfaction can be sourced back to the desire for greater accountability of health professionals resulting from growing consumerism and the need to measure health sector in terms of efficiency (Williams 1994). Patients' satisfaction in HIC has been extensively studied, although the theoretical basis is weak. One review concluded that the service marketing literature provided more

advanced consumer theories than the healthcare satisfaction models (Gill and White 2009). The authors identify five major theories of patient satisfaction in healthcare: 1) discrepancy and transgression theories of Fox and Storms (1981), according to which, patients are satisfied if their healthcare orientation is congruent with providers' conditions; 2) expectancy-value theory of Linder-Pelz (1982), according to which, satisfaction derives from personal beliefs, values about care and earlier expectations about care; 3) determinants and components theory of Ware et al. (1983), which states that patient satisfaction is a function of patients' subjective responses to experienced care; 4) multiple models theory of Fitzpatrick and Hopkins (1983) arguing that expectations are socially mediated; and, 5) the healthcare quality theory of Donabedian (1980) that considers patients' satisfaction as a main outcome of the interpersonal process of care. In sum, although some argue that measures of technical and functional quality are appropriate for health services, measuring patients' satisfaction is recommended: authors claim that it is a good proxy for patients' assessment of service quality (Gill and White 2009). As stated by Donabedian (1988), whatever the strengths and limitations of patients' satisfaction as an indicator of quality may be, it remains essential to assess the quality of healthcare systems.

3.2.2. EVIDENCE ON PATIENTS' SATISFACTION

Most evidence on patient satisfaction with healthcare services comes from HIC and shows the importance of satisfaction with clinical over non-clinical dimensions. A meta-analysis performed by Hall and Dornan (1988) shows that humaneness, technical, and overall quality are the most important, while information, psychosocial problems, access, cost and bureaucracy are the least important determinants of patient satisfaction. In the US, satisfaction with patient-provider relationships outweighs satisfaction with other dimensions. Patients are also more satisfied under the fee-for-service payment mechanism as compared to prepaid schemes or gatekeeping arrangements (Crow et al. 2002).

Patient satisfaction is associated with prior satisfaction with healthcare, respondents' predisposition, utilization and the granting of patients' desires (for tests and medications for instance). Sicker patients tend to be less satisfied, while older and less educated patients are more satisfied. Evidence on gender, ethnicity

and socio-economic status remains unclear (Hall and Dornan 1990, Crow et al. 2002, Sitzia and Wood 1997, Hekkert et al. 2009).

Interestingly, satisfaction with a healthcare system largely depends on factors external to the health system: in Europe, patients' experience with healthcare was found to explain only 10% of the variation in satisfaction, whereas patient expectations, health status, type of care and immunization coverage explained only 17.5% (Bleich, Özaltin, and Murray 2009).

3.2.3. PERFORMANCE INCENTIVES AND PATIENTS' SATISFACTION

In HIC, where performance incentives are common, patients' satisfaction is given significant importance. In most pay-for-performance (P4P) schemes, a measure of patient satisfaction is used, along with process (content of care), outcome (effect of care on patients) and structure measures (facility, personnel, equipment) to calculate the financial incentive (Peterson et al. 2006). The measure generally assesses patients' perception of the quality of care (such as information, cleanliness or privacy) (Rosenthal et al. 2004). However, published studies on the effect of P4P focus on a narrow definition of quality (clinical) and do not present patients' perspectives (Young, Meterko, and Desai 2000, Campbell et al. 2007, Peterson et al. 2006).

In traditional LIC health systems, patients' perception of health services is largely ignored. In LIC, PBF schemes have tended to adopt a narrow clinical focus with the risk that providers may then focus on clinical indicators at the expense of patients' satisfaction. More recent PBF schemes however measure patients' satisfaction (Cordaid-SINA Health 2014) but the results are not yet reported in the literature. This chapter takes an unusual viewpoint (from the patients' perspective) to assess the effect of PBF on the quality of health services.

Evidence from LIC is scant. In the DRC, Soeters et al. (2011) found that patients were more satisfied with the availability of drugs, perceived quality and respect for patients in districts participating in the PBF program. Waiting time was judged more acceptable in control districts, but the difference with PBF districts was not significant. Other evaluations of PBF schemes do not report the impact on patients' satisfaction. Patients' satisfaction in LIC is studied in relation to the status of health

facilities (public or private) with authors arguing that what differs between those facilities is the available financial incentive. In a comparative analysis of patients' satisfaction with family planning services in Tanzania, Kenya and Ghana, Hutchinson, Do, and Agha (2011) found that patients were more satisfied with the process quality in private facilities, but found less difference in technical quality. Greater satisfaction with family planning services in private facilities was associated with process and structural factors, such as reduced waiting time and less stock outs. A systematic review using 80 studies on LIC also found that drug supply, waiting time, privacy, confidentiality, staff friendliness, communication, dignity and efforts were better in the private sector, but that patient satisfaction with care did not differ between public and private providers (Berendes et al. 2011).

3.3. METHODS

3.3.1. DATA

Data was collected from 157 primary healthcare facilities, including 77 treatment facilities and 80 control facilities in 2008, after two years of PBF implementation in treatment facilities. Patient exit interviews were conducted with patients visiting the health center on the day of the interview for prenatal care, child curative care and adult curative care. In the case of children, respondents were the accompanying adult. Eight to twelve patients were interviewed for each service in each facility. Information collected from the patients included: patient characteristics, provider effort and patient satisfaction with services. Patients were asked to rank their satisfaction with medical and non-medical services according to five categories: very unsatisfied, unsatisfied, no opinion, satisfied and very satisfied for a list of ten satisfaction indicators (Table 3-1).

Table 3-1: Satisfaction indicators

Satisfaction indicators	Hypothesis on indicators
Waiting time	Patients expect to see a healthcare provider in an acceptable waiting time. Lower waiting time indicates better respect for patients.
Cleanliness of the facility	Patients expect the health facility to be clean. A clean and organized appearance can influence patients' impressions about the facility.
Availability of the	Patients expect prescribed drugs to be available. Their

Satisfaction indicators	Hypothesis on indicators
medicine	satisfaction with services will increase with the availability of drugs.
Time with the health provider	Patients expect the consultation to last some time. Time spent with patients indicates a provider's responsiveness to patients' needs.
Privacy during the examination	Patients expect privacy during examination. Privacy illustrates respect of patients' dignity.
Staff attitude	Patients expect staff to be responsive to their needs and to be professional. Staff attitude will influence patients' perception about the facility.
Explanation from provider	Adequate information from the provider is critical to patients' satisfaction and to ensure a good healing process.
Cost of the medicine	If patients perceive drug costs as excessive, it can affect their satisfaction.
Cost of the service	If patients perceive treatment costs as excessive, it can affect their satisfaction.
Overall service received today	Overall satisfaction with services will depend on satisfaction with the most determining dimensions of satisfaction (clinical dimensions)

Source: Author (2015)

3.3.2. VARIABLES

To facilitate the interpretation of results, an index was constructed from the various dimensions of satisfaction. The traditional principal component analysis (PCA) method that creates indexes from dummy variables (Filmer and Pritchett 2001) was not appropriate, as satisfaction variables are ordinal. Using dummy indicators in PCA would have introduced fake correlations as there were more than two categories for a variable. Following Kolenikov and Angeles (2009), polychoric correlation, an alternative approach for the analysis of ordinal data using PCA, was used. It assumes that ordinal variables were obtained by categorizing normally distributed underlying variables, and that those unobserved variables followed a bivariate normal distribution. Polychoric correlation corresponds to the maximum likelihood estimate of that correlation.

The first factor structure derived from polychoric correlation resulted in only one factor having an Eigenvalue over 1 and explaining 88% of the variation (Table 3-2). However, waiting time, time with provider and cleanliness were not well captured by the first factor as their uniqueness exceeded their contribution to factor 1 (Table

3-3). These variables were thus removed from factor 1, and factor 1 was normalized to facilitate interpretation. As further analysis showed that they could not be combined in an index, they were kept as single measures of satisfaction.

Table 3-2: Output of initial factor analysis

Factor	Eigenval.	Diff.	Prop.	Cum.
1	4.28670	3.52473	0.8823	0.882
2	0.76197	0.53421	0.1568	1.039
3	0.22776	0.08069	0.0469	1.086
4	0.14707	0.0455	0.0303	1.116
5	0.10157	0.13436	0.0209	1.137
6	-0.03279	0.03236	-0.0067	1.130
7	-0.06515	0.08863	-0.0134	1.117
8	-0.15378	0.04091	-0.0317	1.085
9	-0.19469	0.02532	-0.0401	1.045
10	-0.22001	0	-0.0453	1

Table 3-3: Contribution of variables to factor 1

Variable	Factor1	Uniqueness
Waiting time	0.4164	0.8266
Time w/ provider	0.5824	0.6608
Cleanliness	0.596	0.6448
Privacy	0.684	0.5321
Staff attitude	0.7362	0.458
Cost of service	0.6606	0.5636
Cost of drug	0.6611	0.5629
Avail. of drugs	0.6659	0.5565
Explanation	0.6855	0.5301
Overall service	0.7888	0.3778

Four satisfaction measures were retained, including one index corresponding to satisfaction with clinical services and three measures of satisfaction corresponding to non-clinical services (Table 3-4).

Table 3-4: Satisfaction measures retained for analysis

Area	Satisfaction measure	Satisfaction indicators included in the measure
Clinical services	Clinical services index	Privacy during examination, staff attitude, explanation, cost of medicine, cost of the service, availability of drugs, overall satisfaction
Non-clinical services	Waiting time	Waiting time
	Time with provider	Time with provider
	Cleanliness	Cleanliness

3.3.3. STATISTICAL METHODS

3.3.3.1. Ordinary Least Squares

Ordinary least squares were used for regressions on the clinical satisfaction index. OLS were compared to a censored model (Tobit) assuming no negative values. Regression outcomes from OLS and Tobit were comparable revealing the robustness of OLS outputs presented in this chapter. Independent variables in the models aimed to control for facility characteristics (public or faith-based, PBF treatment or control); individual characteristics (primary education, sex when relevant, age, health insurance); and characteristics of the health service (whether

the patient was given a prescription to buy drugs outside or to perform laboratory tests from another health facility). In the sample of pregnant women, additional controls included the months of pregnancy and whether it was their first prenatal care visit. In the sample of children, their age was controlled for. For all models, independent variables were included in the models based on variables' availability and variables that proved to influence satisfaction in the literature. The review of the literature indeed revealed that sicker patients tend to be less satisfied, while older and less educated patients are more satisfied. Evidence on gender, ethnicity and socio-economic status remains unclear (Crow et al., 2002; Hall and Dornan, 1990; Hekkert et al., 2009; Sitzia and Wood, 1997).

3.3.3.2. Ordered probit and marginal effect

The ordinal measures of satisfaction with non-clinical services (waiting time, time with provider and cleanliness) were modeled with ordered probit regressions. Independent variables included facility characteristics (public of faith-based, PBF treatment or control) and individual characteristics (primary education, sex, age and health insurance). Time spent waiting in the facility was added as a control in the regression on satisfaction with waiting time.

The model is estimated using maximum likelihood and supposes the following underlying relationship:

$$y^* = x'\beta + \epsilon$$

where y* is the exact unobserved dependent variable (i.e. the exact level of a patient's satisfaction); x' is the vector of independent variables, and β is the vector of regression coefficients to estimate. As we cannot observe y*, the ordered probit allows observing different categories of responses as follows:

$$y = \begin{cases} 0 \ if \ y^* \leq 0 \\ 1 \ if \ 0 < y^* \leq \mu_1 \\ 2 \ if \ \mu_1 < y^* \leq \mu_2 \\ \vdots \\ N \ if \ \mu_{N-1} < y^* \end{cases}$$

The ordered probit uses observations on y, which are a form of censored data on y* and fits the parameter vector β.

As only the sign of coefficients of ordered probit regressions can be interpreted, marginal effects were computed. The marginal effect of an independent variable measures the impact of change in an independent variable on the expected change in the dependent variable.

3.3.4. ROBUSTNESS CHECKS

Data drawn from the household surveys, which provide information on the utilization of health services collected from 2,145 households in the catchment areas of the 157 primary healthcare facilities of the impact evaluation, was used to control for district level utilization of child curative care and prenatal care services. Following evidence of large regional disparities in utilization of basic health services in Rwanda, robustness checks verify whether the observed effect of PBF on satisfaction varies with a district level utilization of services.

3.3.5. LIMITATIONS

This chapter has its own limitations, although it is one of the first attempts to explore the effect of performance incentives on patients' satisfaction in LIC. First, the questionnaires included only ten satisfaction dimensions, thus restricting the analysis. Second, not enough data were collected from the respondents on their assets which did not allow for computing a wealth index. Third, instructions given for the survey firm on the number of patients to interview in each facility were misunderstood in 2006; thus too few interviews were conducted on satisfaction at baseline. Only 2008 (follow-up) data is used in the analysis which does not allow for isolating the impact of PBF through a difference-in-difference technique. Only causal relationships can be drawn. Nevertheless, the analysis benefits from the randomized design of the study and rigorous evaluation of household perceptions of the quality of care in their health facility, measured from the household surveys, which showed a balance at baseline between treatment and control groups (Basinga et al. 2009). Due to data limitations, this chapter has to assume that satisfaction of patients exiting the same facilities was also comparable at baseline and that any difference observed at follow-up can be attributed to PBF.

3.4. RESULTS

This section starts with a brief descriptive analysis of respondents' satisfaction on the ten dimensions of satisfaction. Then, it provides results from multivariate analyses to assess whether PBF affects clinical and non-clinical satisfaction. Finally, robustness checks are presented to assess whether PBF has a differential effect according to the district level utilization of services.

3.4.1. DESCRIPTIVE ANALYSES

The majority of respondents were satisfied with prenatal care and curative care for children and adults. Overall satisfaction (respondent satisfied or very satisfied) with service reached 86% for adult curative care, 90% for child curative care and 95% for prenatal care. Satisfaction with the cost of drugs and services, which occurs in about 90% of cases, is probably due to the fact that most patients benefit from health insurance. Drugs delivered at the facility and medical services are thus free of charge, except for a small financial contribution. Dissatisfaction with waiting time is the largest for the three categories of care, as close to half of respondents were not satisfied (Figure 3-1 to Figure 3-3). On average, patients waited for two and half hours before seeing a healthcare provider and 20% to 25% had to wait for more than three hours (and some up to eight hours). Descriptive statistics of independent variables included in the models are presented in Appendix 2. T-tests reveal overall balance between the treatment and control groups.

Figure 3-1: Satisfaction with curative care (adults)

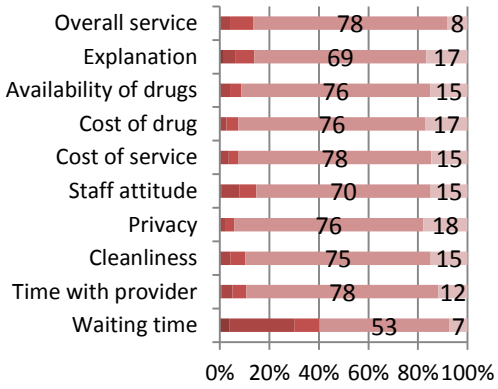


Figure 3-2: Satisfaction with prenatal care

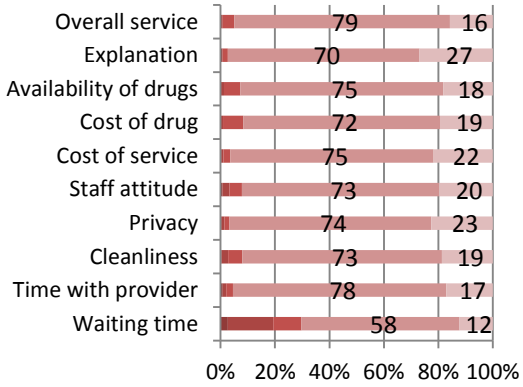
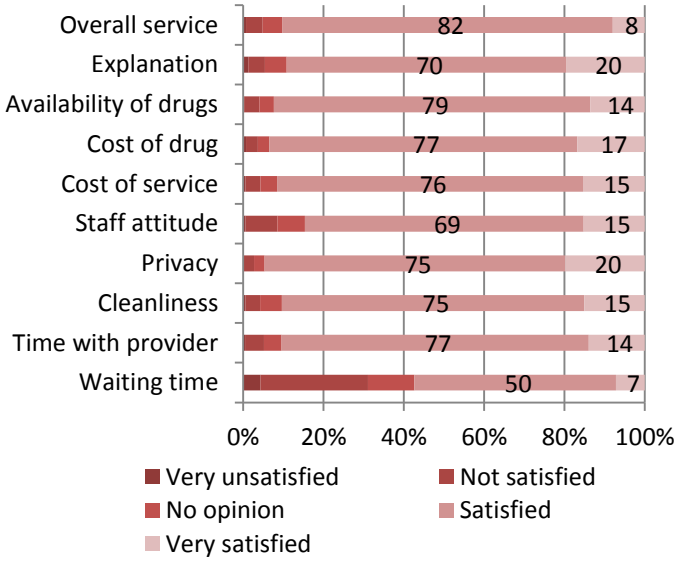


Figure 3-3: Satisfaction with curative care for children



3.4.2. REGRESSION ANALYSES

3.4.2.1. Adult curative care

Adults seeking care from a facility implementing PBF are more satisfied with clinical services (+2.5%), time spent with provider and cleanliness of the facility compared to patients in control facilities. PBF has no effect on satisfaction with waiting time.

Health insurance is the only other determinant of satisfaction with clinical services: insured patients were 6.7% more satisfied with clinical services than non-insured ones. This may reflect that patients that are more satisfied with services of the health facility are those with health insurance. Patients' characteristics such as age, education or sex have no effect. Similarly, prescribing practices (for drugs or

laboratory tests) did not influence adults' satisfaction with clinical services (Table 3-5).

Table 3-5: Satisfaction with clinical and non-clinical services for adult curative care

VARIABLES	Clinical services index	Waiting time	Time with provider	Cleanliness
	OLS	OP	OP	OP
Public (=1)	-0.014	-0.025	0.002	-0.170**
	(0.009)	(0.064)	(0.071)	(0.070)
PBF (=1)	0.025***	-0.016	0.119*	0.169**
	(0.008)	(0.061)	(0.068)	(0.067)
Drug prescription (=1)	-0.003			
	(0.008)			
Laboratory tests (=1)	0.024			
	(0.030)			
Has primary education (=1)	0.013	0.044	0.005	-0.013
	(0.008)	(0.065)	(0.072)	(0.072)
Male (=1)	-0.006	-0.180***	0.052	-0.033
	(0.008)	(0.063)	(0.070)	(0.069)
Age	0.000	0.006***	0.002	0.003
	(0.000)	(0.002)	(0.002)	(0.002)
Has health insurance (=1)	0.067***	0.012	0.130	0.304*
	(0.025)	(0.164)	(0.180)	(0.177)
Waiting time (hours)		-0.257***		
		(0.020)		
Observations	**1,088**	**1,324**	**1,326**	**1,314**

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
OLS= Ordinary Least Squares; OP = Ordered Probit

Marginal effects computed in Table 3-6 show that men were 7% more likely to be unsatisfied or very unsatisfied with waiting times compared to women. A possible explanation could be that the opportunity cost of waiting is higher for men. Adults were also 7% less likely to be satisfied with an additional waiting hour and 3% less likely to be very satisfied. Age is positively associated with satisfaction with waiting time as older patients tend to be more satisfied. PBF has no effect on satisfaction with waiting time but a positive effect on satisfaction with time spent with provider as patients were 2% more likely to be very satisfied in treatment facilities. Patients in PBF facilities were also 4% more likely to be very satisfied with cleanliness.

Contrary to waiting time, patients' characteristics did not influence satisfaction with time spent with the provider and the cleanliness of the facility.

Table 3-6: Satisfaction with non-clinical services related to adult curative care (marginal effects)

	Very unsatisfied		Unsatisfied		No opinion		Satisfied		Very satisfied	
	Marginal effect	SE	Marginal effect	SE	Marginal effect	SE	Marginal effect	SE	Marginal effect	SE
WAITING TIME										
Public = 1	0.002	0.004	0.007	0.018	0.001	0.003	-0.007	0.017	-0.003	0.008
PBF = 1	0.001	0.004	0.004	0.017	0.001	0.003	-0.004	0.016	-0.002	0.007
Primary education = 1	-0.003	0.004	-0.012	0.018	-0.002	0.003	0.012	0.017	0.005	0.008
Male = 1	0.012***	0.004	0.051***	0.018	0.007***	0.003	-0.049***	0.018	-0.020***	0.007
Age	-0.000***	0.000	-0.002***	0.001	-0.000***	0.000	0.002***	0.001	0.001***	0.000
Health insurance = 1	-0.001	0.010	-0.003	0.046	-0.001	0.007	0.003	0.045	0.001	0.019
Waiting time (hours)	0.016***	0.002	0.072***	0.006	0.011***	0.002	-0.069***	0.007	-0.030***	0.003
TIME WITH PROVIDER										
Public = 1	-0.000	0.001	-0.000	0.006	-0.000	0.006	-0.000	0.001	0.000	0.014
PBF = 1	-0.002	0.001	-0.010*	0.006	-0.009*	0.005	-0.002	0.002	0.023*	0.013
Primary education = 1	-0.000	0.001	-0.000	0.006	-0.000	0.006	-0.000	0.001	0.001	0.014
Male = 1	-0.001	0.001	-0.005	0.006	-0.004	0.005	-0.001	0.002	0.010	0.014
Age	-0.000	0.000	-0.000	0.000	-0.000	0.000	-0.000	0.000	0.000	0.000
Health insurance = 1	-0.003	0.004	-0.012	0.019	-0.011	0.015	0.002	0.008	0.024	0.030
CLEANLINESS										
Public = 1	0.001*	0.001	0.013**	0.005	0.014**	0.006	0.011*	0.006	-0.040**	0.017
PBF = 1	-0.001	0.001	-0.014**	0.006	-0.015**	0.006	-0.009**	0.004	0.039**	0.015
Primary education = 1	0.000	0.001	0.001	0.006	0.001	0.006	0.001	0.004	-0.003	0.016
Male = 1	0.000	0.001	0.003	0.006	0.003	0.006	0.002	0.003	-0.007	0.016
Age	-0.000	0.000	-0.000	0.000	-0.000	0.000	-0.000	0.000	0.001	0.000
Health insurance = 1	-0.004	0.004	-0.031	0.022	-0.029	0.018	0.004	0.015	0.059**	0.029

Note: *** p<0.01, ** p<0.05, * p<0.1

3.4.3. *PRENATAL CARE*

Results on satisfaction with prenatal care present some differences when compared to satisfaction levels with curative care for adults. As for adults, pregnant women seeking care from PBF facilities were more likely to be satisfied with clinical services (+1%). However, PBF also positively influenced satisfaction with waiting time which was not the case for adults. Finally, PBF showed no effect on satisfaction with time spent with provider and cleanliness. Satisfaction with clinical services decreased in public facilities but increased when women were asked to perform laboratory tests from another facility (+1%). Satisfaction with care also rose slightly with months of pregnancy (Table 3-7).

Table 3-7: Satisfaction with clinical and non-clinical services for prenatal care

	Clinical services index	Waiting time	Time with provider	Cleanliness
	OLS	**OP**	**OP**	**OP**
Public (=1)	-0.004*	-0.153**	-0.170**	-0.210***
	(0.002)	(0.068)	(0.080)	(0.075)
PBF (=1)	0.006**	0.199***	-0.029	0.089
	(0.003)	(0.064)	(0.074)	(0.070)
Drug prescription (=1)	-0.001			
	(0.002)			
Laboratory tests (=1)	0.011**			
	(0.005)			
Has primary education (=1)	-0.004	-0.128**	-0.174**	-0.104
	(0.003)	(0.065)	(0.076)	(0.071)
Age	0.000	0.005	-0.012	0.006
	(0.000)	(0.008)	(0.009)	(0.008)
Has health insurance (=1)	0.002	-0.041	0.180	-0.034
	(0.002)	(0.121)	(0.141)	(0.134)
Waiting time (hours)	0.000	-0.174***		
	(0.000)	(0.018)		
Months pregnant	0.001***	0.052***	0.019	0.023
	(0.000)	(0.019)	(0.022)	(0.021)
First prenatal visit (=1)	0.006			
	(0.004)			
Number of children		-0.032	0.005	-0.032
		(0.028)	(0.033)	(0.031)
Observations	**683**	**1,197**	**1,196**	**1,192**

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
OLS= Ordinary Least Squares; OP = Ordered Probit

Marginal effects associated with the three non-clinical dimensions of satisfaction showed that women were 3% more likely to be satisfied and 4% more likely to be very satisfied with waiting time in PBF facilities compared to the control group. Satisfaction with waiting time decreased by 4% among more educated women and with time spent waiting (-6% per hour) but this improved with months of pregnancy. Satisfaction with time spent with providers decreased with primary education (Table 3-8).

Satisfaction with waiting time, time with provider and cleanliness of the facility was consistently greater in faith-based facilities compared to public facilities, with the probability of women being very satisfied increasing from 3% to 6% in faith-based facilities (Table 3-8). As for adults, most individual characteristics did not influence satisfaction with time spent with provider and cleanliness of the facility.

Table 3-8: Satisfaction with non-clinical services related to prenatal care (marginal effects)

	Very unsatisfied		Unsatisfied		No opinion		Satisfied		Very satisfied	
	Marginal effect	SE	Marginal effect	SE	Marginal effect	SE	Marginal effect	SE	Marginal effect	SE
WAITING TIME										
Public = 1	0.007**	0.003	0.032**	0.014	0.012**	0.006	-0.021**	0.009	-0.031**	0.014
PBF = 1	-0.010***	0.004	-0.043***	0.014	-0.016***	0.005	0.030***	0.010	0.038***	0.012
Primary education = 1	0.006*	0.003	0.027*	0.014	0.010*	0.005	-0.020*	0.010	-0.024**	0.012
Age	-0.000	0.000	-0.001	0.002	-0.000	0.001	0.001	0.001	0.001	0.001
Health insurance = 1	0.002	0.006	0.009	0.025	0.003	0.010	-0.006	0.016	-0.008	0.024
Waiting time (hours)	0.009***	0.002	0.037***	0.004	0.014***	0.002	-0.026***	0.004	-0.034***	0.004
Months pregnant	-0.003***	0.001	-0.011***	0.004	-0.004***	0.002	0.008***	0.003	0.010***	0.004
Number of children	0.002	0.001	0.007	0.006	0.003	0.002	-0.005	0.004	-0.006	0.005
TIME WITH PROVIDER										
Public = 1	0.003*	0.002	0.004**	0.002	0.008**	0.004	0.029**	0.015	-0.044**	0.021
PBF = 1	0.001	0.001	0.001	0.002	0.001	0.004	0.005	0.012	-0.007	0.019
Primary education = 1	0.003*	0.002	0.005**	0.002	0.008**	0.004	0.027**	0.012	-0.043**	0.019
Age	0.000	0.000	0.000	0.000	0.001	0.000	0.002	0.001	-0.003	0.002
Health insurance = 1	-0.004	0.004	-0.006	0.005	-0.009	0.008	-0.023*	0.014	0.042	0.031
Months pregnant	-0.000	0.000	-0.001	0.001	-0.001	0.001	-0.003	0.004	0.005	0.006
Number of children	-0.000	0.001	-0.000	0.001	-0.000	0.002	-0.001	0.005	0.001	0.008
CLEANLINESS										
Public = 1	0.002*	0.001	0.011***	0.004	0.016***	0.006	0.030**	0.012	-0.059***	0.022
PBF = 1	-0.001	0.001	-0.005	0.004	-0.007	0.006	-0.011	0.009	0.024	0.019
Primary education = 1	0.001	0.001	0.006	0.004	0.008	0.006	0.013	0.009	-0.028	0.019
Age	-0.000	0.000	-0.000	0.000	-0.001	0.001	-0.001	0.001	0.002	0.002
Health insurance = 1	0.000	0.001	0.002	0.007	0.003	0.010	0.005	0.019	-0.009	0.038
Months pregnant	-0.000	0.000	-0.001	0.001	-0.002	0.002	-0.003	0.003	0.006	0.006
Number of children	0.000	0.000	0.002	0.002	0.003	0.002	0.004	0.004	-0.009	0.008

Note: *** p<0.01, ** p<0.05, * p<0.1

3.4.4. *CHILD CURATIVE CARE*

PBF showed to have the smallest effect on child curative care, as the strategy only influenced satisfaction with clinical services with respondents (accompanying adult) being 2% more satisfied in treatment facilities. PBF had no effect on satisfaction with waiting time, time with provider or cleanliness. As for adult curative care, satisfaction with clinical services improved by 5% among insured respondents and no other individual or service-related factor influenced satisfaction with clinical services (Table 3-9).

Table 3-9: Satisfaction with clinical and non-clinical services for child curative care

VARIABLES	Clinical services index	Waiting time	Time with provider	Cleanliness
	OLS	OP	OP	OP
Public (=1)	-0.005	0.043	-0.084	-0.189**
	(0.010)	(0.075)	(0.085)	(0.084)
PBF (=1)	0.020**	-0.007	-0.027	0.099
	(0.010)	(0.072)	(0.080)	(0.080)
Drug prescription (=1)	0.001			
	(0.010)			
Laboratory tests (=1)	0.030			
	(0.030)			
Has primary education (=1)	-0.007	-0.172**	-0.018	-0.040
	(0.010)	(0.072)	(0.081)	(0.080)
Male (=1)	-0.005	0.000	0.039	0.001
	(0.013)	(0.126)	(0.141)	(0.140)
Age	0.001	0.003	0.007	-0.002
	(0.001)	(0.005)	(0.005)	(0.005)
Has health insurance (=1)	0.053**	-0.291**	0.195	-0.052
	(0.024)	(0.125)	(0.140)	(0.139)
Age of the child	-0.006	-0.052*	-0.122***	-0.038
	(0.004)	(0.028)	(0.032)	(0.031)
Waiting time (hours)		-0.206***		
		(0.021)		
Observations	**750**	**947**	**945**	**940**

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
OLS= Ordinary Least Squares; OP = Ordered Probit

As for other groups of patients, waiting time was the satisfaction dimension most influenced by individual characteristics. Insured respondents and those with

primary education were less likely to be satisfied or very satisfied with waiting time. Their satisfaction also decreased as they spent more time waiting. Satisfaction with time spent with the provider was higher for younger children. Finally, patients were 4.5% more likely to be very satisfied with cleanliness in faith-based facilities (Table 3-10).

Table 3-10: Satisfaction with non-clinical services related to child curative care (marginal effects)

	Very unsatisfied		Unsatisfied		No opinion		Satisfied		Very satisfied	
	Marginal effect	SE	Marginal effect	SE	Marginal effect	SE	Marginal effect	SE	Marginal effect	SE
WAITING TIME										
Public = 1	-0.003	0.005	-0.012	0.021	-0.002	0.003	0.012	0.021	0.005	0.009
PBF = 1	0.000	0.005	0.002	0.020	0.000	0.003	-0.002	0.020	-0.001	0.008
Primary education = 1	0.012**	0.006	0.048**	0.020	0.007**	0.003	-0.048**	0.020	-0.020**	0.008
Male =1	-0.000	0.009	-0.000	0.035	-0.000	0.006	0.000	0.035	0.000	0.015
Age	-0.000	0.000	-0.001	0.001	-0.000	0.000	0.001	0.001	0.000	0.001
Health insurance = 1	0.016***	0.006	0.078**	0.032	0.016*	0.008	-0.069***	0.025	-0.041*	0.021
Age of the child	0.004*	0.002	0.014*	0.008	0.002*	0.001	-0.014*	0.008	-0.006*	0.003
Waiting time (hours)	0.014***	0.002	0.057***	0.007	0.009***	0.002	-0.056***	0.007	-0.024***	0.003
TIME WITH PROVIDER										
Public = 1	0.001	0.001	0.008	0.007	0.005	0.005	0.005	0.006	-0.019	0.019
PBF = 1	0.000	0.001	0.002	0.007	0.002	0.005	0.001	0.004	-0.006	0.017
Primary education = 1	0.000	0.001	0.002	0.007	0.001	0.005	0.001	0.004	-0.004	0.018
Male =1	-0.000	0.002	-0.003	0.012	-0.002	0.009	-0.002	0.009	0.009	0.032
Age	-0.000	0.000	-0.001	0.000	-0.000	0.000	-0.000	0.000	0.001	0.001
Health insurance = 1	-0.003	0.003	-0.020	0.016	-0.013	0.010	-0.003	0.005	0.039	0.025
Age of the child	0.001*	0.001	0.011***	0.003	0.008***	0.002	0.006**	0.003	-0.027***	0.007
CLEANLINESS										
Public = 1	0.003*	0.001	0.013**	0.006	0.015**	0.007	0.015*	0.008	-0.045**	0.021
PBF = 1	-0.001	0.001	-0.007	0.006	-0.008	0.007	-0.006	0.006	0.023	0.019
Primary education = 1	0.001	0.001	0.003	0.006	0.003	0.007	0.002	0.005	-0.009	0.018
Male =1	-0.000	0.002	-0.000	0.010	-0.000	0.011	-0.000	0.009	0.000	0.032
Age	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.000	0.001
Health insurance = 1	0.001	0.002	0.004	0.009	0.004	0.011	0.004	0.011	-0.012	0.033
Age of the child	0.001	0.000	0.003	0.002	0.003	0.003	0.002	0.002	-0.009	0.007

Note: *** p<0.01, ** p<0.05, * p<0.1

3.4.5. ROBUSTNESS CHECK

Robustness checks were run to see whether satisfaction with clinical services (index) was influenced by regional disparities in the utilization of health services. Utilization of four or more prenatal care visits and of curative care for children in the event of an illness was aggregated at the district level to create two groups of districts (lower and upper) according to their utilization level. This grouping revealed that the overall coverage of four or more prenatal care visits was larger than that of curative care for children in the event of an illness. A higher utilization of services was observed in almost the same districts for both services (Southern and Northern part of the country) and Eastern districts consistently registered with lower utilization rates (Figure 3-4 and Figure 3-5).

Figure 3-4: Coverage of 4 or more prenatal care visits (2 groups)

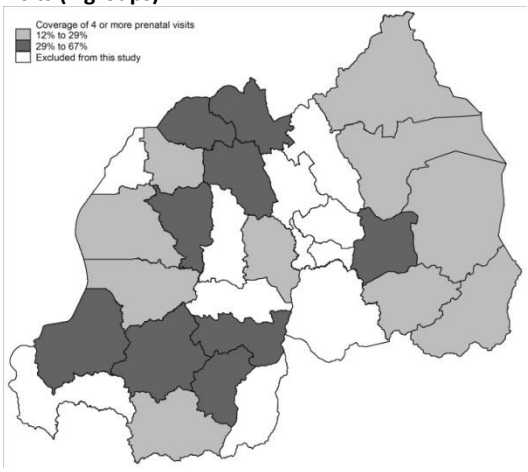
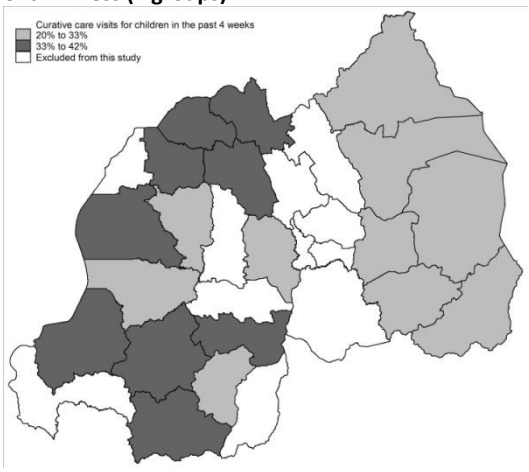


Figure 3-5: Curative care for children in the event of an illness (2 groups)



Source: Author (2015)

The robustness checks confirm the positive effect of PBF on patients' satisfaction with clinical services among pregnant women and children under-five. They reveal however that PBF has an effect on satisfaction of pregnant women only in districts where utilization of prenatal care is the lowest (+0.5%) and an effect on satisfaction with child curative care in places where utilization is the highest (+3%) (Table 3-11).

Table 3-11: Robustness check for prenatal care and child curative care distinguishing district level utilization

	Clinical services index for prenatal care		Clinical services index for child curative care	
	Lower group	**Upper group**	**Lower group**	**Upper group**
Public (=1)	-0.004***	-0.006	0.003	-0.001
	(0.001)	(0.008)	(0.016)	(0.014)
PBF (=1)	0.004***	0.007	0.009	0.026*
	(0.001)	(0.007)	(0.015)	(0.014)
Drug prescription (=1)	-0.001	-0.005	-0.015	0.022*
	(0.002)	(0.004)	(0.014)	(0.013)
Laboratory tests (=1)	0.007	0.014**	0.059	-0.002
	(0.005)	(0.007)	(0.039)	(0.027)
Has primary education (=1)	-0.001	-0.009	-0.016	0.008
	(0.001)	(0.009)	(0.014)	(0.014)
Male (=1)			-0.000	-0.020
			(0.018)	(0.019)
Age	-0.000	0.001	0.001	0.000
	(0.000)	(0.001)	(0.001)	(0.001)
Has health insurance (=1)	0.001	0.003	0.047	0.070***
	(0.002)	(0.004)	(0.037)	(0.023)
Waiting time (hours)	0.000	-0.000		
	(0.000)	(0.001)		
Months pregnant	0.001***	0.000		
	(0.000)	(0.000)		
First prenatal visit (=1)	0.004***	0.008		
	(0.001)	(0.009)		
Age of the child			-0.004	-0.008
			(0.006)	(0.005)
Observations	**386**	**297**	**452**	**298**

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

3.5. DISCUSSION

This chapter focuses on health workforce performance from the patients' viewpoint, by looking at how responsive health workers are to patient needs. The randomized implementation of the strategy allows for a comparison of treatment and control facilities to see how PBF affects satisfaction measured across ten clinical and non-clinical dimensions.

This chapter adds to knowledge in at least three ways: first, it provides evidence on patients' satisfaction with health services (and health workforce responsiveness) in rural Rwanda. Second, it provides evidence on determinants of patient satisfaction and discusses differences between HIC and LIC that can serve as policy recommendations. Third, it confirms the PBF reform potential related to quality assurance and patients' satisfaction.

3.5.1. PATIENTS' SATISFACTION WITH HEALTH SERVICES IN RWANDA

As observed in other countries (Sitzia and Wood 1997, Bernhart et al. 1999), patients interviewed in Rwanda reported high satisfaction levels for clinical and non-clinical services. This contrasts with the suboptimal use of basic health services in the country and suggests a response-bias as patients tend to hold back negative views. Respondents show their lack of satisfaction only in the case of waiting time, probably because it is the most tangible measure and can be easily quantified.

PBF has a positive effect on satisfaction with clinical services, as observed in the DRC (Soeters et al. 2011), but its effect on non-clinical services varies. Results suggest two interesting patterns: first, PBF primarily influences satisfaction related to the clinical content of care: satisfaction with clinical services improved by 2.5% for adult care, 1% for prenatal care and 2% for childcare in PBF facilities, suggesting that productivity gains achieved through PBF did not hamper healthcare service quality as perceived by patients. This is a key finding as service quality under pay-for-performance schemes is a major concern in the literature (Greene and Nash 2009, Peterson et al. 2006). Second, PBF can influence non-clinical dimensions of satisfaction if healthcare providers find an incentive to do so, that is to say, if the dimension is somehow compatible with the existing incentives. For instance, with PBF, the proportion of very satisfied adults increases by 2% for time spent with provider and by 4% for cleanliness of the facility, whereas those dimensions are not influenced by PBF for pregnant women and children. This may reveal that contrary to pregnant women who primarily pay attention to clinical services as they have no alternative but to visit the health facility, adults that are not satisfied with non-clinical services could have chosen self-medication and thus not visited the facility. As a consequence, healthcare providers have an incentive to satisfy adults with

clinical but also non-clinical dimensions so that they visit the facility again and advise other people to do so, which will have a positive effect of providers' earnings.

Interestingly, PBF has no effect on waiting time except for pregnant women: pregnant women are 7% more likely to be satisfied or very satisfied with waiting times in PBF facilities. This suggests that healthcare providers have adopted a coping strategy to raise satisfaction among patients that represent the largest potential financial gain. If pregnant women are very pleased, they may visit the facility again for prenatal care (rewarded service) and institutional delivery (the service with the largest financial reward). This contradicts evidence from the DRC where PBF had a negative (but not significant) effect on waiting time (Soeters et al. 2011). In the case of adults and children, dissatisfaction with waiting time can reflect the lack of human resources, space and equipment, but also poor responsiveness of healthcare providers which do not have an incentive to reduce waiting times.

Satisfaction with clinical services is greater among insured patients (+7% for adults and +5% for children). Prescribing laboratory tests also influences a pregnant woman's satisfaction as she may feel that the provider is taking good care of her. Interestingly, individual characteristics do not influence patients' satisfaction with clinical services, but only satisfaction with non-clinical services. This study finds that women, older patients and less educated patients tend to be more satisfied with non-clinical services in Rwanda, which is in accordance with published evidence on the determinants of patients' satisfaction (Hall and Dornan 1990, Crow et al. 2002, Sitzia and Wood 1997, Hekkert et al. 2009). The results also confirm evidence on satisfaction according to the status of facilities (public or private) in LIC (Berendes et al. 2011) as differences between public and faith-based facilities were found only for non-clinical services.

3.5.2. PBF AND HEALTH WORKFORCE PERFORMANCE

The case of Rwanda provides a unique opportunity to comprehensively assess the impact of PBF on health workforce performance (World Health Organization 2006). The positive effect of PBF on health workforce competences was reported by Basinga et al. (2010). Chapter 2 shows that PBF improves the availability of

healthcare providers by cutting absenteeism by 6% to 9% and that PBF can result in improved productivity by placing a higher workload on staff and cutting absenteeism. This chapter shows that PBF also improves health workforce responsiveness for clinical services. This entails satisfaction with explanation, staff attitude, privacy, cost of service and drugs and overall satisfaction. PBF can also improve some non-clinical dimensions of responsiveness that depend on healthcare providers and for which they can perceive an indirect incentive to improve patients' satisfaction. Results also suggest that healthcare providers tend to satisfy patients associated with the greatest reward (pregnant women in the case of Rwanda) but not at the expense of other patients. Further, in none of the cases was PBF negatively associated with satisfaction, showing that efficiency gains are not achieved at the expense of service quality or patient satisfaction.

In sum, PBF can improve all dimensions of health workforce performance. This stands for a major finding as this chapter is the first to show that performance gains resulting from incentives to suppliers are not achieved at the expense of patients' experience with healthcare. This is even more remarkable in the case of Rwanda as the PBF scheme did not include any assessment of patients' satisfaction. This suggests that improvements in other dimensions of health workforce performance mechanically resulted in improvements in the fourth dimension; all dimensions are intertwined.

3.5.3. LIC SPECIFICITIES

Contrary to HIC, the assessment of patients' satisfaction is not systematic in LIC and only limited evidence exists. Further, LIC traditional health systems are not well organized to internalize patient satisfaction. Until recently, performance-based financing schemes did not include a measure of satisfaction. As satisfaction with health services determines future utilization, attention paid to patients' satisfaction is however critical to raise the overall utilization of basic health services in LIC.

While HIC intend to limit the number of contacts between patients and the healthcare system, some basic maternal and child health services remain underutilized in LIC, particularly by the most vulnerable. Low utilization is a major impediment to patients becoming a countervailing force because the most

unsatisfied patients rarely or never use the services. Results from the robustness check suggest that PBF improves satisfaction with clinical services, only from a certain threshold and up to a certain level. For child curative care, where the utilization of services does not exceed one third of cases, PBF could make a difference, but only in districts where utilization is higher. For prenatal care services which are more commonly used, PBF can influence satisfaction, but only in districts with lower utilization. Contrary to high income countries where patients represent a countervailing force and can influence healthcare providers' attitudes, patients from LIC are not empowered to oppose to healthcare providers.

3.5.4. POLICY RECOMMENDATIONS

The literature review has suggested that healthcare managers and decision makers in LIC should consider service quality and patients' satisfaction as important strategic objectives. Patients' satisfaction with healthcare services is particularly critical in LIC where the population lacks trust in health services and where utilization of basic health services is low. However, the case study on Rwanda did not enable to measure the impact of integrating satisfaction measures in the incentive mechanism.

The potential of performance-based financing in addressing structural problems of health systems should be acknowledged. As argued by Meessen, Soucat, and Sekabaraga (2011), PBF can be a reform catalyst. The Rwanda case shows that, although PBF focuses on suppliers of healthcare services and on the process of care, it can improve patients' experience with healthcare services and improve their satisfaction with clinical and some non-clinical services. This should further encourage policymakers to explore synergies between PBF and other strategies aimed at improving fuller utilization and higher quality of health services.

3.6. CONCLUSION

This study provides evidence on patients' satisfaction with primary healthcare services in LIC. It contributes in filling a knowledge gap by looking at an unexplored aspect of performance-based financing, taking a patient's perspective to see how PBF affects healthcare services and healthcare workers' responsiveness. It thus

complements the body of evidence on the impact of PBF on health workforce performance measured in terms of competence, availability and productivity.

This chapter supports the hypothesis that PBF succeeds in improving all health patients' satisfaction levels with health services, in particular for clinical related services. Improvements in staff availability, productivity and competences can result in patients being more satisfied with both clinical and non-clinical services provided. In other words, efficiency gains are not achieved at the expense of a perceived quality of care. In some instances, PBF can also improve satisfaction with non-clinical dimensions if they can generate future financial gains.

The positive effect of PBF on patient satisfaction confirms that PBF is more than a provider payment mechanism, because it can contribute in strengthening health systems. As satisfaction with services can improve healthcare utilization and health outcomes, LIC should build on the experiences of HIC to respond better to the voice of the patients and include their feedback in quality assessments. As PBF is increasingly implemented in African countries, its reform catalyst potential should further be explored.

PART 3: EQUITY

4. CAN PERFORMANCE-BASED FINANCING HELP IN REACHING THE POOR WITH MATERNAL AND CHILD HEALTH SERVICES? THE EXPERIENCE OF RURAL RWANDA[11]

ABSTRACT

More than twenty countries in Africa are scaling up performance-based financing (PBF) but its impact on equity in access to health services remains to be documented. This chapter draws on evidence from Rwanda to examine the capacity of PBF to ensure equal access to key health interventions, especially in rural areas where most of the poor live. Specifically, it focuses on maternal and child health services, distinguishing two wealth groups and uses data from a rigorous impact evaluation.

The difference in difference technique is used and different model specifications are tested: a control for unobserved heterogeneity and common random error using a linear probability model, seemingly unrelated regression equations as well as clustering and fixed effects.

Results suggest that in Rwanda from 2006 to 2008 PBF improved efficiency rather than equity for most health services. We find that PBF achieved efficiency gains by improving access to health services for those easier to reach; generally, the relatively more affluent and was less effective in reaching the poorest. Results illustrate the advantages of rigorous randomized impact evaluation data, as results published earlier using a nationally representative survey (DHS) were not able to capture the potential negative effect on equity of the PBF scheme in Rwanda.

This chapter advocates building mechanisms targeting the vulnerable groups in PBF strategies. It also highlights the need to understand the impact of PBF together with

[11] This chapter is based on a paper accepted for publication in the International Journal of Health Planning and Management.

the specific development of health insurance coverage and the overall organization of the health system.

4.1. INTRODUCTION

One year before the deadline of the Millennium Development Goals (MDGs), most countries were not running to schedule. Goal 4, aiming to cut mortality among children under 5 by two-thirds between 1990 and 2015 is unlikely to be met in Africa, despite substantial progress. Africa still has the world's highest under 5 mortality rate, accounting for 1 in 9 child deaths (United Nations Economic Commission for Africa et al. 2014). Over the last decade, an unprecedented search for strategies capable to accelerate progress toward these ambitious targets has taken place.

There is growing recognition that as aggregate targets, MDGs may hide inequalities within countries. In an analysis conducted over 54 countries, Barros et al. (2012) found inequalities for most services. Skilled birth attendant coverage was found to be the least equitable intervention, followed by the indicator 'four or more prenatal care visits'. The poorest children are also 2 to 3 times more likely to die or to be malnourished than better off children (UN System Task Team on the Post-2015 UN Development Agenda 2012).

This recognition invites researchers to assess the performance in terms of equity of strategies promoted in low income countries (LIC). Performance-based financing (PBF) is one of these strategies. As a reform proposition (Meessen, Soucat, and Sekabaraga 2011), it aims to address systemic shortcomings of health systems in LIC. It focuses on the supply side and aims at improving the performance of the service delivery system by encouraging effort and compliance with recommended clinical practice, leading to improved access to health services (Soeters, Habineza, and Peerenboom 2006, Meessen, Kashala, and Musango 2007, Eichler 2006, Palmer et al. 2006).

While there is growing evidence of the effectiveness of PBF, there is less evidence on the distribution of its effects. Most evidence is focused on the impact of the strategy in terms of the use of services and quality of care, but less is known on its cost-

effectiveness, equity impact and potential adverse effects (Witter et al. 2012, Witter et al. 2013). It is however likely that the strategy can have a negative impact on equity in access to services as it can encourage health workers to cherry-pick patients that make it easier to reach targets (Ireland, Paul, and Dujardin 2011).

Rwanda is one of the few countries in the world that is on track to reach the health related MDGs (Binagwaho et al. 2014) and the poor have not been left aside from progress achieved. Strategies aimed to improve financial access for the poor have resulted in increased utilization of health services and lower out-of-pocket payments. The country has experienced a rapid scale-up of health insurance schemes from 7% of the target population in 2003 to 85% in 2008 (Rwanda Ministry of Health 2009) thus improving equity in access to basic health services (Saksena et al. 2010). As a result, health spending and catastrophic expenditures have declined (Sekabaraga, Diop, and Soucat 2011). Rwanda is also one of the few countries in the world that has implemented PBF at the national scale.

Evidence from developed countries on the impact of performance-based financing (or pay-for-performance – P4P) on access to care for disadvantaged groups is mixed. The design of the schemes and context in which they are implemented also vary. Some studies show that P4P may exacerbate disparities in healthcare (Greene and Nash 2009) while others find no impact on equity in access to care (Crawley et al. 2009). Setting up a targeted mechanism for vulnerable groups is a critical element to improve access to care for these groups (Peterson et al. 2006).

Evidence from developing countries is more limited (Lagarde and Palmer 2006) and the diversity of schemes and contexts even more flagrant. In a review of 14 PBF experiences, the impact on equity was measured in only three cases (Loevinsohn 2008). Still, available evidence insists on the importance of targeting the poor as the better-off could be the main beneficiaries of an increase in utilization (Gwatkin, Bhuiya, and Victora 2004). Equity in access can improve only when the poor are explicitly targeted by a PBF scheme, such as in urban Bangladesh and Cambodia (Loevinsohn 2008). In Rwanda, using Demographic and Health Survey (DHS) data, Priedeman et al. (2013) show that PBF was neither a pro-poor nor a pro-rich strategy. These latter results are further debated in the discussion section. In

neighboring Burundi, PBF was found to be pro-rich in the case of institutional deliveries, but pro-poor in the case of immunization (Bonfrer, Van de Poel, and Van Doorslaer 2014).

In the absence of clear and robust evidence, this chapter first seeks to examine the distributional impact of PBF on access to basic health services using data from a randomized control trial evaluating the impact of PBF in Rwanda. The analysis covers a large range of maternal and child health interventions. The hypothesis is that the population uniformly benefits from an increase in the volume of care because the implementation of PBF followed a situation where no mechanism existed to target the poor.

In the following sections, background information is provided on the utilization of basic health services in Rwanda, followed by details on methods, results and a discussion providing policy implications.

4.2. BACKGROUND

4.2.1. OVERALL ACCESS TO BASIC HEALTH SERVICES IN RWANDA

In Rwanda, increases in the health workforce and their skills, performance-based financing, health insurance, and better leadership and governance led to impressive results in service use. Births attended by skilled personal rose by 77% between 2006 and 2010 compared with 26% between 2000 and 2005. Similarly, contraceptive prevalence rose by 351% against 150% (Bucagu et al. 2012).

Rapid increases in use of essential maternal and child health services resulted in significant progress in health outcomes. The infant and under-five mortality rates fell drastically from 121 per 1,000 to 50 per 1,000 and from 217 per 1,000 to 76 per 1,000 respectively between 2000 and 2010. The maternal mortality ratio also decreased, although not significantly from 1,071 maternal deaths per 100,000 live births in 2000 to 750 in 2005. The use of modern contraceptive rose from 10.3% in 2005 to 45.1% in 2010 and the percentage of children taken to a healthcare provider in the event of diarrhea rose from 14.1% to 37.2% over the same period (National Institute of Statistics of Rwanda 2006, 2009, 2001) (Table 4-1).

4.2.2. *EQUITY IN ACCESS TO BASIC HEALTH SERVICES IN RWANDA*

It is significant to note that the poor experienced significant improvements in access to basic services. Although the rich still used more services than the poorest in 2010, the gap between the rich and the poor narrowed in many of the health services (Table 4-1). Using the 2005 and 2010 DHS data, Pierce, Heaton, and Hoffmann (2014) show that the greatest increases in health center deliveries occurred among less educated, less wealthy and rural Rwandan women. Strategies aimed at improving financial access for the poor resulted in an increased utilization of health services and lower out-of-pocket payments. Health spending and catastrophic expenditures have declined (Sekabaraga, Diop, and Soucat 2011). The poorest also benefited from significant improvements in health outcomes. In 2005, the under-five mortality rate for the poorest quintile (211 per 1,000) was almost twice as high as the level for the richest quintile (122 per 1,000) but the gap between the two groups was cut by half between 2005 and 2010. The same pattern is true for infant mortality rate. Finally, the poorest experienced significant improvements in fertility, but the gap between the poorest and the richest widened. The gap remained the same for stunting but little improvement was achieved (Table 4-1).

Table 4-1: Use of basic health services and health outcomes for richest and poorest quintile (2005-2010)

	2005				2010			
	Q1	**Q5**	**Tot.**	**gap**	**Q1**	**Q5**	**Tot.**	**gap**
Fertility	6.1	5	6.1	1.1	5.4	3.4	4.6	2
IMR (/1000)	114	73	86	41	70	50	50	20
U5MR (/1000)	211	122	152	89	119	75	76	44
Use of modern FP (%)	6	22	10	16	38	50	45	12
ANC by trained personnel (%)	92	96	94	4	97	99	98	2
Assisted delivery (%)	27	66	39	39	61	85	69	24
Children < 5 taken to health provider for diarrhea (%)	13	18	14	5	26	50	37	24
Children under 5 stunted (%)	55	30	45	25	54	26	44	28

Source: Author (2015): using DHS 2005 and 2010 data.
Note: FP=Family Planning; U5MR= Under-five mortality rate; IMR= Infant mortality rate; Q1= poorest quintile; Q5= richest quintile

4.3. METHODS

4.3.1. DATA

4.3.1.1. Household surveys

The database contains baseline and follow-up rounds of household data collected in 2006 and 2008 for a total of 166 primary healthcare facilities and 2,145 households in the catchment areas of these facilities. Thirteen zones, of about 15 to 20 households were initially sampled for each health facility. Households with at least one child below the age of six were selected until the fulfillment of the sample (Basinga et al. 2011). The same households were interviewed at baseline and follow-up thus allowing panel data analysis. Household surveys provide basic socio-demographic characteristics of a population, data and health status and utilization rates of health services.

The analyses are performed using three different groups of population: a group of married women aged 15-49 for the analyses on family planning, a group of women who were pregnant in the two years preceding the survey for the analyses of maternal health services; and, a group of children up to 5 years of age for analyses on child health services. Dependent variables are services that were incentivized as part of the PBF strategy: institutional deliveries, use of modern family planning, 'four or more prenatal care visits', 'prenatal care during the first quarter' and 'preventive and curative child care in the past four weeks' and for which baseline data showed lower utilization by the poorest.

Individual, household and health facility characteristics were added in the specification as explanatory variables: family members, children under six in each household, the distance between the household and the facility, whether the individual had health insurance and the status of the health facility (public or faith-based). Specific controls for the analyses on women included years of schooling, marital status, partner living in the household, prior pregnancies and age. Specific controls for the children's analyses included whether the parents lived in the household, whether the mother had primary education, health insurance, the children's age and sex. The decision to include those control variables was guided by theory and published literature using the same dataset (Basinga et al. 2011).

4.3.1.2. Wealth groups

Since data on income or consumption was not available, a wealth index was estimated to proxy living standards using a principal component analysis. As the same households were interviewed at baseline and follow-up, wealth groups were created according to the baseline wealth index and households' wealth status was categorized according to the baseline in both rounds. The two groups called, the upper and lower groups, thus represent households below and above the median wealth at baseline.

The asset score includes the following items: complete sofa set; refrigerator; deep freezer; radio; music system; television; satellite dish; video deck; DVD player; computer and accessories; landline phone; mobile phone; washing machine; mosquito net; ventilator; air conditioner; sawing machine; bed; wardrobe; metallic library; table; chair; car; lorry/trailer; motorcycle; boat; and, bicycle. Table 4-2 reports the assets possessed by households in the lower and upper wealth groups in both waves. It reveals three important findings: first, as discussed later in the chapter, households in the upper group are not rich households. The sample was drawn from rural Rwanda where the population is mostly poor. Thus, the upper group households do not possess assets that characterize wealth such as a car, a refrigerator or air conditioning. Second, the categorization of the population in the two wealth groups succeeded in constituting groups that differ in the assets they possess. Households from the upper group are more likely to possess a complete sofa set, a radio, music system, mobile phone, mosquito net, bed, wardrobe, table and bicycle. Indeed, assets of the lowest group households are limited to radio (26% in 2008), mosquito net (63%), bed (43%), table (40%) and chair (81%). Third, overall wealth status of households improved over the two year period as the number of assets possessed by households increased overtime as well as the proportion of households possessing a given asset. For instance, 18% of households possessed a mobile phone in 2008 against 2% in 2006.

Table 4-2: Households assets according to wealth group and wave

	Baseline (2006)			Follow-up (2008)		
	Lower group	**Upper Group**	**Mean**	**Lower group**	**Upper Group**	**Mean**
Complete sofa set	0.0%	7.9%	**2.5%**	0.0%	15.3%	**9.8%**
Refrigerator	0.0%	0.4%	**0.1%**	0.0%	1.3%	**0.8%**
Deep freezer	0.0%	1.6%	**0.5%**	0.0%	1.7%	**1.1%**
Radio	36.0%	80.4%	**50.0 %**	26.5%	88.7%	**66.2%**
Music system	0.0%	15.3%	**4.8%**	0.0%	8.1%	**5.2%**
Television	0.0%	0.7%	**0.2%**	0.0%	2.6%	**1.7%**
Satellite dish	0.0%	0.4%	**0.1%**	0.0%	1.6%	**1.0%**
Video deck, DVD	0.0%	0.3%	**0.1%**	0.0%	2.2%	**1.4%**
Computer	0.0%	0.1%	**0.0%**	0.0%	1.6%	**1.0%**
Landline phone	0.0%	0.3%	**0.1%**	0.0%	1.7%	**1.1%**
Mobile phone	0.0%	7.3%	**2.3%**	0.0%	28.9%	**18.5%**
Satellite dish	0.0%	0.3%	**0.1%**	0.0%	1.5%	**0.9%**
Washing machine	0.0%	0.1%	**0.0%**	0.0%	1.5%	**1.0%**
Mosquito nets	9.7%	61.1%	**25.9 %**	63.6%	94.5%	**83.3%**
Ventilator	0.0%	0.3%	**0.1%**	0.0%	1.2%	**0.8%**
Air conditioner	0.0%	0.4%	**0.1%**	0.0%	1.2%	**0.8%**
Sawing machine	0.0%	3.3%	**1.0%**	0.0%	4.4%	**2.8%**
Bed	50.5%	82.0%	**60.4 %**	44.3%	86.3%	**71.2%**
Wardrobe	0.0%	15.6%	**4.9%**	0.0%	11.5%	**7.3%**
Metallic library	0.0%	3.3%	**1.0%**	0.0%	4.0%	**2.6%**
Table	53.5%	83.2%	**62.9 %**	40.1%	83.0%	**67.5%**
Chair	84.4%	84.9%	**84.5 %**	81.6%	91.1%	**87.7%**
Car	0.0%	1.9%	**0.6%**	0.0%	2.1%	**1.4%**
Lorry / trailer	0.0%	0.1%	**0.0%**	0.0%	1.5%	**0.9%**
Moto cycle	0.0%	1.5%	**0.5%**	0.0%	2.4%	**1.5%**
Boat	0.0%	0.9%	**0.3%**	0.0%	2.8%	**1.8%**
Bicycle	1.2%	51.6%	**17.2 %**	0.4%	34.1%	**22.0%**

Source: Author (2015)

4.3.2. STATISTICAL METHODS

4.3.2.1. Clustered t-tests

Descriptive analyses including t-tests were performed for all dependent and independent variables in the models to compare the means in the treatment and control groups at baseline. This enables to check whether the randomization worked as expected, and if treatment and control groups were balanced before implementing PBF in treatment districts. As the data is randomized in clusters, t-tests were performed using clustering at the district-by-year level. The importance of testing the equality of samples lies in that randomization does not guarantee that control and treatment groups are comparable, and hence controls need to be added in the regression.

Clustered t-tests for the variables of interest at baseline and follow-up by wealth groups were also run to assess difference in access to basic services according to wealth status in both years. This enables us to check the validity of the data used in this chapter by comparing results to those of the demographic and health surveys.

4.3.2.2. Regression analyses

As in chapter 2, a difference-in-difference model was used because the study lost its randomized design and shifted to a quasi-experimental status thus making the case for using difference-in-difference. Although the dependent variables are dichotomous, a Linear Probability Model was preferred to logistic regression as interactions in non-linear models are not consistently interpretable (Ai and Norton 2003). The regression specification of the difference-in-difference model using LPM is:

$$Y_{it} = \alpha + DD.T_i t + \beta T_i + \delta t_i + \mathrm{X}_{it} + \varepsilon_{it}$$

where Y is the outcome of interest, T is the treatment variable (0= control; 1= treatment), t is the time dummy (0 = 2006; 1=2008), X is a list of time varying individual characteristics and Ɛ is the error term. The coefficient of the interaction of T and t (DD) gives the estimate of the impact of treatment on outcome Y.

A series of robustness checks were run to assess the robustness of regression coefficients. As there are reasons to believe that the probability of using one health service is linked to the probability of using another, Seemingly Unrelated Regression Equations (SURE) were completed. SURE provide the advantage of gaining efficiency in estimation by combining information on different equations and by imposing or testing restrictions that involve parameters in different equations (Moon and Perron 2006, Zellner 1962). In practice, SURE enable us to run several regression equations simultaneously as error terms across the equations can be correlated. The regression specification of the SURE are:

$$Y1_{it} = \alpha 1 + DD1.T_i t + \beta 1 T_i + \delta 1 t_i + \mathrm{X}1_{it} + \varepsilon 1_{it}$$

…

$$Yn_{it} = \alpha n + DDn.T_i t + \beta n T_i + \delta n t_i + \mathrm{X}n_{it} + \varepsilon n_{it}$$

where Y = 1,… ,n are the outcomes of interest, T is the treatment variable, t is the time dummy, X is a list of time varying individual characteristics and the coefficient of the interaction of T and t (DD) gives the estimate of the impact of treatment on outcome Y.

A second set of robustness checks were run using fixed-effects and clustering. Fixed effects control the effect of unobservable characteristics that can influence the dependent variable (Bertrand, Duflo, and Mullainathan 2004, Khandker, Koolwal, and Samad 2010). They mitigate the risk of omitted variable bias related to unobservable variables that do not change over time or across facilities. As performed in a previous analysis using the same data, facilities and time fixed effects were used to control for time and time-invariant locations (Basinga et al. 2011). Further, clustered standard errors were computed. Clustering allows the error terms to be correlated in the same cluster. As randomization was conducted at the district level and facilities in the same district are more likely to share common observable and unobservable characteristics, robust standard errors clustered at the district level were computed. As a potential unobservable characteristic is more likely to be auto-correlated within a cluster after implementing PBF, clustering is done at the interaction of the district with post intervention level (38 clusters)

(Basinga 2009). The regression specification of the difference-in-difference model using clustering and fixed effects is:

$$Y_{ijt} = \alpha + \lambda_j + DD.T_{ij}t + \beta T_i + \delta t_i + X_{ijt} + \varepsilon_{ijt}$$

where T is the treatment variable, t is the time dummy, λ_j are facility fixed effects, X is a list of time varying individual characteristics and the coefficient of the interaction of T and t (DD) gives an estimate of the impact of treatment on outcome Y_{ijt} for individual i living in the catchment area of facility j in year t.

4.3.3. EMPIRICAL STRATEGY

All multivariate statistical analyses were performed on three groups: total group, lower group and upper group, to see whether there is a difference in the impact of PBF according to wealth status. Four different specifications were used successively. Specification 1 specifies a linear relationship between the dependent variable and the interaction between the treatment variable and the year variable without any control. Specification 2 adds a selection of explanatory variables to Specification 1. Specification 3 adds an interaction between PBF and insurance to describe the simultaneous influence of the two variables rather than the additive influence. Finally, Specification 4 adds an interaction between PBF and the asset index to provide a different measurement of the relationship between wealth and PBF.

Only results of Specification 3, which provided the best estimates, are presented in this chapter while other results are reported in the appendixes. The analyses revealed the importance of controls in the regression (and thus the weakness of Specification 1) and the importance of the interaction between PBF and health insurance for the interpretation of results (thus advocating against using Specification 2). As the interaction with the wealth index was not significant, Specification 4 was not retained.

4.3.4. LIMITATIONS

This study has limitations, although it is the first to provide rigorous evidence on the impact of PBF on equity for family planning, maternal health and child health services. First, the sample was not balanced at baseline for modern family planning methods for the richer group. However, as use was greater in the control group,

results presented here are indeed underestimating the impact of PBF. Second, the sample is not representative of the total population of Rwanda. The sample was designed to test the impact of PBF in a randomized evaluation and included only the districts that had not piloted PBF in the past. These districts excluded the capital city Kigali (17% of the population) and the second main city of Butare (9%). The sample studied here represents a more rural and less wealthy population than the overall population of Rwanda. Consequently our differentiation between lower and upper groups in this chapter could be better characterized as a difference between 'poor' and 'near poor'. Hence one can acknowledge that the first phase of the PBF implementation was successful in reaching the rural 'near poor' although it did not have impact in reaching the 'poor'. Third, as the observation period of the treatment was over 23 months only, one cannot observe the long term effect of performance-based financing on the use of services in general, and on equity in access in particular, although this effect may be different from the one observed in the short term.

4.4. RESULTS

4.4.1. BALANCE CHECK

The evaluation design achieved balance at baseline between the treatment and the control groups in the lower group, in the upper group and in the total sample (Appendix 3, 4 & Appendix 5). There are only significant differences for poor women who completed four or more prenatal care visits (with a larger utilization rate in the treatment group) and current use of family planning in the richest group (with a larger utilization rate in the control group).

4.4.2. DESCRIPTIVE ANALYSIS

The descriptive analysis of the impact evaluation data on utilization of basic health services confirms the trends highlighted in DHS (National Institute of Statistics of Rwanda 2006, 2009): between 2006 and 2008, utilization for women and children rose. Family planning intake rose by 23 percentage points to reach 34% in 2008 and assisted deliveries rose by 25 percentage points to reach 52% in 2008. Use of prenatal care services during the first trimester of pregnancy improved from 10% to 25% while the coverage of four or more prenatal care visits rose from 15% to 28%.

Among the services under study, only preventive care at health centers did not experience any change (Table 4-3).

Table 4-3: Trends in utilization of basic health services (2006-2008)

	2006			2008			Abs. change
	N	%	S.D.	N	%	S.D.	
Family planning and maternal health services							
Family Planning	1592	**0.11**	0.01	1680	**0.34**	0.01	0.23***
Birth at facility	1089	**0.36**	0.02	1019	**0.53**	0.02	0.17***
Assisted deliveries	1271	**0.27**	0.02	1003	**0.52**	0.02	0.25***
4+ prenatal visits	1223	**0.15**	0.02	1000	**0.28**	0.03	0.13**
Prenatal care during 1st quarter	1227	**0.10**	0.02	996	**0.25**	0.03	0.15***
Child health services							
Curative care	1388	**0.23**	0.02	1039	**0.32**	0.02	0.09**
Preventive care	3150	**0.12**	0.02	2428	**0.13**	0.01	0.01
Use of bed nets	3129	**0.18**	0.03	2372	**0.75**	0.02	0.57***

Note: Cluster-adjusted T-tests for differences between 2006 and 2008, *P<0.05, **P<0.01, ***P<0.001.

A further descriptive analysis on utilization of healthcare services shows a mixed picture on equity. Undisputable progress was achieved as the use of services rose significantly among the lower group between 2006 and 2008: family planning intake rose from 9% to 28% and assisted deliveries from 25% to 48% for the poorest in the sample. Prenatal care services are equally used by lower and upper group women in both years showing that recent improvements in access to care are equitable. However, significant levels of inequity remain for family planning and use of Insecticide-Treated Nets (ITN) with inequalities observed in both years, although the gap between the two wealth groups is narrowing. Access to care for children in the event of illness also improved overtime for the poor, but inequalities remain in both years and access is low as fewer than one third of children visited a health center in the event of an illness (Table 4-4).

Table 4-4: Equity in maternal and child health services in 2006 and 2008

		Total Sample		Lower group		Upper group		Absolute change
	Year	Obs	Mean	Obs	Mean	Obs	Mean	Lower-upper
Family planning and maternal health services								
Family	2006	1592	11%	1049	9%	543	15%	6%**
Planning	2008	1680	34%	657	28%	1023	37%	9%***
Assisted	2006	1271	27%	833	25%	438	31%	6%
deliveries	2008	1003	52%	398	48%	605	54%	6%

		Total Sample		Lower group		Upper group		Absolute change
	Year	**Obs**	**Mean**	**Obs**	**Mean**	**Obs**	**Mean**	**Lower-upper**
4+ prenatal visits	2006	1223	15%	791	14%	432	16%	2%
	2008	1000	28%	392	27%	608	28%	1%
Prenatal care during 1st quarter	2006	1227	10%	794	11%	433	10%	1%
	2008	996	25%	390	25%	606	25%	0%
Child health services								
Curative care	2006	1388	23%	934	21%	454	28%	7%*
	2008	1039	32%	338	28%	701	35%	7%*
Preventive care	2006	3150	12%	2048	12%	1102	11%	1%
	2008	2428	13%	767	13%	1661	13%	0%
Use of ITN	2006	3129	18%	2033	7%	1096	39%	32%***
	2008	2372	75%	748	59%	1624	82%	23%***

Source: Author (2015)
Note: T-tests for differences between lower and upper groups, *P<0.05, **P<0.01, ***P<0.001.

4.4.3. REGRESSION ANALYSES

4.4.3.1. Difference in difference estimates

Maternal health

Estimates from OLS regression analyses, that is, assuming a linear probability for three groups (upper, lower and total population) are first reported (Table 4-5). Appendix 6 to Appendix 8 report the results from the four Specifications.

Consistently with previous work (Basinga et al. 2011), results suggest that PBF has an impact on increasing institutional deliveries, but not on prenatal care services. However, we find a positive impact on institutional deliveries for the upper group only. The probability of an upper group woman delivering in a health facility increased by 21% (99% confidence level) in the treatment group compared to the control group. However, PBF alone has no impact on the probability of a lower group woman delivering in a facility. Interestingly though, the coefficient on the interaction between PBF and health insurance suggests that when a poor woman has health insurance and lives in the catchment area of a PBF facility, she has a 15% higher chance of delivering in a health facility (99% confidence level). In sum, for institutional deliveries, PBF has favored those who did not have a financial barrier to access the service, i.e. the upper group women and those from the lower group

who have health insurance. Hence in Rwanda, the impact of PBF needs to be understood together with the specific development of health insurance coverage.

Other significant controls include health insurance for deliveries (upper group only, with women having 18% more chance in delivering at a health facility if they have health insurance), female educational attainment, number of pregnancies (exhibiting a negative experience effect), distance to health facility (negatively correlated to the use of services) and status of the facility (with the probability of institutional delivery decreasing by 7% to 11% in public facilities). Finally, the coefficients on the wave dummy indicate a statistically significant increase in all maternal health services between 2006 and 2008 for all groups, as already highlighted in the bivariate analyses.

Table 4-5: Difference in difference estimates for maternal health services using LPM

	Institutional deliveries			4+ prenatal care visits			Prenatal care 1st trimester		
	Lower	**Upper**	**Total**	**Lower**	**Upper**	**Total**	**Lower**	**Upper**	**Total**
Treatment*post	-0.043	0.208***	0.063	-0.007	-0.004	-0.006	-0.014	0.038	0.007
	(-0.065)	(-0.065)	(-0.045)	(0.054)	(0.053)	(0.037)	(0.050)	(0.047)	(0.034)
Wave (2006=0, 2008=1)	0.175***	0.027	0.119***	0.115***	0.113***	0.117***	0.140***	0.145***	0.145***
	(-0.045)	(-0.046)	(-0.032)	(0.036)	(0.036)	(0.025)	(0.034)	(0.033)	(0.023)
PBF*insurance	0.135**	-0.082	0.027	0.032	-0.042	0.002	0.048	-0.078	-0.005
	(-0.061)	(-0.077)	(-0.047)	(0.047)	(0.061)	(0.036)	(0.042)	(0.058)	(0.033)
Age < 20 years (=1)	0.153*	-0.301*	0.052	-0.006	-0.135	-0.044	0.022	0.001	0.014
	(-0.091)	(-0.173)	(-0.086)	(0.066)	(0.118)	(0.058)	(0.066)	(0.142)	(0.061)
Age > 35 years (=1)	-0.044	-0.001	-0.029	-0.071**	-0.018	-0.047**	-0.024	-0.031	-0.025
	(-0.04)	(-0.043)	(-0.029)	(0.030)	(0.036)	(0.023)	(0.029)	(0.033)	(0.022)
Primary or more education (=1)	-0.054*	-0.019	-0.038*	0.000	0.012	0.005	0.014	0.073**	0.039**
	(-0.03)	(-0.036)	(-0.023)	(0.024)	(0.030)	(0.018)	(0.023)	(0.029)	(0.018)
Married/ union (=1)	0	-0.037	-0.007	0.004	0.022	0.008	-0.068	-0.040	-0.063*
	(-0.056)	(-0.076)	(-0.045)	(0.040)	(0.069)	(0.035)	(0.045)	(0.071)	(0.038)
Partner present (=1)	0.066	0.095	0.076	0.098**	0.036	0.066	-0.051	0.046	-0.008
	(-0.085)	(-0.089)	(-0.062)	(0.049)	(0.076)	(0.043)	(0.065)	(0.070)	(0.048)
Number pregnancies	-0.018**	-0.024**	-0.022***	0.014**	-0.000	0.008	0.003	-0.009	-0.001
	(-0.009)	(-0.01)	(-0.007)	(0.007)	(0.009)	(0.005)	(0.006)	(0.008)	(0.005)
Health insurance (=1)	-0.025	0.183***	0.075**	0.010	0.083**	0.040*	-0.019	0.045	0.009
	(-0.042)	(-0.054)	(-0.033)	(0.030)	(0.037)	(0.023)	(0.027)	(0.037)	(0.022)
Public facility (=1)	-0.072**	-0.111***	-0.089***	-0.008	-0.031	-0.020	0.022	0.008	0.016
	(-0.03)	(-0.033)	(-0.022)	(0.024)	(0.029)	(0.018)	(0.022)	(0.026)	(0.017)
Number of household members	-0.004	-0.005	-0.002	-0.009	-0.007	-0.008	0.008	0.001	0.003

	Institutional deliveries			4+ prenatal care visits			Prenatal care 1st trimester		
	Lower	**Upper**	**Total**	**Lower**	**Upper**	**Total**	**Lower**	**Upper**	**Total**
	(-0.01)	(-0.011)	(-0.008)	(0.008)	(0.009)	(0.006)	(0.008)	(0.008)	(0.006)
Distance HH-Facility (Km)	-0.027***	-0.023***	-0.024***	-0.011*	-0.010	-0.010**	-0.005	-0.011**	-0.008*
	(-0.008)	(-0.009)	(-0.006)	(0.007)	(0.006)	(0.004)	(0.006)	(0.005)	(0.004)
Observations	**1,092**	**987**	**2,079**	**1,164**	**1,031**	**2,195**	**1,165**	**1,030**	**2,195**

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Family planning

The estimated impact of PBF on the probability of a woman using a modern contraceptive method is not significant if one considers the total sample. However, regressions run by wealth groups provide interesting results: the coefficient associated with PBF reports a large and positive impact for the upper group (probability of 17% with a 99% confidence level) and a negative impact on the lower group (probability of -10% with a 90% confidence level) suggesting that the richest are the main beneficiaries of PBF at the expense of the poorest. However, the latter benefited from a large improvement in access to family planning between 2006 and 2008 (an increase of 19 percentage points). The interaction between PBF and health insurance is significant for the lower group women only, but it affects utilization negatively (probability of -10% with a 95% confidence level) showing a possible crowding-out effect for the poorest because of different strategies influencing family planning utilization. Another potential explanation is that lower group women enrolling in the insurance scheme do it while pregnant (as they expect more health expenditures) which is when they do not need family planning services. The increase in the use of family planning for the lower group is probably caused by other policies put into effect in Rwanda to increase contraception use (Table 4-6) (see Appendix 9 for results on the 4 specifications).

Table 4-6: Difference in difference estimates for use of modern family planning method using LPM

	Use of modern family planning		
	Lower	**Upper**	**Total**
Treatment*post	-0.101*	0.174***	0.054
	(0.055)	(0.057)	(0.039)
Wave=0 if 2006, Wave=1 if 2008	0.191***	0.064	0.126***
	(0.042)	(0.042)	(0.029)
interaction between PBF and insurance	-0.100**	-0.012	-0.068*
	(0.045)	(0.070)	(0.038)
Age	-0.000	-0.001	-0.001
	(0.002)	(0.004)	(0.002)
Has primary or more education (=1)	-0.007	0.013	-0.003
	(0.023)	(0.033)	(0.019)
Married/union (=1)	-0.016	0.383***	0.192**
	(0.150)	(0.032)	(0.089)
Partner present (=1)	-0.092	0.055	-0.035
	(0.069)	(0.092)	(0.056)
Number of pregnancies	-0.016**	-0.014	-0.015**
	(0.007)	(0.010)	(0.006)

	Use of modern family planning		
	Lower	**Upper**	**Total**
Health insurance (=1)	0.079**	0.016	0.067**
	(0.033)	(0.051)	(0.027)
Public facility (=1)	0.031	0.039	0.028
	(0.022)	(0.030)	(0.019)
Total number alive child	0.011	0.017	0.011
	(0.011)	(0.018)	(0.010)
Number of household members	0.010	0.011	0.015*
	(0.010)	(0.015)	(0.009)
Household-Facility distance (in Km)	0.006	0.008	0.007
	(0.007)	(0.007)	(0.005)
Delivery assisted by a skilled attendant	0.026	0.042	0.040**
	(0.025)	(0.030)	(0.020)
Observations	**1,059**	**966**	**2,025**

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Child health services

Results from regression analyses on curative care received by a child at a health center in the event of an illness show no impact of PBF for none of the groups under study. This may be related to the fact that the price paid by the PBF scheme for curative care was purposely low and most of the incentives came from health insurance that provided free access to those services. Indeed, the regression analysis shows a positive impact of health insurance for getting healthcare among all groups (12% and 25% increase respectively for the lower and upper groups). Besides, for the lower group, the coefficient on the interaction between insurance and PBF shows that if the child benefits from health insurance and lives in a treatment district, the child will be 8% more likely to get care at the health center in the event of an illness (90% confidence interval). Results for preventive care show a positive impact of PBF (probability of 0.09 for the total group with a 99% confidence interval) for all groups. Age is negatively correlated showing that the older children are, the less likely they will visit a health facility. Distance to the facility also negatively influences the decision to visit (Table 4-7) (see Appendix 10 and Appendix 11 for results of the four specifications).

Table 4-7: Difference in difference estimates for use of child care using LPM

	Curative care			Preventive care		
	Lower	**Upper**	**Total**	**Lower**	**Upper**	**Total**
Treatment* post	0.035	0.024	0.027	0.081***	0.098***	0.092***
	(-0.053)	(-0.06)	(-0.039)	(-0.028)	(-0.026)	(-0.019)
Wave=0 if 2006, Wave=1 if 2008	0.027	0.013	0.024	-0.013	-0.015	-0.018
	(-0.034)	(-0.04)	(-0.026)	(-0.019)	(-0.019)	(-0.013)
PBF*Insurance	0.078*	-0.093	0.006	0.033	-0.038	0.008
	(-0.046)	(-0.062)	(-0.037)	(-0.025)	(-0.031)	(-0.019)
Age	-0.023***	-0.009	-0.016***	-0.037***	-0.045***	-0.040***
	(-0.007)	(-0.009)	(-0.006)	(-0.004)	(-0.004)	(-0.003)
Sex	0.031	-0.065**	-0.013	0.015	0.008	0.012
	(-0.023)	(-0.028)	(-0.018)	(-0.012)	(-0.013)	(-0.009)
Mother has primary or more education (=1)	-0.019	0.039	0.007	-0.007	0.012	0.003
	(-0.023)	(-0.029)	(-0.018)	(-0.012)	(-0.013)	(-0.009)
Household-Facility distance (in Km)	-0.015**	-0.013*	-0.014***	-0.005	-0.007**	-0.006***
	(-0.006)	(-0.007)	(-0.005)	(-0.003)	(-0.003)	(-0.002)
Health insurance (=1)	0.117***	0.245***	0.179***	0.003	0.046**	0.015
	(-0.031)	(-0.039)	(-0.024)	(-0.018)	(-0.021)	(-0.014)
Number of household members	-0.019***	0.004	-0.008	-0.002	0.003	0
	(-0.007)	(-0.008)	(-0.005)	(-0.003)	(-0.004)	(-0.003)
Observations	**1,370**	**1,074**	**2,444**	**2,964**	**2,595**	**5,559**

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

4.4.4. ROBUSTNESS CHECKS

Maternal health

Results from OLS for maternal health suggested that PBF has a positive impact, but only on institutional deliveries, and for the richer group. As there are reasons to assume that the utilization of all maternal health services is linked and that error terms across the equations can be correlated, SURE were run simultaneously for institutional deliveries, four or more prenatal care visits, prenatal care visits during the first trimester and assisted deliveries (the latter not being incentivized by PBF)

to see whether the use of any of these services was reinforcing that of other services.

Results confirm previous estimates: PBF benefited upper group women as well as lower group women with health insurance in the case of institutional deliveries. Further, SURE enables us to find the positive impact of PBF on the total group, as showed by Basinga et al. (2011). The coefficient associated with prenatal care remains non-significant with SURE. Finally, clustering at the district and year level, as well as individual and facility fixed effects, also confirm results with slight modification in the size of coefficients: the effect of PBF on the upper group is lower, but the coefficient of the interaction between PBF and insurance for the lower group is greater. Significance disappears for the impact of PBF on the total group which is caused by the interaction term with insurance. Indeed, the same analysis ran on Specification 2 shows a statistically significant coefficient associated with PBF (probability of 0.073% with a 95% confidence interval) (Table 4-8).

Table 4-8: Robustness checks for maternal health

	Institutional deliveries			4+ prenatal care visits			Prenatal care 1st trimester		
	Lower	**Upper**	**Total**	**Lower**	**Upper**	**Total**	**Lower**	**Upper**	**Total**
LPM without specification									
Effect of PBF	-0.043	0.208***	0.063	-0.007	-0.004	-0.006	-0.014	0.038	0.007
	(-0.065)	(-0.065)	(-0.045)	(-0.054)	(-0.053)	(-0.037)	(-0.05)	(-0.047)	(-0.034)
Interaction PBF * insurance	0.135**	-0.082	0.027	0.032	-0.042	0.002	0.048	-0.078	-0.005
	(-0.061)	(-0.077)	(-0.047)	(-0.047)	(-0.061)	(-0.036)	(-0.042)	(-0.058)	(-0.033)
SURE estimates									
Effect of PBF	-0.033	0.241***	0.086*	-0.013	0.010	-0.001	-0.013	0.058	0.016
	(0.067)	(0.066)	(0.046)	(0.054)	(0.058)	(0.039)	(0.050)	(0.053)	(0.036)
Interaction PBF * insurance	0.115*	-0.090	0.009	0.033	-0.033	0.002	0.063	-0.057	0.008
	(0.065)	(0.082)	(0.050)	(0.052)	(0.072)	(0.042)	(0.049)	(0.066)	(0.039)
Clustering and Fixed-Effects									
Effect of PBF	-0.005	0.185***	0.054	-0.009	0.003	0.011	0.004	0.060	0.024
	(0.066)	(0.043)	(0.041)	(0.049)	(0.049)	(0.035)	(0.050)	(0.055)	(0.036)
Interaction PBF * insurance	0.164**	-0.021	0.064	0.045	-0.033	-0.001	0.036	-0.107*	-0.011
	(0.064)	(0.070)	(0.055)	(0.054)	(0.088)	(0.039)	(0.040)	(0.063)	(0.033)
Observations	**1,092**	**987**	**2,079**	**1,164**	**1,031**	**2,195**	**1,165**	**1,030**	**2,195**

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Family planning

Results for the use of modern contraceptives suggest that PBF had a positive impact on family planning for the upper group but a negative impact on the lower group. This was reinforced by a negative and significant coefficient on the interaction between insurance and PBF for the lower group.

As family planning intake may be linked to a woman's knowledge of services provided at a health facility and may be proposed to a woman who recently gave birth, SURE were run to capture potential correlations between assisted deliveries, institutional deliveries, four or more prenatal care visits and family planning. Results show that it only slightly affects the size of the coefficient, but not the interpretation of results. Similarly, running the model with clustering and fixed effects only slightly increases the size of coefficients. The impact of PBF on the upper group thus increases from 0.174 to 0.204 and the negative coefficient of the interaction between PBF and insurance changes from -0.100 to -0.119 (Table 4-9).

Table 4-9: Robustness checks for use of modern contraceptive

	Family planning		
	Lower	**Upper**	**Total**
LPM without specification			
Effect of PBF	-0.101*	0.174***	0.054
	(-0.055)	(-0.057)	(-0.039)
Interaction PBF * insurance	-0.100**	-0.012	-0.068*
	(-0.045)	(-0.07)	(-0.038)
SURE estimates			
Effect of PBF	-0.113**	0.188***	0.047
	(0.052)	(0.063)	(0.040)
Interaction PBF * insurance	-0.105**	0.024	-0.061
	(0.052)	(0.078)	(0.044)
Clustering and Fixed-Effects			
Effect of PBF	-0.087	0.204***	0.060
	(0.058)	(0.039)	(0.036)
Interaction PBF * insurance	-0.119**	0.015	-0.064
	(0.050)	(0.078)	(0.043)
Observations	**1,056**	**965**	**2,021**

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Child health services

The first estimates of the impact of PBF on the probability of a child getting curative care showed no impact. However, a positive impact was found for both wealth groups for preventive care.

SURE was conducted to account for other services that may influence a child's visit to a health center: curative care, preventive care, but also use of ITN as it can affect morbidity. SURE confirm the impact of PBF on preventive care with a larger effect. The probability of a child receiving preventive care rises from 0.08 to 0.1 in the lower group, from 0.1 to 0.16 in the upper group and from 0.09 to 0.13 in the total sample. SURE do not find any significance in the interaction between insurance and PBF. Clustering and fixed effects, on the contrary, provide a lower but still significant coefficient associated with the impact of PBF, in particular for the upper group (Table 4-10).

Table 4-10: Robustness checks for child health services

	Curative Care			**Preventive care**		
	Lower	**Upper**	**Total**	**Lower**	**Upper**	**Total**
LPM without specification						
Effect of PBF	0.035	0.024	0.027	0.081***	0.098***	0.092***
	(-0.053)	(-0.06)	(-0.039)	(-0.028)	(-0.026)	(-0.019)
Interaction PBF * insurance	0.078*	-0.093	0.006	0.033	-0.038	0.008
	(-0.046)	(-0.062)	(-0.037)	(-0.025)	(-0.031)	(-0.019)
SURE estimates						
Effect of PBF	0.037	0.029	0.031	0.102**	0.160***	0.126***
	(0.051)	(0.060)	(0.038)	(0.047)	(0.050)	(0.033)
Interaction PBF * insurance	0.075	-0.099	0.001	0.067	-0.071	0.013
	(0.048)	(0.071)	(0.040)	(0.044)	(0.060)	(0.035)
Clustering and Fixed-Effects						
Effect of PBF	0.012	-0.048	0.010	0.096***	0.089***	0.103***
	(0.055)	(0.057)	(0.036)	(0.031)	(0.029)	(0.024)
Interaction PBF * insurance	0.152***	-0.088	0.037	0.037	-0.011	-0.002
	(0.056)	(0.086)	(0.059)	(0.032)	(0.039)	(0.023)
Observations	**1,370**	**1,074**	**2,444**	**2,964**	**2,595**	**5,559**

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

4.5. DISCUSSION

This chapter measures and compares the impact of PBF on equity in access to healthcare in rural Rwanda, and specifically examines the effect of PBF on income sub-groups defined according to their wealth status (upper and lower groups). Factors associated with inequality in access to basic services are quantified to show the dynamic and fairness of performance-based financing in Rwanda and draw policy recommendations. Notably, findings confirm the positive trend in access to care in Rwanda, in particular for the poor. Still, they show remaining differences in access to child health services, family planning and maternal health services.

This chapter adds to current knowledge in at least two independent ways: first, it speaks to existing evidence on the impact of PBF on the overall use of health services in Rwanda (Basinga et al. 2011) by evaluating the effect of PBF on subgroups of the population. Second, this chapter highlights the advantages of the impact evaluation panel data over nationally representative cross sectional data by comparing results published earlier on PBF's impact on equity in Rwanda using DHS data (Priedeman et al. 2013).

4.5.1. IMPACT OF PBF ON USE OF HEALTH SERVICES

Results are consistent with previous studies conducted on Rwanda using nationally representative data or impact evaluation data (Basinga et al. 2011, Sekabaraga, Diop, and Soucat 2011). Findings show a positive impact of PBF on the probability of a woman delivering in a health facility and no impact on prenatal care, consistent with results published elsewhere for the population as a whole (Priedeman et al. 2013, Basinga et al. 2011). Our results suggest that the probability of a woman delivering in a health facility increases by 8.6 percentage points (SURE) compared to 8.1 (Basinga et al. 2011) and 10 (Priedeman et al. 2013). As in previous studies, no impact of financial incentives was found on prenatal care. As shown by Basinga et al. (2011), results highlight a positive impact on the probability of a child benefiting from preventive care.

4.5.2. *DISTRIBUTIONAL IMPACT OF PBF*

Other findings contradict previously published results as regard to the impact of PBF on equity in access to services. Priedeman et al. (2013) using DHS data found that PBF in Rwanda was neither a pro-rich nor pro-poor strategy for increasing use of services. In contrast, results reported here using panel data from the PBF impact evaluation suggest that PBF has a positive impact on the upper group. That is, the already known positive impact of PBF on the probability of a woman delivering in a health facility is driven by the richest. This is consistent with findings from Burundi, although the magnitude of change is greater in the case of Rwanda (Bonfrer, Van de Poel, and Van Doorslaer 2014). More specifically, we find that women from the upper group are 18% to 24% more likely to deliver in a health facility in the treatment group compared to those of the control group. In other words, the proportion of assisted deliveries in treatment facilities could reach up to 74% in 2008 for women of the upper group compared to 50% in control facilities. Women from the lower group with health insurance also experienced a positive increase in use due to PBF.

Contrary to Priedeman et al. (2013), we find a significant impact of PBF on the use of modern contraceptives: in the treatment group, women from the lower group are 10% to 11% less likely to use family planning (i.e. 21% use, compared to 32% among the poorest women in the control group). On the contrary, women from the upper group are 17% to 20% more likely to use modern contraceptives in the treatment group (i.e. 55% intake of modern contraceptives for the richest women of the treatment group, compared to 35% of those in the control group) (Table 4-11).

Table 4-11: Estimated differential effects of PBF by wealth on service use (specification 3)

	Lower group	Upper group
Family planning	-0113** (0.052) to -0.087 (0.058)	0.174*** (-0.058) to 0.204*** (0.039)
Birth at facility	-0.005 (0.066) to -0.043 (-0.065)	0.185*** (0.043) to 0.241*** (0.066)
4+ prenatal visits	-0.007 (-0.054) to -0.013 (0.054)	-0.004 (-0.053) to 0.010 (0.058)
Prenatal care 1st quarter	-0.013 (0.050) to 0.004 (0.050)	0.038 (-0.047) to 0.060 (0.055)
Curative care	0.012 (0.55) to 0.037 (0.051)	-0.048 (0.057) to 0.029 (0.060)
Preventive care	0.081*** (-0.028) to 0.102** (0.047)	0.089*** (0.029) to 0.160*** (0.050)

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Results thus support the hypothesis that, for most services, PBF favors efficiency at the expense of equity as the effect of PBF did not play equally on different income groups. PBF achieved efficiency gains by inciting healthcare providers to focus on the easier to reach, i.e. the less poor. Further, PBF was not effective in helping reach the poorest. This confirms evidence from the literature, using less rigorous techniques, that shows that PBF can be equitable only if it is targeting the poor (Loevinsohn 2008). This pattern in which health programs primarily benefit richer groups is typical and has been widely studied as an 'inverse care law' (Gwatkin 2002b, Hart 1971).

This chapter also brings new evidence on the impact of PBF on equity in access to basic health services for children. PBF alone has no impact on curative care for children but has a positive impact on the probability of getting preventive care for the upper and lower groups. One can thus assert that, of all services under study, PBF has the most equitable effect on preventive care at health centers. Children from the lower and upper group are respectively 10% and 16% more likely to benefit from preventive services in the treatment group compared to the control group. Further research is needed to better understand the synergies or competitions between different incentivized services as the impact found variations from one service to another.

4.5.3. INTERACTION WITH HEALTH INSURANCE

This chapter contributes in reducing the knowledge gap by providing evidence on the interaction of several strategies aiming at improving access to care (health insurance and PBF). As pointed out, different strategies were put into effect in Rwanda at the same time with the same purpose of raising the use of basic health services. The impact evaluation aimed to disentangle the impact of PBF. However, assessing synergies between the different initiatives is important to see whether they are mutually reinforcing or not.

Results suggest a mixed effect of the interaction of PBF and health insurance according to the services and the wealth group concerned. As health insurance removes the financial barrier to health services (demand side) and PBF improves

the supply of health services, one can expect that the interaction of interventions is positive. Results confirm the hypothesis for institutional deliveries and curative care for children among the lower group (for which the cost of services is a major barrier to care). This suggests that the potential negative impact of PBF on equity in access disappears when a strategy such as health insurance removes the main barrier.

The negative coefficient for the interaction of PBF and health insurance in the case of family planning for the poorest group probably reveals the existence of competing interventions aimed at increasing the intake of family planning service (free contraceptives, Imihigo) and the fact that insured women are primarily those that are not in need of family planning. Further research, using qualitative methods, is necessary to better understand this pattern in the particular context of Rwanda.

4.5.4. STRENGTHS OF THE IMPACT EVALUATION DATA OVER A CROSS-SECTIONAL NATIONALLY REPRESENTATIVE SURVEY

Using data from the impact evaluation of PBF in Rwanda, we were able to isolate the distributional impact of PBF. We came to different results than those found by Priedeman et al. (2013) with DHS data. The strengths of the impact evaluation data reside in the fact that it allows for better identification, as the same individuals were interviewed before and after; hence, unobserved heterogeneity was captured. Further, the selection of households was guided by the purpose of the evaluation (e.g. focus on households with young children).

Our results show the impact of limitations, highlighted by Priedeman et al. (2013), have on their estimates. They recognized that relying on DHS data, which is a nationally representative dataset, involved some constraints to the analysis: the exposure window was limited to 18 months (instead of 23); the survey designed resampled the 2005 clusters in 2007, and individuals were not re-interviewed; finally, no rural specific asset data was available to create an asset score, although the impact evaluation was conducted in rural areas.

4.5.5. POLICY IMPLICATIONS

The empirical results suggest that PBF can improve utilization of healthcare services, but that its impact varies according to the population and services

concerned. When utilization rates are low, such as for institutional deliveries and family planning, PBF can increase the demand for services. The results advocate a PBF model further tailored to target the most in need. One approach could be to introduce differential payment for PBF with higher levels of payments for poor and remote districts or identified poor groups. This would be feasible in Rwanda as poverty maps are developed in each sub-district in a participatory way (Niringiye and Ayebale 2012). Neighboring Burundi and the DRC have already put into effect such a differential approach (Witter et al. 2013).

Further, when utilization of basic services is greater among the richest, demand side mechanisms should complement PBF to ensure that the poorest benefit from the strategy. It is therefore important to better understand demand side barriers to set up adequate incentives for the target population. In Cambodia for instance, PBF schemes were supported by health equity funds that target the most in need to ensure that they are not excluded from the health system. These health equity funds have been successful in ensuring greater access to care for the poorest and greater community participation (Jacobs and Price 2006, Noirhomme et al. 2007, Bigdeli and Leslie Annear 2009, Hardeman et al. 2004). Conditional cash transfers, as seen in Mexico and Brazil, can also be introduced and were tested in Rwanda. The evidence on conditional cash transfers indeed shows that they are effective ways to cut inequalities in access and ensure greater use of health services for the poor (Victora et al. 2003, Lagarde, Haines, and Palmer 2009).

This chapter contributes to a call for more rigorous research. Using the same independent and control variables, with similar econometric techniques, results from the panel impact evaluation data differ from those produced using DHS data. Estimates from the DHS data were not able to capture unobserved heterogeneity as the pro-rich nature of PBF was not found.

This chapter also provides some insight on the importance of specifications. The comparison of a simple linear model, seemingly unrelated regression equations and further specifications using clustering and fixed-effects enabled us to highlight the importance of specification on coefficients. Specification tests showed that the significance of coefficients did not change according to the models, but that the

magnitude of coefficients is sensitive to specification. One other important conclusion is that results in this chapter are robust as three different econometric approaches produced comparable results.

4.6. CONCLUSION

Over the last decade, the population of Rwanda has experienced improvement in health outcomes and access to care. Poor people have better access and use more services. Yet improvements benefitted the richest initially and more over time. Two of the innovative health financing strategies designed by Rwanda; health insurance and PBF, have seen a positive impact on the demand and supply of healthcare services. Nevertheless, results support the hypothesis that, for most services, PBF favors efficiency at the expense of equity. Rwanda is an outlier in many respects. Twenty years after the genocide of 1994 that killed one fifth of its population, it is one of the few countries on track to reach the MDGs and beyond. Yet Rwanda is no exception in the way benefits of health programs reach the poor last. As inequalities in access to care persist, policy changes are needed to tailor PBF payments to better reach the poor. As a 2005 benefit-incidence analysis showed, a large share of public subsidies to the health sector benefited the richest, thus some reorientation of public spending toward pro-poor programs is always required (World Bank 2010).

This study highlights potential pitfalls of PBF (at least as originally designed and implemented in Rwanda): PBF is not inherently pro-poor. Its effect on improving the welfare of the poor depends on its design, and the equity concern needs to be built early in the design of the program. Also PBF is unlikely to be the sole mechanism and is likely to be more effective if used in synergy with other programs such as health insurance or selected free healthcare. A number of African countries are indeed moving in that direction. Further research is necessary to test various designs and models of interactions in different contexts.

5. DO DECENTRALIZED INCENTIVE HEALTHCARE PAYMENTS INFLUENCE SPATIAL DISPARITIES?

ABSTRACT

Contrary to income-related health inequalities, those that are uncorrelated with income, such as spatial disparities, are often overlooked. Spatial disparities result from contextual factors such as geography, policies, institutions and economic development. Addressing these areas is critical to ensure access to basic services across territories, especially when mobility is limited. This chapter examines the combined contribution of PBF which resulted in the context of a wider fiscal decentralization strategy to dissipate spatial disparities in the utilization of basic maternal and child health services. It draws on data from a randomized control trial evaluating the impact of PBF in Rwanda between 2006 and 2008 when the country rolled-out both PBF and fiscal decentralization.

This chapter, on the one hand, measures the evolution of spatial disparities (drawing on the coefficient of variation) between 2006 and 2008. Second, it examines the sources of such spatial variability in the utilization of basic health services overtime through a mapping exercise. Third, drawing on a regression-based decomposition (Fiorio and Jenkins 2010) this chapter aims to identify the relative contribution of different features underpinning spatial disparities. To avoid losing too many degrees of freedom, this exercise groups potential determinants in three factors, namely; a Gini index to proxy district income inequalities; the per capita health budget allocated to districts to assess the contribution of fiscal decentralization; and, performance-based financing to identify those districts subject to PBF from the rest.

Results show that overall reduction in spatial disparities and expansion of utilization of services between 2006 and 2008 in the country hide large variations between districts. This is in line with some literature on developed and emerging economies. Disparities decreased between 2006 and 2008 for most services examined. Decentralization accounts for up to 12.5% of the decline in spatial

disparities and performance-based financing for up to 27%. Income inequality, as measured by the Gini index, showed little to no impact.

Three policy recommendations are formulated. First, policymakers should not overlook regional inequalities as this can result in lower economic development, social unrest and poor health outcomes. Second, as contextual factors influence regional inequalities, policymakers should aim to narrow the gap between regions through adequate reforms and financing. Third, policymakers should consider PBF in its broader context and look at potential synergies with other reforms to gain as much as possible from the strategy.

5.1. INTRODUCTION

The Millennium Development Goals (MDGs) succeeded in bringing the world's attention to the utilization of basic maternal and child health services in low income countries (LIC). Despite significant improvements, access to basic health services for women and children remains unacceptably low in comparison with levels observed in high income countries (HIC). Well known factors explain variations between countries, and financial, cultural and geographical barriers still hamper demand for basic services. On the supply side, poor infrastructure, a lack of drugs and equipment, insufficient resources as well as the misuse and shortage of healthcare providers result in insufficient and poor quality basic services.

Within countries, inequalities are also a growing concern for LIC as the poor always experience lower access to basic health services compared with the rich (Barros et al. 2012). Most evidence of health inequalities in LIC concerns income-related inequalities and, to a lesser extent, urban-rural inequalities. Inequalities uncorrelated with income are often overlooked (Pradhan, Sahn, and Younger 2003). Regional inequalities (or more broadly, spatial disparities) can however be large and have a comparable or even greater impact than income-related inequalities. Spatial disparities result from geography, policies, institutions and economic development. Addressing these areas is critical to ensure access to basic services across the territory, especially when mobility is limited. Spatial disparities in health hamper progress in health outcomes but can also lead to economic and political instability and deserve significant attention.

Within countries, inequalities are a worldwide phenomenon. Westert and Groenewegen (1999) found large variations in hospital discharges in regions compared to the national average in eleven European countries. In China, Zhang and Kanbur (2005) found growing disparities in education and healthcare from 1981 to 2000 between urban and rural areas, as well as between inland and coastal regions. These disparities were found to be responsible for social unrest and slower poverty reduction. In Tunisia regional inequalities for assistance during delivery have increased overtime (Boutayeb and Helmert 2011). Using three rounds of demographic and health survey data in Ethiopia, Skaftun, Ali, and Norheim (2014) found significant regional disparities for maternal and child health outcomes and services.

Regional disparities are rooted in institutions, policies and economic development. Reforms, policies and economic choices at central or local levels either positively or negatively affect spatial disparities. The recent history of North African countries illustrates how regional social inequalities, that were at the origins of the Arab Spring (Ansani and Daniele 2012), can impact the economic and political spheres. Westert and Groenewegen (1999) found that spatial disparities in healthcare were smaller in countries with socialist or social-democratic governments. In China, regional inequalities in health have increased since the economic reforms (Zhang and Kanbur 2005).

Regional inequalities in access to basic health services call for reforms aiming to harmonize utilization levels across regions. Decentralization is probably the major reform promoted in LIC to improve the performance of health systems. The objective is to rely on administrative reform to improve the efficiency and quality of services and to foster accountability in the health sector as the reform can incentivize local decision makers to achieve health objectives (Bossert 1998). Fiscal decentralization allows subnational units to employ health workers; in principle it creates more flexibility, but depends on local political and economic conditions (Soucat, Scheffler, and Ghebreyesus 2013).

PBF is also implemented in many countries, particularly in Africa, to increase performance in healthcare delivery. There is a growing body of evidence on the

effectiveness of PBF on the supply of healthcare (Witter et al. 2012, Witter et al. 2013). Its impact on inequalities has been studied in relation to age, sex, ethnicity and socioeconomic status in developed countries (Alshamsan et al. 2010), in relation to socioeconomic status in LIC (Loevinsohn 2008) but never on regional inequalities.

To address this gap in the knowledge, this chapter focuses on the effect of PBF and decentralization on contextual inequalities which relate to "the broader political, cultural, or institutional context, for example the presence or absence of features that are intrinsic to places, such as infrastructural resources, economic policies of states, social and public support programs" (Kawachi, Subramanian, and Almeida-Filho 2002).

Specifically, this chapter examines the contribution of PBF and fiscal decentralization to spatial disparities using data from the randomized control trial evaluating the impact of PBF in Rwanda. It seeks to address the following research questions: 1) How do spatial disparities change overtime? 2) What is the source of spatial variability in the utilization of basic health services? and, 3) What is the contribution of contextual factors to spatial disparities? The analysis covers key maternal and child health services. PBF provides local decision makers with more autonomy and incentivizes providers to perform better. Therefore the hypothesis is that PBF narrows the gap between regions through a leveling effect and therefore reinforces the impact of fiscal decentralization. In the subsequent sections, background information on Rwanda is provided, followed by methods, results and a discussion with policy implications.

5.2. BACKGROUND

5.2.1. FISCAL DECENTRALIZATION

The Government of Rwanda adopted the National Decentralization Policy in May 2000 to promote good governance, poverty reduction as well as the efficient, effective and accountable delivery of services. After the first phase of administrative reform, the second phase (2006-2010) corresponding to fiscal decentralization, aimed to enhance effectiveness in service delivery by making human and financial

resources available at the district level (Rwanda Ministry of Local Government and Social Affairs 2001, Rwanda Ministry of Local Government Good Governance Community Development and Social Affairs 2008). Since 2006 and following fiscal decentralization, districts are now responsible for coordinating lower administrative levels in the delivery of services and districts receive part of the health budget. Budget transfers have progressively increased in size and scope and budget execution has improved showing that districts are able to cope with increased resources and responsibilities (World Bank 2010).

5.2.2. HEALTH FINANCING REFORMS

Three major health financing reforms have been implemented over the past 10 years in Rwanda with a significant impact on the supply and demand for healthcare (Sekabaraga, Diop, and Soucat 2011). First, the 2005 national health insurance policy made health insurance compulsory for all citizens and resulted in better financial protection (Rwanda Ministry of Health 2009). Second, following the fiscal decentralization reform, health facilities are now autonomous, responsible for service delivery and they manage financial and human resources. Third, the country is the first to have implemented performance-based financing (PBF) in primary healthcare facilities at a national scale, after three years of piloting (Rusa et al. 2009, Soeters, Habineza, and Peerenboom 2006, Meessen, Kashala, and Musango 2007).

5.3. METHODS

5.3.1. DATA

The database contains two rounds (baseline and follow-up) of household and health facility surveys collected in 2006 and 2008. It allows for estimations on the effect on spatial disparities of several reforms implemented at that time in Rwanda, including performance-based financing and fiscal decentralization. Although it would be interesting to assess regional inequalities countrywide, restricting the sample to districts that participated in the PBF impact evaluation gives a unique opportunity to generate sound evidence on the impact of PBF on spatial disparities.

Data was collected from 166 primary healthcare facilities and 2,145 households in the catchment areas of these facilities. The analysis presented in this chapter uses

the household surveys which provide basic socio-demographic characteristics and information on the utilization of health services. The analysis is performed using three different samples: a sample for family planning analysis with married women aged 15-49, a sample where mothers are interviewed about their last pregnancy and a sample of children up to five years. The analysis focuses on five services and the decision to include them was driven by their importance in reducing maternal and child mortality and morbidity. First, the coverage of institutional delivery is one of the most important MDG indicators as it largely contributes to maternal mortality reduction; this service also received the largest financial incentive as part of the PBF strategy (Table 1-6). Second, benefiting from at least four prenatal care visits is an international standard aiming to reduce the risks of complications during pregnancy. Third, increased access to family planning is largely promoted in Rwanda to reduce unwanted pregnancies and fertility as well as cut infant and child mortality. Finally, the utilization of preventive and curative care in the four weeks prior to interview aims to assess measures taken to reduce the burden of disease of children under-five.

As the focus of this chapter is disparities in the utilization of basic health services between districts, individual data was aggregated to compute district level averages for the two waves. As a result, there are 38 observations for each variable (one for each district per wave). Although this represents a small sample and having more waves would improve the statistical power of analyses, the sample is purposely limited to benefit from the strengths of the impact evaluation and measure the contribution of PBF to spatial disparities. The sample size still exceeds the rule of thumb minimum of 30 observations.

5.3.2. STATISTICAL METHODS

5.3.2.1. Regression analyses

Before exploring spatial disparities, regressions are run using Ordinary Least Squares (OLS) and a difference-in-difference model to assess the impact of PBF on basic maternal and child health utilization. The use of a difference-in-difference model is justified by the fact that the randomization of the study somehow failed due to the decentralization process as explained in section 2.3.3. The difference-in-difference model first calculates the mean difference between the baseline and

follow-up values of the variables of interest for the treatment and control groups; second, it calculates the difference between these two mean scores. This second difference isolates the impact of PBF. The regression specification of the difference-in-difference model is:

$$Y_{it} = \alpha + DD.T_i t + \beta T_i + \delta t_i + \mathrm{X}_{it} + \varepsilon_{it}$$

where Y is the outcome of interest, T is the treatment variable (0= control; 1= treatment), t is the time dummy (0 = 2006; 1=2008), X is a list of time-varying individual characteristics and Ɛ is the error term. The coefficient of the interaction of T and t (DD) gives the estimate of the impact of treatment on outcome Y.

Individual, household and health facility characteristics aggregated at the district level that proved to influence utilization (Basinga et al. 2011) were added in the specification as explanatory variables: primary education attainment of women (or mothers), average distance between the household and the facility, health insurance coverage and the proportion of public facilities in the district. For institutional deliveries and postnatal care, the average number of children per woman was also added in the regression.

5.3.2.2. Coefficient of variation

To describe spatial diversity in the utilization of basic health services overtime, coefficients of variation were computed for each service in 2006 and 2008. In contrast to standard deviation, which is an absolute measure of dispersion, the coefficient of variation (CV) is a relative measure. It is the ratio of the standard deviation δ to the mean μ and the higher the CV, the greater the dispersion will be:

$$CV = \frac{\sigma}{\mu}$$

The CV is particularly useful when comparing measurements across multiple variables as it allows direct comparison even when variables are measured on different scales.

5.3.2.3. Decomposition

The decomposition identifies determinants of spatial disparities and quantifies their relative contribution. The absolute measure of variation (standard deviation) was decomposed to estimate what percentage of inequality is attributed to different covariates to assess to what extent contextual factors explain spatial disparities in maternal and child health service utilization.

The traditional approach of decomposition that relies on the analysis of the mathematical properties of inequality indices is criticized on the grounds that it allows inequality accounting, but not causal analysis. As an alternative, a regression-based inequality decomposition is proposed (Fiorio and Jenkins 2010). This chapter uses a regression-based approach, which was first developed for income-inequality decompositions, but is now used for regional analyses (Shorrocks and Wan 2005, Costa-Font 2010). The health output (y_i) is measured as follows:

$$y_{it=}^{m} X\beta + \varepsilon_{it}$$

where X is a matrix of health output determinants and the vector β indicates the effect of each determinant on the measure of health service utilization. Using the above model, the following is estimated:

$$y_{it=}^{m} \sum \hat{\beta}_m x_{it} + \hat{\varepsilon}_{it}$$

where $\hat{\beta}$ is the OLS coefficient and $\hat{\varepsilon}_{it}$ is the OLS residual. The decomposition of the inequality index s^m is conducted as follows:

$$s_{it}^{m} = \sum \frac{\alpha(y_{it}^{m}) x_{it}}{I(y_{it}^{m})}$$

where $\alpha(y_{it}^{m})$ is a weight and $I(y_{it}^{m})$ is the total inequality in utilization of health services with bootstrapping standard errors (Costa-Font 2010).

Three health output determinants are included in the right hand side of the regression to assess the contribution of policies and of contextual factors to spatial disparities. First, a Gini index is used to proxy district income inequalities. It measures the extent to which the distribution of income deviates from a perfectly

equal distribution. As data on household income or consumption was not available, a wealth index is estimated to proxy living standards using a principal component analysis (Filmer and Pritchett 2001). Second, using district budget data (Rwanda Ministry of Finance and Economic Planning 2006, 2008) and projections of district populations (Rwanda Ministry of Finance and Economic Planning and National Institute of Statistics of Rwanda 2014), a per capita budget was computed to assess the effect of fiscal decentralization as the reform put into effect district level budget transfers. Third, the interaction between performance-based financing (0 for control and 1 for treatment district) and the time variable is once again used to measure the contribution of performance-based financing.

Robustness checks are conducted to verify how confident one can be in the results presented. The robustness checks particularly aim to assess the importance of population-based characteristics in regional disparities. District population density, sex ratio and median age were successively added as a fourth component in the decomposition.

5.3.3. LIMITATIONS

This study has a number of limitations, although it is the first to decompose spatial disparities in the utilization of health services in Rwanda and to estimate the contribution of major reforms such as fiscal decentralization and performance-based financing. First, the analysis is not conducted on the entire country as 11 districts are excluded. Spatial disparities may be underestimated as the analysis cannot capture urban-rural inequalities. Second, because the impact evaluation data was purposely chosen to rigorously assess the impact of PBF, the analysis is limited to two waves and the sample size is small. One can however be confident that results provide a good sense of regional disparity determinants. Third, as both waves are separated by two years only, the observation period is too short to observe long term effects of performance-based financing and of fiscal decentralization.

5.4. RESULTS

Before focusing on spatial disparities, this section begins by reporting upon overall utilization of basic maternal and child health services in Rwanda at the time of the

study. The evolution of spatial disparities (drawing on the coefficient of variation) between 2006 and 2008 is then presented before examining the sources of such spatial variability through a mapping exercise. Finally, results from the regression-based decomposition show the relative contribution of different features underpinning spatial disparities.

5.4.1. OVERALL UTILIZATION OF BASIC MATERNAL AND CHILD HEALTH SERVICES

Utilization of basic maternal and child health services in the treatment and control groups were balanced at baseline as highlighted by Basinga et al. (2011). Utilization of maternal services rose significantly overtime: use of family planning rose from 11% to 33% between 2006 and 2008, and, institutional deliveries from 36% to 60% with a higher coverage in treatment districts (65% in 2008 compared to 50% in the control group). The probability of a woman attending at least four prenatal care visits during pregnancy also rose from 16% to 32%. Improvements in the use of child health services are smaller: the percentage of children visiting a health center for curative care in the event of an illness rose from 25% to 33% while that of children benefiting from a preventive care visit rose from 11% to 15% (Table 5-1).

Table 5-1: Average utilization of basic maternal and child health services (2006-2008)

	2006			2008		
	Control	**Treatment**	**Total**	**Control**	**Treatment**	**Total**
Family planning	13%	10%	**11%**	35%	32%	**33%**
Institutional deliveries	38%	35%	**36%**	50%	65%	**60%**
4+ prenatal visits	11%	19%	**16%**	24%	36%	**32%**
Child curative care	24%	26%	**25%**	31%	33%	**33%**
Child preventive care	13%	10%	**11%**	11%	18%	**15%**

Source: Author (2015)

Utilization of basic services also improved as a result of PBF. Table 5-2 highlights the positive impact of PBF on institutional deliveries (+14%) and Table 5-3 on preventive care for children (10%). Being a treatment district also positively affects the probability of a woman benefiting from at least 4 prenatal care visits (OLS only).

The coefficient associated with time ('post') confirms the above positive trend in access to family planning and institutional deliveries overtime (+25% for family planning and +30 to 40% for institutional deliveries).

Table 5-2: Determinants of utilization of basic maternal health services at district level

	Family planning		Institutional deliveries		4+ ANC visits	
	OLS	DD	OLS	DD	OLS	DD
Treatment	-0.019	-0.022	0.038	-0.034	0.087**	0.066**
	(0.021)	(0.034)	(0.034)	(0.036)	(0.034)	(0.027)
Post	0.256***	0.253***	0.402***	0.308***	0.066	0.039
	(0.042)	(0.054)	(0.086)	(0.078)	(0.079)	(0.078)
Interaction		0.005		0.145**		0.042
		(0.042)		(0.065)		(0.070)
Obs.	**38**	**38**	**38**	**38**	**38**	**38**

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
OLS: Ordinary Least Squares; DD: Difference in difference

Table 5-3: Determinants of utilization of basic child health services at district level

	Child curative care		Child preventive care	
	OLS	**DD**	**OLS**	**DD**
Treatment	0.017	0.023	0.018	-0.03
	(-0.028)	(-0.045)	(-0.023)	(-0.028)
Post	0.002	0.009	0.017	-0.039
	(-0.059)	(-0.07)	(-0.038)	(-0.037)
Interaction		-0.012		0.097**
		(-0.056)		(-0.041)
Obs.	**38**	**38**	**38**	**38**

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
OLS: Ordinary Least Squares; DD: Difference in difference

5.4.2. EVOLUTION OF SPATIAL DISPARITIES IN UTILIZATION OF BASIC SERVICES

The analysis of spatial disparities, measured by the coefficients of variation, reports two interesting patterns: first, there are important spatial disparities between districts in 2006 and 2008 for all services; second, inequalities decreased overtime, in particular for family planning, curative care for children, institutional deliveries and preventive care. Disparities slightly increased for prenatal care visits (Table 5-4).

Table 5-4: Coefficients of variation of district level inequality in utilization of basic health services

	2006	2008	Difference
Institutional deliveries	0.40	0.28	-0.12
Family planning	0.53	0.23	-0.31
4+ prenatal care visits	0.47	0.50	0.03
Curative care for children	0.43	0.19	-0.24
Preventive care for children	0.56	0.49	-0.07

Source: Author (2015)

5.4.3. MAPPING OF SPATIAL DISPARITIES IN UTILIZATION OF BASIC SERVICES

Mapping of spatial disparities confirms the existence of inequalities in utilization of basic services across districts in both waves (Figure 5-1 to Figure 5-10). For instance, utilization of institutional deliveries varies from 20% to 70% in 2006 and from 41% to over 90% in 2008 across districts.

Figure 5-1: Modern family planning utilization (2006)

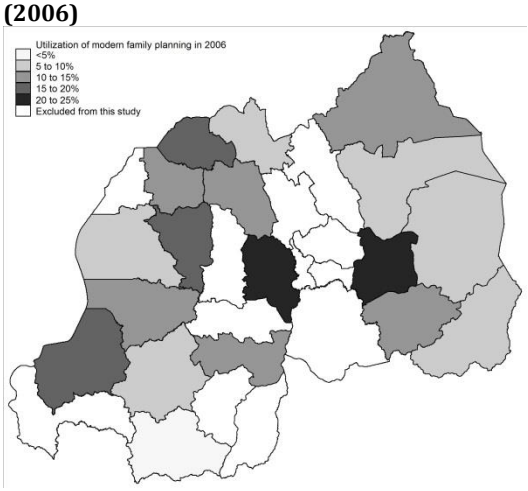


Figure 5-2: Modern family planning utilization (2008)

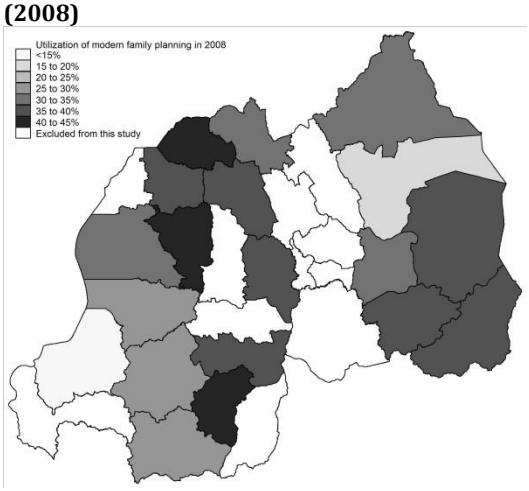


Figure 5-3: Institutional deliveries (2006)

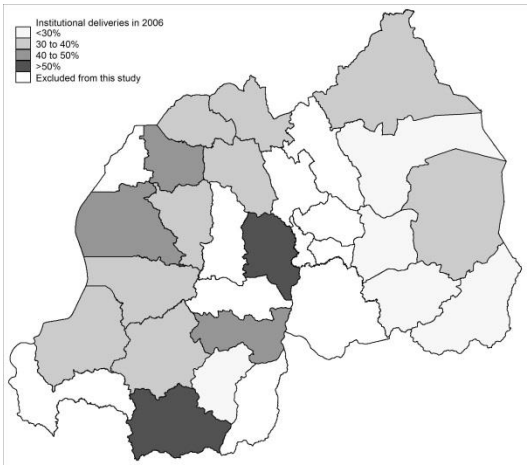


Figure 5-4: Institutional deliveries (2008)

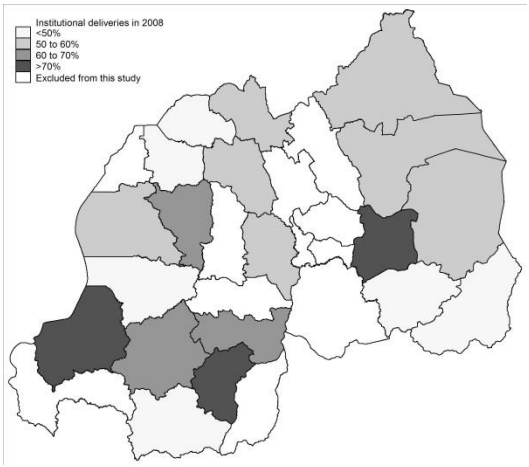


Figure 5-5: 4 or more prenatal care visits (2006)

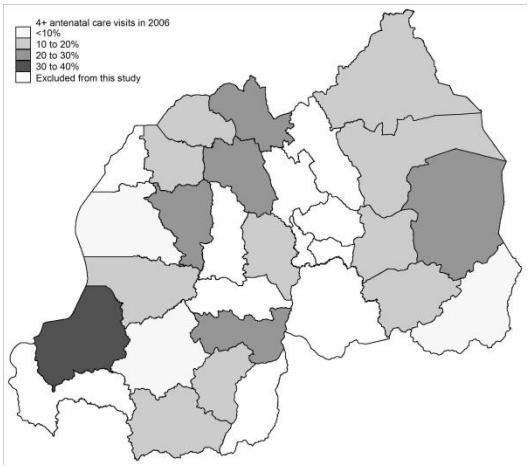


Figure 5-6: 4 or more prenatal care visits (2008)

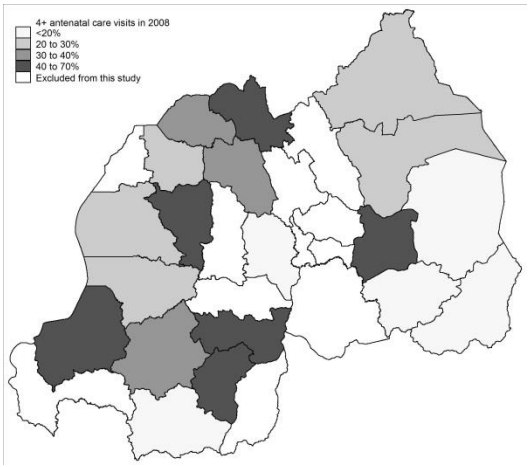


Figure 5-7: Utilization of child curative care (2006)

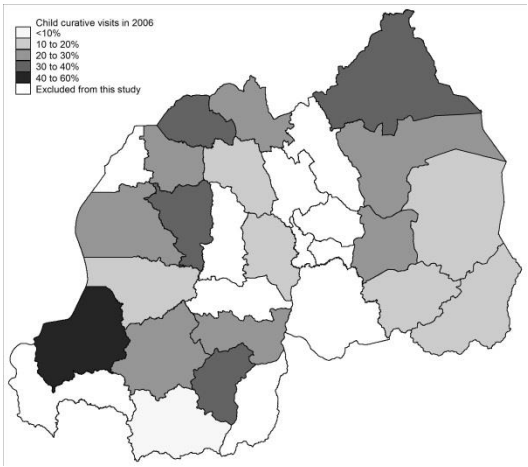


Figure 5-8: Utilization of child curative care (2008)

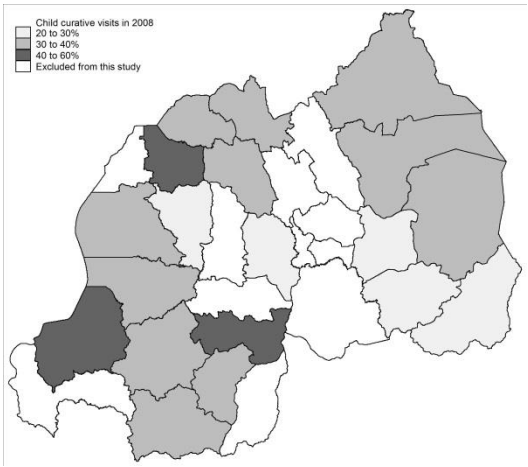


Figure 5-9: Utilization of child preventive care (2006)

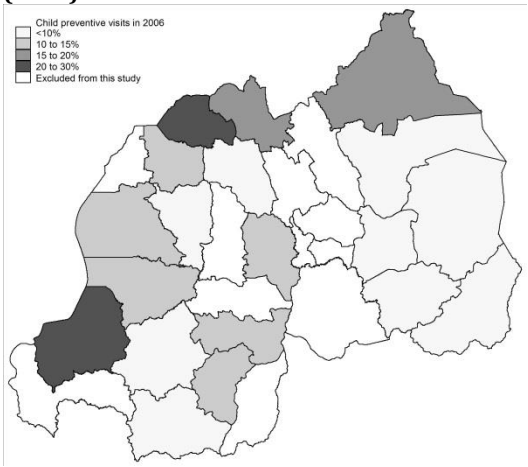
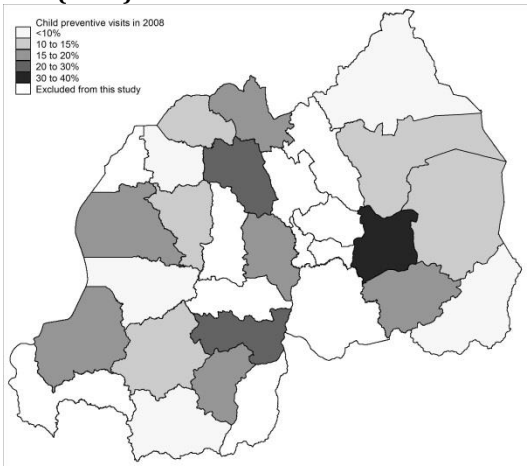


Figure 5-10: Utilization of child preventive care (2008)



Source: Author (2015)

5.4.4. DECOMPOSITION OF SPATIAL INEQUALITIES

5.4.4.1. Descriptive analysis of contextual factors

Spatial disparities in utilization of basic health services were decomposed using three potential explanatory factors: the Gini index, per capita district health budget and performance-based financing. Mapping of the Gini index (Figure 5-11 and Figure 5-12) shows large disparities between districts. The Gini index varied from 29 to 63 in 2006 and from 10 to 72 in 2008.

Figure 5-11: Gini index (2006)

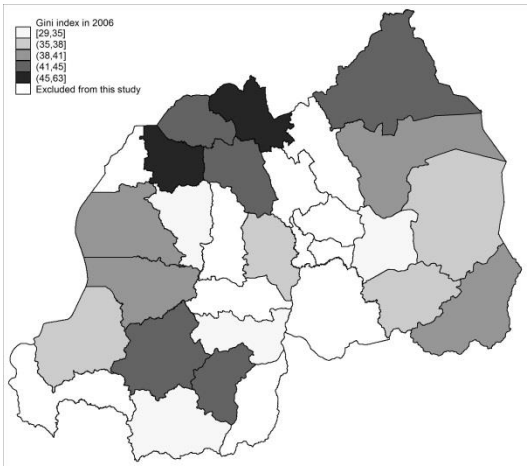
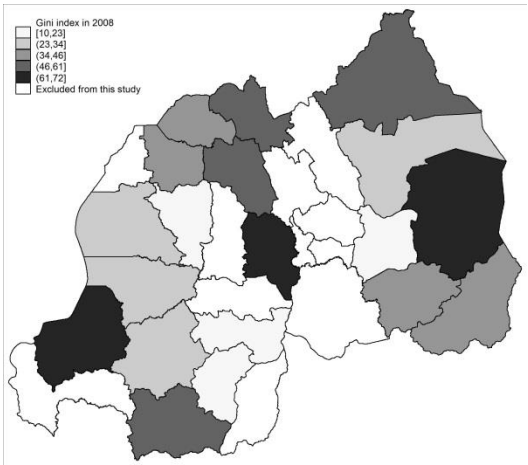


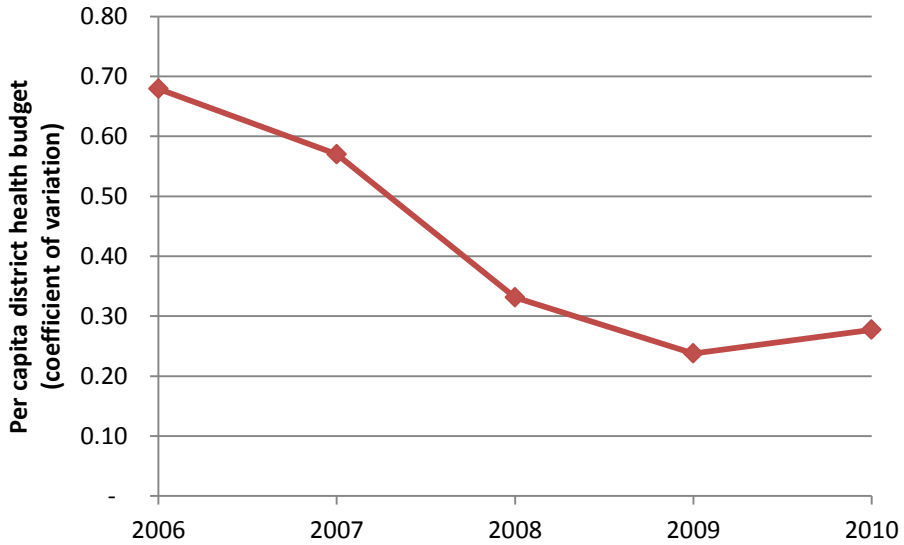
Figure 5-12: Gini index (2008)



Source: Author (2015)

The per capita health budget significantly increased between 2006 and 2008 as a result of fiscal decentralization. Countrywide, variations in per capita district health budgets decreased significantly between 2006 and 2010 suggesting a positive effect of fiscal decentralization on the reduction of spatial disparities (Figure 5-13). The mapping of resources allocated to districts also shows that disparities existed but did not evolve over time (Figure 5-14 and Figure 5-15).

Figure 5-13: Spatial disparities in per capita district health budget (2006-2010) in Rwanda



Source: Author (2015)

Figure 5-14: District health budget (RwF p.c.) (2006)

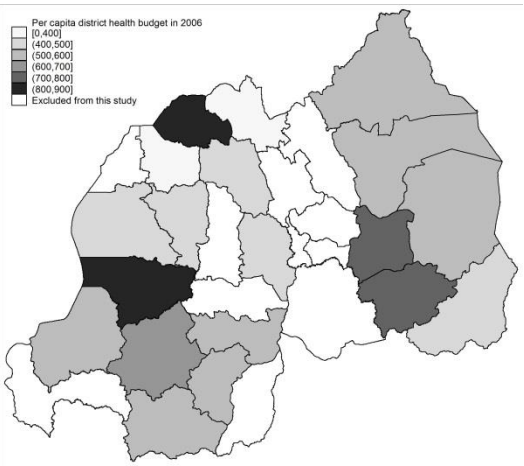
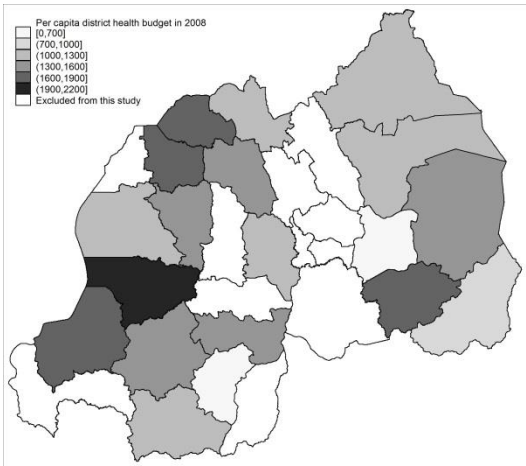


Figure 5-15: District health budget (RwF p.c.) (2008)



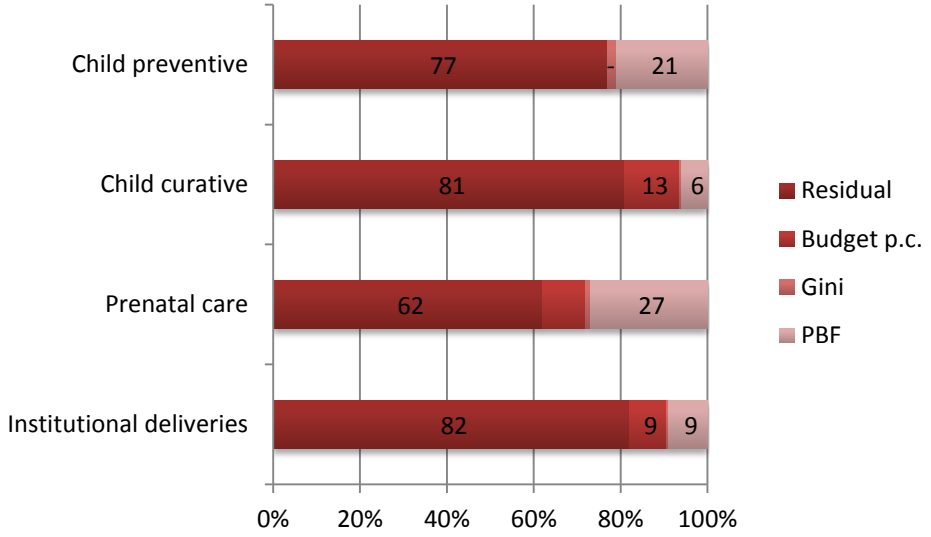
Source: Author (2015)

5.4.5. COMPONENTS OF SPATIAL DISPARITIES

The main factors underpinning spatial variations in the utilization of services are fiscal decentralization (measured by per capita budget) and performance-based financing. Their effect depends on the type of service considered (Figure 5-16). Results on family planning are not reported as coefficients were not significant.

Decentralization explains 8.5% of spatial disparity decline in institutional deliveries, 10% in at least 4 prenatal care visits and 12.5% in the probability of a child visiting a health center in the event of illness. Performance-based financing accounts for 27% of the decline in spatial variation for at least four prenatal care visits, 21% for child preventive care, 9% for institutional deliveries and 6% for child curative care. The impact of district level inequalities (Gini) is marginal (Figure 5-16).

Figure 5-16: Decomposition of spatial disparities

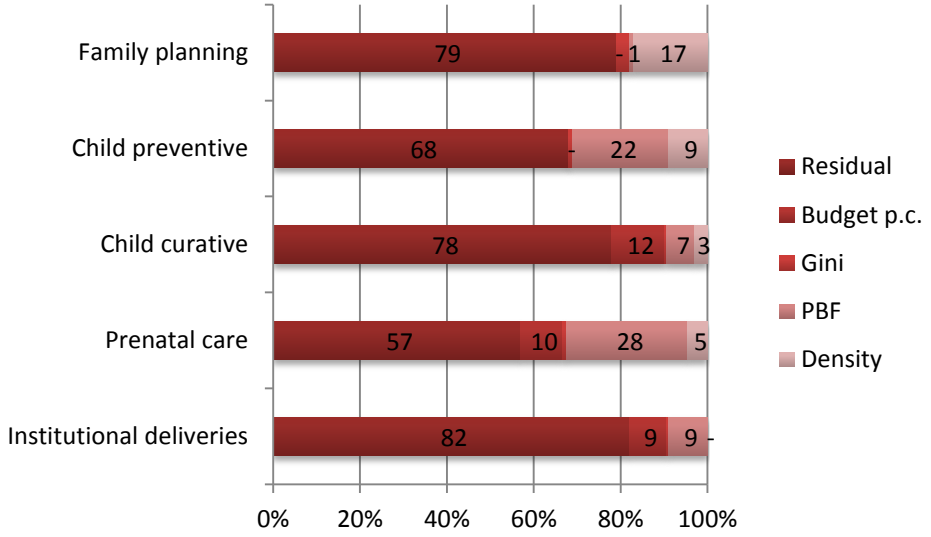


5.4.6. ROBUSTNESS CHECKS

As percentages associated with the residual (Figure 5-16) suggest that spatial disparities are also explained by factors not included in the model, robustness checks are run to measure the extent to which disparities can be explained by population-based characteristics.

As Rwanda has one of the highest population densities in the region and a largely varying density across districts (from 2,124 to 178 inhabitants/km$^{2)}$ (Rwanda Ministry of Finance and Economic Planning and National Institute of Statistics of Rwanda 2014), district population density was added as a fourth component in the decomposition. Results suggest that regional disparities are smaller in more populated areas for all services except institutional deliveries (Figure 5-17). Robustness checks are also run using the median age in the district population and sex composition. As coefficients associated with those variables were not significant, results are not presented.

Figure 5-17: Robustness check for the decomposition of spatial disparities



5.5. DISCUSSION

This chapter focuses on spatial disparities in rural Rwanda between 2006 and 2008. It is an interesting period from a policy analysis viewpoint as the country started implementing both fiscal decentralization and performance-based financing in 2006.

This chapter adds to current knowledge in at least four ways: first, it provides evidence on spatial disparities in the utilization of basic maternal and child health services in rural Rwanda. Second, it adds to existing knowledge on the impact of PBF on the overall use of health services in Rwanda (Basinga et al. 2011) and on the use of services by the poorest (Chapter 4) by analyzing the impact of PBF on spatial disparities. Third, this chapter brings empirical evidence to a mostly theoretical debate on the effect of decentralization on regional inequalities. Fourth, it analyzes the joint effect of PBF and decentralization on regional inequalities.

5.5.1. UTILIZATION OF BASIC MATERNAL AND CHILD HEALTH SERVICES IN RURAL RWANDA

The findings reported in this chapter confirm the positive trend in utilization of basic services in Rwanda documented by Sekabaraga, Diop, and Soucat (2011). However, in 2008, utilization of all services under study remained low: only one third of women used a modern family planning method or benefited from at least

four prenatal care visits during their last pregnancy, fewer than two thirds of women delivered in a health facility, and only one third of children under-five visited a health facility in the event of an illness. Results also confirm the positive impact of PBF on institutional deliveries and utilization of preventive care for children as demonstrated elsewhere (Basinga et al. 2011).

5.5.2. COMPONENTS OF SPATIAL DISPARITIES

This chapter brings new evidence by reporting that overall improvements in utilization of services between 2006 and 2008 hide large variations between rural districts. Disparities however decreased between 2006 and 2008 for all services except prenatal care.

The major contribution of this chapter lies in the decomposition of spatial disparities to better understand their contextual components. First, decentralization reduced spatial disparities for institutional deliveries, prenatal care and curative care for children. It had no impact on family planning and preventive care for children. Second, performance-based financing narrowed spatial disparities in the utilization of all basic health services except family planning. Third, the limited contribution of the Gini index suggests that between districts, inequalities do not influence service utilization. Rather, as documented in Chapter 4, within-district variations matter more. Interventions to address those inequalities should therefore aim to target the poorest households within communities rather than target a district as a whole.

5.5.3. DECENTRALIZATION

By bringing new empirical evidence, this chapter contributes to the debate on the effect of decentralization on regional inequalities. The decentralization theorem postulates that "in the absence of cost-savings from the centralized provision of a [local public] good and of inter-jurisdictional externalities, the level of welfare will always be at least as high (and typically higher) if Pareto-efficient levels of consumption are provided in each jurisdiction than if any single, uniform level of consumption is maintained across all jurisdictions" (Oates 1972). In other words, on grounds of economic efficiency, the decentralized provision of public goods with localized effects will enhance efficiency and is therefore desirable, in particular, if

needs are geographically unbalanced. Proponents of decentralization also argue that devolving healthcare delivery responsibilities to local levels improves technical and allocative efficiency as decentralized programs are designed according to local needs (Robalino, Picazo, and Voetberg 2001). Decentralization can also increase governments' accountability in service delivery, reduce information asymmetries and develop local democracies (Costa-Font and Rico 2006).

Decentralization can stimulate competition between regions. Citizens of one region can compare their benefits to those of a neighboring region and judge their region's performance. This can result in regions increasing or decreasing budgets allocated to health (Costa-Font and Pons-Novell 2007). Decentralization can induce welfare migration, a phenomenon observed when welfare recipients move from low-benefit to high-benefit regions to secure a better standard of living (Brueckner 2000). When welfare migration is limited, regional decision makers will have incentives to increase coverage. Decentralization can lead to political competition as well. Partisan cycles can influence public expenditure, although this will depend on the types of public expenditure or the kind of government (Costa-Font and Pons-Novell 2007).

However, the theoretical debate highlights risks associated with decentralization. Local authorities can capture most of the benefits at the expense of the non-elite resulting in inefficient and inequitable cross-subsidization (Bardhan 2002). Decentralization can exacerbate existing disparities, since giving more power to regions can hinder uniformity in service delivery. Furthermore, as decentralization has implicit fiscal, political and administrative costs, poorer regions may face difficulties and the gap between regions may then increase. Indeed, decentralization is seen by some scholars as the denunciation of the equalization role of national governments (Gill 2004). They argue that centralized systems are the best way to redistribute resources in favor of poorer areas while decentralization favors richer communities.

Results presented in this chapter support the hypothesis that decentralization reduces inequalities between regions. In line with the theory of fiscal decentralization, informal competition between districts and political competition is

likely to incentivize local decision makers to increase satisfaction levels of their population. Local decision makers granted with more responsibilities and resources were encouraged to put sufficient resources into their health system to ensure adequate service delivery. Decentralization may also have encouraged local authorities to improve efficiency in public spending and to use savings for other purposes. As for healthcare providers, they were incentivized to improve the quality of services to ensure patients will visit the facility again. Typical problems that exacerbate inequalities in the context of decentralization, such as the absence of a mechanism to transfer resources from richer to poorer areas or to ensure the availability of skilled personnel, were successfully addressed in Rwanda and facilitated the smooth implementation of decentralization.

The evidence reported in this chapter is in line with evidence from some developed and emerging economies. For instance in Spain, healthcare devolution did not increase regional inequalities in healthcare outcomes and outputs (Costa-Font and Rico 2006). In fact, decentralization resulted in spatial interactions and competition between regions that had a positive impact on the level of public health expenditure (Costa-Font and Pons-Novell 2007). In Chile and Colombia, decentralization improved equity of resource allocation thanks to the utilization of a budget allocation formula, adequate local funding choices and equity funds. Poorer communities were encouraged to put more resources into health systems while wealthier communities did not increase spending, thus closing the gap between communities (Bossert et al. 2003). Finally, in a cross-country analysis, higher fiscal decentralization was associated with lower mortality rates, in particular in poorer countries, and better health outcomes (Robalino, Picazo, and Voetberg 2001).

The Rwandan case thus contradicts evidence from China where regional inequalities coincide with the degree of decentralization (Fan, Kanbur, and Zhang 2011). In China, the poorest local governments reduced their investments in the health sector, cut welfare benefits and decreased financing of public infrastructure in rural areas as a result of decentralization (Zhang and Kanbur 2005).

5.5.4. POLICY RECOMMENDATIONS

As the literature review has pointed out, researchers and policymakers have a tendency to focus their attention on socioeconomic inequalities in access to health services in low and middle income countries, and to a lesser extent on urban-rural inequalities. Although it is critical to address such inequalities, policymakers should not overlook regional inequalities as they can result in lower economic development, social unrest and poor health outcomes. Recent history in Arabic countries shows that such inequalities can originate profound instabilities. In their analysis of regional disparities in North African countries, Boutayeb and Helmert (2011) note that the challenge for those countries, besides improving economic, social and health conditions, is mainly to reduce avoidable regional inequalities.

Despite the limitations spelled out in section 5.3.3, the findings from this chapter are informative in many ways. Empirical results from Rwanda revealed the positive short term impact of decentralization on the reduction of spatial disparities. Increased district budget reduced variation in the per capita health budget as well as disparities in the utilization of basic maternal and child health services. These findings highlight the importance of contextual factors in regional inequalities and how policymakers can narrow the gap between regions through reform. By increasing budgets available to local decision makers, promoting competition and strengthening accountability in the use of public resources, decentralization can lead to a more efficient use of resources. As a result of decentralization, a leveling effect can operate and service delivery and utilization of health services can become more homogenous across regions. The case of Rwanda suggests that fiscal decentralization can narrow the funding gap between regions.

Results from Rwanda suggest that PBF can narrow the gap between districts as it provides incentives, at district and health facility levels, to perform better. It also gives more autonomy to decision makers on the use of resources. PBF alone accounts for up to 27% of the decline of spatial disparities for basic maternal and child health services. As argued by Meessen, Soucat, and Sekabaraga (2011), performance-based financing therefore must not only be seen as a provider payment mechanism. Meessen, Soucat, and Sekabaraga (2011) state that if PBF “is

incorporated into a broader reform context, it can help address several structural problems facing health systems around the world, problems that have proven intractable for years". The case of Rwanda illustrates that PBF, when combined with decentralization, can help achieve the objectives of decentralization. In Rwanda, PBF was even more effective than decentralization in narrowing spatial disparities. These findings should encourage policymakers to consider PBF in the broader context of reform and to explore potential synergies with other policies. The case of Rwanda also illustrates that PBF and decentralization work hand in hand as they pursue the same objective of improving efficiency in the use of resources by giving more resources and autonomy to local actors.

5.6. CONCLUSION

This study provides evidence on an unexplored aspect of performance-based financing that can benefit Rwanda as well as other countries implementing or planning to adopt this strategy. It complements the body of evidence on PBF that is mainly related to its impact on the quantity and quality of services delivered, and more recently on its impact on the utilization of services by poorer groups. This chapter is the first to explore the impact of PBF on another type of inequality, namely, regional inequalities or spatial disparities.

Since the genocide of 1994, Rwanda has achieved tremendous progress rebuilding its health system and developing innovative health financing reforms that have put it on track to achieve the Millennium Development Goals (Binagwaho et al. 2014). Nevertheless, in 2006-2008, the country was confronted with large spatial disparities in service utilization of basic maternal and child health.

In 2006, Rwanda engaged in large structural reforms aimed to improve efficiency in the delivery of health services. Decentralization and performance-based financing thoroughly transformed the health system. This chapter supports the hypothesis in that PBF and decentralization can significantly cut regional inequalities. Besides its primary objective of incentivizing healthcare providers to deliver more and better quality health services, PBF can reinforce the impact of broader reforms. As decentralization and PBF are increasingly being promoted in low and middle

income countries, this chapter encourages policymakers to explore synergies between those reforms to reduce regional inequalities.

PART 4: CONCLUSIONS AND POLICY RECOMMENDATIONS

6. CONCLUSIONS

The overarching objective of this thesis was to investigate the impact of performance incentives on health system performance. To date, published evidence on the impact of performance incentives mainly relates to high income countries (HIC) but the performance challenges faced by their health systems are not the same as those of low income countries (LIC). This highlights the need for more evidence from poorer settings. LIC are characterized by poor utilization of basic health services, a lack of financial and human resources, poor management capacities and broad inefficiencies in service delivery (Belli 2004). Performance-based financing (PBF) is increasingly promoted in LIC to overcome inefficiencies in service delivery but the evidence-base is insufficient (Witter et al. 2012). This thesis thus sought to contribute in closing a gap in the literature by providing sound evidence on one of the most unexplored aspects of performance-based financing in LIC to assist countries in designing evidence-based policies. Rwanda was chosen as a case study as it is the first country that implemented PBF on a national scale with an embedded rigorous impact evaluation that enables to isolate the net effect of PBF on several variables of interest.

Since the literature suggests that efficiency gains from performance incentives may be achieved at the expense of other performance dimensions, this thesis aimed to assess whether PBF can raise productivity without hampering equity and responsiveness. PBF is currently at the center of a debate, and the major contribution of this thesis is to provide sound evidence on poorly documented aspects of the strategy. Opponents argue that there lacks evidence on the impact of PBF and that there is a bias in the literature with only positive results being published. Further, they state that PBF may generate perverse effects and hamper equity, however, these are not well documented (Ireland, Paul, and Dujardin 2011). Proponents on the contrary argue that the strategy can catalyze reforms and address health system inefficiencies, such as low responsiveness and inequality (Basinga, Mayaka, and Condo 2011, Meessen, Soucat, and Sekabaraga 2011).

This chapter and the following one summarize the results from the empirical chapters. It proposes policy recommendations for improving health systems' performance in LIC with considerations for equity and responsiveness. Limitations and a future research agenda are also presented.

6.1. SUMMARY AND DISCUSSION OF RESULTS

6.1.1. OVERALL ANSWER TO THE RESEARCH PROBLEM

To address the question 'Can performance-based financing raise productivity without hampering equity and responsiveness?' this thesis examined the impact of PBF on efficiency, which comprises productivity and responsiveness, and on equity.

Chapter 2 and Chapter 3 argued that PBF has a positive impact on efficiency. First, PBF raises health workforce productivity through higher workloads and lower absenteeism. Second, these improvements in health workforce performance are accompanied by higher responsiveness to patients' needs as health workforce performance dimensions are linked and influence one another.

Chapter 4 and Chapter 5 demonstrated that the impact of PBF on equity is uncertain. PBF can deter equity in access for the poorest as they are more difficult to reach. However, when combined with a strategy that aims to reduce inequalities between households or regions, PBF reinforces the positive impact of such strategies and strengthens equity gains. The thesis thus argues that PBF should be used to raise health systems' performance and that synergies with other reforms must be developed to amplify their effect and avoid potential perverse effects of PBF, in particular on equity in access to services. Summaries by chapter are presented below.

6.1.2. CHAPTER 2: DRIVERS OF PRODUCTIVITY GAINS

Efficiency gains are generally put forward as the main reason for implementing performance incentive schemes in HIC and LIC. As a result, studies investigating the impact of PBF focus mainly on technical and allocative efficiency. Most publications on LIC and HIC (Witter et al. 2012, Greene and Nash 2009) report only descriptive analyses of efficiency gains achieved through changes in utilization (quantitative aspect) and productivity ratios and changes in process quality. Such approaches are

limited for a number of reasons: first, reporting that performance incentives succeed in doing what they were designed for is a limited finding, although it is informative for policymakers; second, the evidence base is now large enough to be confident that the strategy has a positive impact on efficiency which reduces the contribution to knowledge of any new study; third, it is unsatisfactory to report the success of a strategy if the contribution of contextual factors is not reported. By demonstrating the impact of PBF on health workforce productivity and looking into the drivers for productivity gains, Chapter 2 thus aimed to depart from existing evidence and contribute to knowledge by bringing innovative evidence that can benefit policymakers.

Chapter 2 assessed the contribution of PBF to health workforce performance which can be measured through availability, competences, responsiveness and productivity (World Health Organization 2006); in particular, it estimated the impact on availability, measured by distribution and attendance at work, and productivity. Chapter 2 proposed a conceptual framework to understand the drivers of health workforce productivity. It explored links between availability of the health workforce, presence at work and productivity and quantified the contribution of PBF on changes observed overtime. Following the theory on incentives, Chapter 2 argued that PBF could enhance health workforce productivity as a result of extrinsic motivation, but particular attention was given to intrinsic motivation as it influences each step identified by the conceptual framework, and thus productivity.

Results support the hypothesis that PBF improves health workforce productivity. Productivity gains are not driven by staff expansion but by cutting absenteeism and placing a higher workload on staff. Productivity gains can be achieved through financial incentives, improved supervision and more responsiveness but potentially at the expense of a relaxed working environment. Chapter 2 thus argues that mechanisms should be put in place in parallel to extrinsic motivation mechanisms to ensure greater job satisfaction and working conditions, which are critical determinants of intrinsic motivation.

These findings lend support to exploring new ways of improving the availability of healthcare services and utilization through higher workforce productivity. Although

there is evidence that utilization of healthcare services raises with the availability of staff (Chen et al. 2004) and traditional input-based approaches tend to argue for more staff being recruited to increase service utilization, Chapter 2 suggests that raising performance of existing staff can partially cover the shortage in the health workforce. In a context of resource constraints and staff shortage, the evidence from Rwanda shows that PBF can raise health workforce performance to increase productivity and deliver more services. This is in line with the principle of 'more money for health and more health for the money' supported by the international taskforce on innovative international financing for health systems. Making more inputs available for the health sector is not the only solution, particularly when it is underperforming. Efforts should be targeted in making the allocation of existing and additional funds more efficient (Taskforce on innovative international financing for health systems 2009).

Increasing value for money is particularly critical in countries such as Rwanda that are confronted with large budget constraints and sustainability issues due to the heavy reliance on donors. Human resources for health generally represent the bulk of a recurrent budget for LIC which makes the wage bill unsustainable for the long term. Strategies are thus needed to overcome this problem and reduce the burden on the national budget. The case study on Rwanda has demonstrated that PBF succeeds in making health workers more present at work, which reduces resource wastage. It also improves their productivity and therefore succeeds in closing the gap between supply and demand for healthcare services.

6.1.3. CHAPTER 3: PATIENTS' PERCEPTION ON EFFICIENCY GAINS

Responsiveness to patients' needs is one of the four dimensions of health workforce performance (World Health Organization 2006) and Chapter 3 reported that LIC and HIC differ in the way they include this dimension in the delivery of services. LIC still pay little attention to patients' satisfaction and the PBF scheme did not include it in the incentive mechanism. On the contrary, HIC are concerned with patients' satisfaction which is powerful and can influence healthcare providers. Most P4P schemes in HIC tie part of the incentive schemes to patients' satisfaction.

Efficient service delivery requires delivering quality health services: thus all P4P and PBF schemes measure quality of care (process quality) to estimate their impact on efficiency. Following Donabedian (1988), Chapter 3 argued that patients' satisfaction is a critical part of quality evaluation and must be measured along with process quality (clinical indicators). The majority of studies from HIC and LIC do not report the impact of performance incentives on patients' satisfaction although it is legitimate to verify that productivity gains are not achieved at the expense of responsiveness. For instance, healthcare providers that have pressure to deliver more services tend to spend less time with the patients, provide less of an explanation or neglect the infrastructure which can negatively impact satisfaction. Despite the risk of perverse effects, the literature review revealed that changes in health service quality are mostly measured from a clinical point of view in HIC and LIC. Chapter 3 thus innovated by offering a new perspective, providing patients' view on efficiency gains achieved through performance incentives. Data from Rwanda collected from patients exiting primary healthcare facilities who were asked to rank their satisfaction with waiting time, cleanliness, availability of medicine, time with provider, privacy during examination, staff attitude, explanation from provider, cost of the medicine, cost of the service and overall service received was used. Satisfaction dimensions on clinical care were aggregated in one index using a polychoric correlation method while non-clinical satisfaction dimensions were kept as separate ordinal measures.

Results support the hypothesis that PBF improves health workforce responsiveness. Productivity gains due to performance incentives (Chapter 2) were not achieved at the expense of patients' satisfaction or perceived service quality. Improvements in productivity, availability and competences of the health workforce have a positive effect on satisfaction with clinical services, even if patients' satisfaction is not tied to a reward. Providers benefiting from PBF can be incentivized to raise patients' satisfaction with non-clinical services if they think it is associated with future financial gains. Chapter 3 concluded that low and middle income countries should build on the experience from high income countries to better listen to the patient voice in general, and in PBF schemes in particular.

The case study on Rwanda revealed that satisfaction with clinical dimensions is more important to patients than those with non-clinical dimensions. This is consistent with evidence from HIC where the patient-provider relationship outweighs satisfaction with other dimensions (Crow et al. 2002, Hall and Dornan 1988). As performance incentives target healthcare providers' behavioral changes, they potentially represent a powerful tool to raise providers' responsiveness to patients' needs and therefore increase patients' satisfaction. Further research is needed to explore mechanisms through which one can influence providers to modify their behaviors and those through which patients' perception of services evolve. As patients' perception depends on individual and cultural factors (Hall and Dornan 1990, Crow et al. 2002, Sitzia and Wood 1997, Hekkert et al. 2009), performance-incentives must be tailored to the particular setting in which they are implemented and to the characteristics of the target population.

6.1.4. CHAPTER 4: DISTRIBUTIONAL EFFECT

Healthcare service delivery in LIC is characterized by large inequalities in access to basic health services. Wealth related inequalities are the most documented, with the poorest quintiles using fewer healthcare services despite greater needs (Barros et al. 2012). In this context, all health system reforms should converge to cut avoidable inequalities.

Among the potential perverse effects of performance incentives, the risk that the search for more efficiency jeopardizes equity is widely cited. Performance incentives rely on market-based mechanisms according to which the right incentives will lead to an efficient allocation of resources. Welfare economics however recognizes that the market can lead to a suboptimal allocation, in particular, in the presence of large externalities, as in the health sector. As supply oriented mechanisms, such as PBF, do not focus on the distribution of benefits, the potential tension between efficiency and equity (Okun 1975) stands for a major risk. In the health sector, policymakers generally rely on demand side strategies, such as health insurance or conditional cash transfers, to improve equity in access to services. Although these strategies have demonstrated their efficacy (Victora et al. 2003, Lagarde, Haines, and Palmer 2009), simultaneously implementing incentives that aim to increase access to services for the entire population by boosting the

demand of basic health services on the one hand, and the supply of services on the other hand, requires an examination of how they interact. It is not optimal, from a policy angle, to consider that each strategy will achieve its objectives without impacting another. Chapter 4 thus demonstrates that the equity impact of measures targeting efficiency, such as PBF, must be documented. This is of upmost importance to avoid potential perverse effects.

Chapter 4 expands on existing evidence from Rwanda on the positive impact of PBF on the utilization of basic health services (Basinga et al. 2011). It sought to explore whether the increase in utilization of basic maternal and child health services, in light of PBF, was equally distributed among wealth groups. As the literature suggests that targeting is necessary to ensure equity (Gwatkin 2009), the hypothesis was that PBF had no impact on equity in Rwanda, as the poor were not explicitly targeted; doubts remained on whether the strategy would be pro-rich. Chapter 4 builds on two rounds of household surveys collected before and after the implementation of PBF in treatment facilities which provide information on service utilization. The population was categorized in two wealth groups (upper and lower), using a principal component analysis. Difference-in-difference regressions were run to isolate the net impact of PBF on the utilization of basic health services on the total population and on the two subgroups to identify any potential differential effects according to wealth status.

Results show that, as its main focus is on supply side barriers, PBF leads to efficiency gains rather than equity improvements. PBF in Rwanda tended to focus on those easier to reach; generally the most affluent. It was less effective in reaching the poorest. When financial barriers to healthcare utilization are too high, as is the case for the lower group of women, PBF cannot affect utilization. When lower group women are insured, however (and thus the financial barrier disappears), utilization increases due to PBF. Chapter 4 argues that PBF programs should include built-in mechanisms targeting the most vulnerable. Further, it suggests that the impact of PBF should be understood together with the specific development of health insurance coverage and the organization of the health system.

In the absence of incentives to target the vulnerable, providers have the perverse incentive to cherry-pick patients that are easier to reach to raise utilization of services and thus their earnings, as reported in the literature (Gwatkin 2009). This is generally at the expense of the poorest as they live in more remote areas, further from their health facility and have less access to information. In that context, it is critical that policymakers explore synergies between strategies aimed to raise utilization of health services from the supply and demand sides to make sure perverse effects are controlled for. Demand side incentives could help raise demand for services among those that use them the least.

6.1.5. CHAPTER 5: SPATIAL DISPARITIES

Regional inequalities are a major impediment to equitable access to health services in LIC but they are not well documented; indeed, the effect of PBF on spatial disparities has never been explored. Chapter 5 highlights large spatial disparities in access to basic maternal and child health services in Rwanda reflecting inefficiencies in service delivery. Along with many governments of LIC, the government of Rwanda engaged in fiscal decentralization to improve service delivery of social services by making more financial and human resources locally available. With decentralization, local decision makers and managers of health facilities gained more control over decisions and could adapt strategies to the needs of their populations. Chapter 5 assesses how PBF interacts with fiscal decentralization and how it impacts regional inequalities in access to basic health services.

Chapter 5 uses household level data aggregated at the district level on the utilization of basic health services and coefficients of variation to describe spatial diversity in the utilization of services overtime. Regression-based inequality decomposition (Fiorio and Jenkins 2010) enabled the identification of the determinants of spatial disparities in the utilization of basic health services and to quantify their relative contribution. More precisely, the contributions of the Gini index (to proxy income inequalities), per capita district health budget (to measure the effect of decentralization) and PBF were measured.

Results revealed that by bringing decision making and resources closer to beneficiaries, decentralization has a positive impact on the reduction of spatial

disparities. PBF can contribute in dissipating spatial disparities in the utilization of basic health services. It reinforces the impact of decentralization and closes part of the gap between regions due to a leveling effect. Chapter 5 thus revealed that PBF can reinforce the impact of broader reforms. It concluded that policymakers should explore synergies between decentralization and PBF to reduce spatial disparities as decentralization and PBF pursue the same efficiency objective. The recognition that decentralization can reduce inequalities between regions is particularly important in the context of LIC as those inequalities contribute to the under-performance of health services. The mutually reinforcing effect of decentralization and performance-based financing confirms that decentralization improves efficiency in the use of resources. The theory of fiscal decentralization indeed suggests that it promotes informal competition between districts and incentivizes decision makers to increase satisfaction levels of their population. Decentralization also favors efficiency in public spending as local decision makers seek to generate savings for other purposes.

As reported in the literature, PBF can generate a tension between efficiency and equity (Ireland, Paul, and Dujardin 2011, Okun 1975). PBF does not naturally improve equity in access and it can, in some instances, deter equity as the richest can be the main beneficiaries of an increased supply of services. This is a potentially negative finding, particularly for LIC, that policymakers implementing PBF should be aware off. Household wealth (that is to say - being a poor household in a community or living in deprived regions) has a direct causal effect on health (Deaton 2003, Marmot 2005, Pritchett and Summers 1996). Wealth related inequalities (due to income or regional disparities) hamper progress in health outcomes and contribute to a vicious cycle of bad health and poverty: factors related to poverty are also determinants of ill-health; and ill-health, malnutrition and high fertility are the main reasons for such impoverishment (Soucat and Yazbeck 2001).

However, ways to avoid perverse effects on equity do exist. When combined with strategies that aim to overcome perverse effects, PBF can be a good reform catalyst as it amplifies benefits of other strategies. When combined with a strategy that boosts efficiency in service delivery and aims to cut inequalities (such as decentralization), it can reinforce the effect of the strategy. Similarly, it reinforces

the impact of health insurance, but cannot alone improve access to care for the poorest in the absence of financial protection. Further research on the contextual factors that facilitate the apparition of those synergies would help policymakers.

6.2. ACADEMIC CONTRIBUTION OF THE THESIS

The value-added of this thesis is at least threefold. First, it shows that one can use the results of an impact evaluation to perform a sound analysis and generate interesting findings that were not the primary objective of the impact evaluation. Often, impact evaluations in the health sector are used to measure the impact of an intervention on one single outcome of interest (e.g. utilization of a service, out-of pocket expenditures). The impact evaluation of PBF in Rwanda used in this thesis primarily aimed to quantify the impact of the financial incentives on the utilization of basic maternal and child health interventions at primary healthcare facilities. However, this thesis demonstrates that the different databases available (household data, individual data, facility data and patients' interviews) can be used in an uncommon way to generate interesting findings, while still building on the strengths of the impact evaluation. This is an important lesson learned, as impact evaluations are costly and timely and their databases are generally underused. In a resource limited environment and given that the literature often highlights the need for more robust research, one should consider exploiting more of the existing databases.

Second, one of the strengths of this thesis is its exploration of interactions between different interventions. Generally, research papers, for ease of interpretation or because of data limitations, tend to focus on the impact of one intervention regardless of the surrounding reform environment. This thesis aimed to contextualize as much as possible the implementation of PBF in a broader context. The most important interventions that could have affected outcomes of interest, such as decentralization and health insurance, were interacted with PBF. This generated interesting results beneficial to policymakers in LIC.

Third, the thesis shows that borrowing from different disciplines can enrich the analyses. This thesis relied on various bodies of literature including economics, political economy, sociology, geography and psychology to capture the complexity of factors at stake throughout the chapters. Similarly, mapping, as well as a large array

of econometric techniques, was used to accommodate for the different subjects under study.

6.3. LIMITATIONS

6.3.1. DATA LIMITATIONS

The first limitation related to the data is reported by Basinga et al. (2011) and also in the first chapter of this thesis. The original randomized design of the impact evaluation of PBF in Rwanda was compromised by the decentralization process as some facilities that were in the control group were reassigned to treatment group, thus shifting the study to a quasi-experimental status. Nevertheless, the analysis of baseline characteristics shows that any possible confounding bias in the estimates are unlikely as individuals and facilities remained comparable in the two groups.

Second, the observation period of 23 months is not long enough to observe the long term impact on changes for some indicators. Changes observed could be larger with a longer treatment period; on the contrary, some observed changes could disappear with time as providers get used to an incentive. Some indicators that were found insignificant may also become significant after more time. It is, for instance possible, that the 23 month period was not enough for observing an effect on family planning or preventive care as more time is required to change people's habits and raise their awareness and knowledge of available services.

Third, the impact evaluation was conducted on 19 districts out of the 30 districts in Rwanda, so to exclude districts that previously piloted the strategy. Although this was a sound decision from a research design perspective, one cannot observe the impact of the strategy at a national scale. The impact evaluation excludes the three urban districts of the country (located in the capital city) and therefore data is limited to rural Rwanda. The analyses on regional disparities and wealth related inequalities in access to services are thus underestimating the size of the gaps in the country.

Fourth, a related limitation deals with the generalizability of results for the country. As the analyses were performed on rural areas, findings may not be replicable to urban areas. For instance, the staff shortage in urban areas is not the same as in

rural areas. Similarly, as most rich Rwandans live in urban areas, one would probably find a much more unequitable impact of PBF on access for the poorest in urban areas.

Fifth, a generalization of results from Rwanda to another country is difficult as Rwanda is an outlier in many respects. Rwanda is characterized by low corruption, well-grounded performance culture, large coverage of health insurance, rapid and successful implementation of fiscal decentralization and major improvements in the availability of healthcare providers at primary healthcare facilities, even in remote areas. This makes the country hardly comparable with any other on the continent. The strength of the evidence from Rwanda comes from the fact that it shows what can be achieved under favorable conditions. The positive outcomes from Rwanda should thus encourage other countries to follow in its path.

6.3.2. DESIGN OF THE STUDY

The analyses performed in this thesis were not the analyses for which the impact evaluation was conducted in the first place. It was not possible in some instances to use the difference-in-difference method that allows an estimation of the net effect of PBF controlling for other factors. In Chapter 3, errors in data collection at baseline did not allow using baseline data to assess the effect of PBF on patients' satisfaction. Only data collected at follow-up was used assuming that satisfaction was comparable at baseline in treatment and control groups (which is true for the satisfaction of households). Chapter 3 is therefore unable to demonstrate the impact of PBF, but only causality. For the analysis of spatial disparities in Chapter 5, data had to be aggregated at the district level. As there are only 19 districts in the impact evaluation and two waves of observations, the total number of observations is 38, which is a small sample size. To ensure that results reported in Chapter 5 were robust, several robustness checks were run. The chapter concludes that one can be confident in the estimates.

In addition to those limitations, one must remain aware of the potential downsides of randomized controlled experiments. Standard methods of impact evaluation may leave gaps between what we know about the effectiveness of an intervention, and what we want to know. Evaluations must question the intervention itself, what it

aims to address and whether it is the right intervention. This requires us to conceptualize the case for the intervention to better identify policy objectives, constraints and the causal links through which the specific intervention yields its expected outcomes (Ravallion 2009). Although this thesis aimed to look at the surrounding factors of the intervention under study and at its unintended effects (as opposed to the stated outcome of interest of the impact evaluation), the fact that this thesis relies on secondary data analysis and that it was not possible to influence the design of the intervention did not enable the researcher to question the soundness of the intervention. More thinking about policy-relevant questions at the onset would have enabled a minimization of some of the downsides highlighted in this thesis, such as the inequitable impact of the strategy in some instances.

A common criticism of impact evaluation (Woolcock 2013, Ravallion 2009) is that they focus more on internal validity, that is to say, on whether they have controlled for all factors so that valid inferences can be drawn about the impact of the intervention, rather than on their external validity. As for internal validity, the major concerns relate to controlling for a spillover effect and heterogeneity. The assumption that the impact of the intervention does not spillover to those in the control group is questionable as contamination of the control group is difficult to avoid. Results of impact evaluation also tend to assume a homogeneous impact across individuals receiving the treatment. This is however unlikely to be true as the impact may vary according to individual characteristics or preferences (Ravallion 2009). In this thesis, the heterogeneity of impact was taken into account due to the inclusion of the interactions in regressions. However, as some factors are unobservable, it remains imperfect.

In the literature, the external validity of impact evaluation results is rarely discussed although it is crucial to know whether inferences can be drawn from the results for other projects in the same or different settings (Ravallion 2009, Woolcock 2013). One of the main objectives of an impact evaluation is that others can learn from the results of the evaluation and draw lessons for future interventions. This assumes the generalizability of results to everyone and all settings. To address some concerns about external validity, Woolcock (2013) argues that one needs firmer analytical foundations or "key facts" to better interpret results including "causal density"

which relates to the complexity of an intervention and its constituent elements; an "implementation capability" which is the extent to which an organization can realistically implement the same intervention in a new context; and "reasoned expectations" which corresponds to the extent to which the stated impact is understood within the context of a grounded theory of change. In the case of Rwanda, section 1.6 has emphasized the particular political, social and reform contexts in which PBF was introduced in Rwanda. The external validity of results presented in this thesis is therefore uncertain for countries that may be characterized by a poor performance culture, a slow pace of reforms, corruption and poor access to health services, which is the case for most LIC. The results of this thesis are however interesting in that they show what can be achieved in a reform-friendly environment. This can indeed give an incentive for other countries to accelerate the pace of reforms.

To open the "black box" of the impact evaluation (Ravallion 2009), further analyses, using qualitative techniques, are needed to understand why the intervention had an impact in the case of Rwanda. Understanding the contextual factors that contributed to the estimated impact, such as the political, cultural, administrative and economic environment, would add value to the lessons learned from the impact evaluation. Using qualitative methods on top of quantitative techniques can contribute in a number of ways: it can help in generating hypotheses grounded in reality; it can help understand the direction of causality; it can help understand the nature of bias and measurement error; it can facilitate cross-checking and replication; it provides elements of context that help interpret quantitative findings and enhance generalizability of findings; and, it can improve the measurement of outcomes and find ways to measure the "unobservables" (Rao and Woolcock 2003). Although quantitative methods were appropriate in measuring levels and changes in impacts for analyses and data used in this thesis, they were less effective in helping us understand the process or mechanisms by which the observed impact was achieved. Integrating different approaches through mixed-methods could have brought significant insights for interpreting the results.

7. POLICY RECOMMENDATIONS

Based on the evidence generated in this thesis on the impact of PBF on productivity, responsiveness and equity in Rwanda, policy recommendations are formulated. They relate to the use of PBF in general, implementation arrangements as well as broader health system strengthening efforts.

7.1. OVERARCHING RECOMMENDATION

Health systems in LIC are plagued by under-performance. The supply of healthcare services is insufficient and of poor quality, demand for healthcare is inadequate, and access to services is hampered by financial and physical barriers. Besides, the health workforce that plays a pivotal role in the health system lacks motivation to improve service delivery (Mills 2014).

The implication of the findings from this thesis is that advocating for more resources to be available to health systems is not enough. Doing more with existing resources is necessary, both from a public health perspective and in convincing decision makers and the donor community that additional resources put into the health system will make a difference. This is the spirit of the Tunis declaration on Value for Money, Sustainability and Accountability in the Health Sector that was signed by African Ministers of Health and Finance in July 2012 (Joint Declaration by the Ministers of Finance and Ministers of Health of Africa 2012) which recommends to "improve efficiency in health systems, including equitable access to skilled health workers and the introduction of measures such as results-based financing and incentives to enhance transparency and performance and reduce wastage".

The health workforce is central in raising health systems' performance. Increased motivation can raise performance in service delivery and reduce wastage as motivated healthcare providers can make a better use of inputs. A central question to raising a health system's performance and to provide answers to this thesis is "how do we motivate healthcare providers?" Human resource management strategies put increasing emphasis on strategies that can influence workforce behavior. Of all these strategies, performance incentives are probably the most popular, both in HIC and LIC. However, performance incentives have potential

perverse effects, but the probability that they occur is unknown as most are not well documented (Ireland, Paul, and Dujardin 2011, Witter et al. 2012).

This thesis argues that providers' motivation improves with financial incentives and that PBF is an interesting tool to improve value for money and reduce wastage in LIC. These countries experience unacceptable levels of maternal and child mortality, although high-impact low-cost interventions exist. Underperformance of health systems is hampering progress. In the absence of an effective incentive mechanism, the underpaid and poorly motivated health workforce has little incentive to deliver better services. Provider payment mechanisms that focus on inputs rather than outputs have failed to raise performance. This thesis advocates a need to switch to output-based payment mechanisms, as this aligns healthcare providers' objectives with those of the purchaser of health services or those of the patients. Performance incentives contribute in raising health workforce performance and improving the efficient use of resources for an improved service delivery.

Greater health systems' performance can be achieved through human resource management strategies that raise health workforce motivation. Financial incentives to healthcare providers can overcome many service delivery challenges in LIC. Performance incentives are however not a magic bullet and their success largely depends on the context in which they are implemented. The following specific recommendations aim to draw the attention of policymakers and healthcare managers to interventions that can maximize gains in health systems' performance.

7.2. SPECIFIC RECOMMENDATIONS

7.2.1. BORROW FROM PRIVATE SECTOR MANAGEMENT STYLE IN THE HEALTH SECTOR TO RAISE EFFICIENCY

Historically, health sectors of HIC and LIC were exclusively public. They were fully financed by the government's budget; provision of services was a monopoly of the government; and, the management of funds was handled by the public sector (Barnum, Kutzin, and Saxenian 1995). The absence of a separation of functions was justified on the grounds that health is a public good that cannot be left to the market. The economic theory supports the intervention of the state in the health sector for three reasons: first, for public goods or services with large externalities (involving

efficiency); second, in the case of poverty (involving equity); and, third in the presence of an insurance market failure (where both inefficiency and inequity arise) (Musgrove 1996). Progressively however, recognition of health systems' inefficiencies have resulted in a slow but steady implementation of reforms aimed to introduce more competition between providers and raise efficiency in the use of resources, which characterize the private sector management style.

Although most, if not all, global health systems have experienced reforms inspired by the market, a heated debate remains on whether the state should borrow private sector management styles for the health sector. This debate has been crystalized around unpopular reforms promoted by the International Monetary Fund under 'structural adjustment programs'. These programs were viewed as short-term austerities that would lead to long-term growth and development. However, these inter-temporal trade-offs were not acceptable in the health sector (Peabody 1996). However, the new wave of reforms is radically different since management styles are borrowed from the private sector to raise efficiency, but do not privatize the health sector. Reforms currently promoted in the health sector aim to achieve greater performance through hands-on professional management, standards for performance, control of outputs rather than inputs, competition in the public sector, use of private sector management practices and more discipline and efficiency in resource use (Hood 1991). Such reforms can strengthen efficiency in the public provision of services and help address challenges of health systems.

Performance-based financing is part of that movement and this thesis demonstrates its positive impact on health system performance. The empirical results from Rwanda presented in section 0 reveal that with PBF, more outputs (health services) can be produced with the same inputs (human resources). Regression analyses using the WPI revealed no linear effect of PBF on the WPI but a nonlinear relationship as PBF raises workforce productivity through reduced absenteeism and higher workloads. Addressing the human resource shortage by recruiting more healthcare providers may thus not be the only way to increase the quantity of services delivered. The case study from Rwanda demonstrates that with PBF, efficiency gains, as recommended by Ministers of Finance and Health in the Tunis declaration, are possible. Other contracting arrangements can help address

inefficiencies in health systems in LIC. Contracting private sector entities to deliver services can increase access to services, whether that entity is non-for-profit or private (Mills 1998). It can also reduce the cost of services if contracting-out is used for non-clinical services, for instance (Lagarde and Palmer 2009). Contractual staff may also be a solution to incentivize healthcare workers to work in remote areas or to respond to a temporary shortage. The use of private suppliers can also improve supply chains and the availability of drugs for end users (England 2004, Schwartz and Bhushan 2004b).

7.2.2. TARGET POOR REGIONS AND POOR HOUSEHOLDS TO MAXIMIZE THE IMPACT OF REFORMS

Chapter 4 and 5 conclude that equity in utilization of healthcare services, which is an overarching goal of all health systems, cannot be reached unless strategies explicitly target the most vulnerable. The most common strategies aiming at improving access for the most vulnerable are health insurance, conditional-cash transfers and vouchers. Health insurance removes financial barriers to healthcare services and lowers the risk of catastrophic expenditures. Conditional-cash transfers and vouchers incentivize a specific population to use healthcare services.

The analysis conducted in Chapter 4 revealed that in the absence of a specific mechanism to reach the poorest, PBF tended to focus on the most affluent in the population and that PBF alone was not able to remove financial barriers to healthcare services. Chapter 5 explored spatial disparities in access to basic health services and the interaction between PBF and decentralization and revealed that PBF in Rwanda reinforced the impact of decentralization and contributed to close the gap between regions through a levelling effect. As PBF can deter access to services for the most vulnerable (Chapter 4) and therefore cut the benefits of demand side interventions, reforms promoted in the health sector, in particular those aiming primarily to achieve efficiency gains, should include a particular consideration for equity to avoid perverse effects. Section 4.5.3 shows that in the case of Rwanda, the combination of health insurance and PBF could make a difference for the poor as they could benefit from the PBF strategy only if they were insured. Other options could be considered. First, PBF can be used to incentivize providers to deliver services to the most in need. The poorest and more vulnerable

are generally harder to reach, but with the right incentive, providers can develop strategies to ensure they use services. Those households can be identified through geographic targeting (e.g. poorer villages or poorer districts) or through income targeting (e.g. poorer households in each community). Targeting options are generally discussed in a broader context in LIC. The decision related to the method chosen for targeting goes beyond the health sector and has financial, equity and sustainability implications (Hanson, Worrall, and Wiseman 2007). Second, demand side incentives targeting individuals or households can be used in parallel of PBF to raise demand among those that are harder to reach and use fewer services. As the thesis suggests, incentivizing providers is not sufficient to raise utilization of poorer individuals, conditional cash transfers or other forms of demand side incentives could incentivize individuals to seek care (Lagarde, Haines, and Palmer 2009). Third, community demand side incentives can also leverage demand for services in deprived communities, villages or districts. Indeed, subsequent to the successful evaluation of PBF at primary healthcare facilities, Rwanda implemented a community PBF scheme targeting the poorest health centers and combining supply and demand side incentives to increase the number of pregnant women consulting primary healthcare facilities for prenatal care and institutional deliveries (World Health Organization Regional Office for Africa 2013).

In addition to the above proposed innovative ways to improve equity in access to basic health services, continued investments in health systems are needed to ensure sufficient inputs to deliver quality health services, in particular, in the most deprived areas. The case study on Rwanda shows that large improvements in utilization of health services were accompanied by a massive recruitment of healthcare workers in rural areas and by increased financial resources to districts and health facilities through fiscal decentralization (Chapter 5). Further, autonomy of health facilities has enabled them to generate resources and manage inputs as they deem necessary, incentivizing them to maximize efficiency gains. Decentralization proved to be efficient in making the key inputs (financial resources and human resources) locally available, in incentivizing local decision makers to raise value for money and in raising the satisfaction of the population by granting better access to basic services (Costa-Font and Rico 2006). This reform, which goes beyond the health sector, can

thus be pursued to narrow the gap between regions. Significant enabling factors probably facilitated the success of the reform in Rwanda, such as the low corruption and performance culture.

7.2.3. SEE PATIENTS AS CONSUMERS OF HEALTHCARE SERVICES

Contrary to what is observed in HIC, patients' satisfaction is often overlooked in LIC. The major difference between HIC and LIC lies in the fact that HIC are characterized by growing consumerism. Patients are seen as consumers that healthcare providers must satisfy to ensure they will visit again and hence increase their earnings. As a consequence, healthcare providers are concerned with patients' satisfaction and are incentivized to raise responsiveness to patients' needs.

The empirical results from Rwanda presented in Chapter 3 suggest that even in the absence of measurement of patients' satisfaction embedded in the PBF scheme, performance incentives can raise healthcare providers' responsiveness to patients' needs and patients' satisfaction, thus demonstrating the existence of a link between responsiveness and health workforce performance. The literature review from HIC countries suggests that the impact of PBF on patients' satisfaction could be even greater if explicitly targeted by the scheme.

One of the reasons for poor utilization of basic health services in LIC is the lack of trust populations have in their health systems. Knowing that their voice counts and healthcare providers are held accountable would positively impact on how populations perceive health systems. In that context, LIC could build on the experience from HIC to measure patients' satisfaction routinely, as any other measure of performance. Indeed, the new generation of PBF schemes now implemented in LIC includes a measurement of patients' satisfaction. This generates an incentive for healthcare providers to be more responsive to patient needs and incentivizes patients to seek more care and to increase adherence to treatment.

7.2.4. FAVOR EVIDENCE-BASED DECISION MAKING

This thesis reports on the debate that exists between proponents and opponents of performance-based financing in Rwanda. Although the strategy is implemented in more than 20 countries in Africa, evidence on some critical aspects of the strategy

remains poor. The literature review also highlights mixed results that do not enable us to ascertain what impact performance incentives have on a given dimension.

It is recommended that policymakers rely on more robust evidence to set up strategies. Unfortunately, policy debates are largely ideological as evidence is scant and of poor quality. In light of what Rwanda did for PBF, policymakers should seek to embed rigorous impact evaluations in the roll-out of any new strategy. Such evaluations are not necessarily costly and future gains in terms of efficiency and knowledge are worth the investment. Learning lessons from one's experience as well as from other countries is important in avoiding errors and building on positive experiences. For instance, Rwanda organizes study tours for other African countries wishing to implement PBF.

7.3. AGENDA FOR FUTURE RESEARCH

This section briefly highlights research areas worth exploring to complement the growing body of evidence on performance-based financing. First, it would be interesting to test and evaluate the impact of incentives to address health systems' bottlenecks in LIC. For instance, one could test whether PBF can contribute in improving the availability of staff in remote areas, as this stands for a major impediment for efficient and equitable service delivery in LIC. Well-designed incentives may help to attract staff to work in remote facilities, although this phenomenon was not observed in Rwanda. One could however test if increasing PBF financial rewards in regions that suffer from the largest health workforce shortage would incentivize staff to work in remote areas. Assessing how financial incentives can raise healthcare providers' responsiveness and thus patients' satisfaction would also be highly beneficial as the evidence base is limited but the topic is of high interest.

Second, some aspects of PBF still need to be explored. In particular, its cost-efficiency is not documented, although it is a critical element for LIC that suffer from a lack of financial resources. Similarly transaction costs of PBF, which are necessarily high due to increased reporting, should be quantified to better assist policymakers in their decisions (Ireland, Paul, and Dujardin 2011). Positive spillover effects of PBF on health system performance (such as the reduction in disparities,

improved responsiveness and satisfaction) should however be taken into account when judging PBF against another strategy. Ireland, Paul, and Dujardin (2011) argue that the focus of research related to PBF should be on the reasons why and how the intervention is working, rather than whether or not it is working. Although this statement is too categorical as some important aspects related to whether PBF works need to be explored; as demonstrated by this thesis, it is true that understanding the underlying forces that support or prevent the successful implementation of PBF are needed. As PBF relies on changes in health workforce motivation to achieve specific targets, determinants of health workforce motivation in a given context are critical in understanding observed changes. Efficient implementation of the strategy would also not be possible without a certain level of financial and human resources that stand for the key inputs in the delivery of healthcare services. As demonstrated in Chapter 5, fiscal decentralization in Rwanda significantly contributed in cutting staff shortages and making resources available locally. Autonomy of health facilities was also a key determinant as they were free to use their resources (financial and human) as they deemed necessary.

Third, qualitative research on PBF is needed to understand the underlying success or failure factors. This thesis shows what evidence can be produced on PBF using quantitative analyses. It also reports, through the literature review, that most evidence on PBF results from quantitative analyses because the most explored aspect of PBF is its impact on quantity and process quality of services. Knowing how healthcare providers perceive the strategy, how they cope with it and how it affects their intrinsic motivation and working environment would enable us to refine the bonuses and ultimately to achieve more efficiency gains. Similarly, Chapter 3 reveals that more evidence is needed on patients' perception of PBF to ascertain that efficiency gains are not deterred by negative patient perceptions and thus a lower demand for healthcare services. Finally, qualitative research would help capture the effect of PBF on providers' workloads and evaluate the magnitude of transaction costs.

APPENDIXES

Appendix 1: Overview of the main performance incentive schemes evaluated in low income countries

Authors	Country	Description/ target of incentive	Area(s) incentivized	Payment	Evaluation Methodology	Finding
Basinga et al. (2011)	Rwanda	Performance-based financing in primary healthcare facilities to raise utilization and quality of basic health services	14 maternal and child health services	Payments to facilities based on the quantity of services conditional on quality. Average payment to treatment facilities given to control facilities.	Randomized impact evaluation. 12 districts serve as treatment group; 7 districts are in the control group.	Coverage of any prenatal care visits, institutional deliveries, and child preventive care increases. Quality of prenatal visit is also higher in treatment facilities
Loevinsohn and Harding (2005), Eichler (2006), Bhushan, Keller, and Schwartz (2002)	Cambodia	2 different models: contracting out contracting in. Other districts managed by Government without budget supplement	Rural primary healthcare and district hospital services	Contracting out: NGO contracted to provide a package of services to a district. Contracting in: additional $0.25 per capita to use as staff incentives.	Randomized controlled study with 12 districts as experimental units	Larger improvements in prenatal care coverage in contracting out and contracting in districts. The poor have benefited disproportionately from contracting. Cost of contracting higher but led to savings in OOP.

Authors	Country	Description/ target of incentive	Area(s) incentivized	Payment	Evaluation Methodology	Finding
Bonfrer, Van de Poel, and Van Doorslaer (2014)	Burundi	Incentives based on quantity and quality of services provided.	Maternal and child health services. HIV, TB, malaria services	On top of the quantity based payments, facilities receive a quality bonus ranging from 0 to 25 percent.	Compare treatment and control provinces using DHS data.	Improved quality of care during prenatal care but no improvement in timeliness. Increase in institutional deliveries among the better off. Increase in probability of a child being fully vaccinated.
Canavan, Toonen, and Elovainio (2008)	Tanzania	Target payments	VCT,OPD, IPD, institutional deliveries, availability of essential drugs	Intervention facilities paid fixed amount at start of year and equivalent value is available retrospectively if targets are met.	Performance compared retrospectively with selection of government facilities.	Mission facilities saw a decline in IPD, institutional deliveries and prenatal care compared to government facilities.

Authors	Country	Description/ target of incentive	Area(s) incentivized	Payment	Evaluation Methodology	Finding
Loevinsohn and Harding (2005), Eichler (2006), Eichler et al. (2007)	Haiti	3 pilot NGOs	Primary healthcare	Payment is a combination of fixed quarterly payments based on 95% of the estimated cost of producing the defined package and NGO can earn the 5% plus an additional 5% if all performance targets are achieved.	In the pilot year, an independent firm was contracted to measure baseline and end of pilot period performance. Then performance targets are self-reported by NGOs with random audits.	All 3 NGOs exceeded the performance targets for immunization coverage. ORS increased in 2/3. Weak performance in ANC and contraceptive use. Availability of contraceptive increased.
Loevinsohn and Harding (2005), Eichler (2006)	Guatemala	Government contracted NGOs to deliver a package of health services. 3 models: a service delivery type of contract, a management contract and a control group.	Rural primary healthcare in mountainous areas.	Contracts with NGOs were fixed-price at $6.25 per capita per year.	Controlled designs based on household survey 3 years after the contracting. No baseline data available.	Results were not reported in the grey literature

Authors	Country	Description/ target of incentive	Area(s) incentivized	Payment	Evaluation Methodology	Finding
Loevinsohn (2008)	8 countries	National TB programs provide TB drugs to private practitioners in exchange for compliance with national standards of TB care.	TB	Direct monetary incentive in 1 case	Mostly before and after designs.	Working with private practitioners can achieve high rates of treatment success and increase case detection rates.
Loevinsohn (2008)	Afghanistan	International and local NGOs contracted in 8 provinces.	Basic package of health services	Performance bonuses if NGO achieves quality and coverage targets.	Health facility assessments carried out each year by a third party. Quality index.	Contracted facilities had large improvements in quality of care whereas quality worsened in facilities managed by Government.

Authors	Country	Description/ target of incentive	Area(s) incentivized	Payment	Evaluation Methodology	Finding
Loevinsohn and Harding (2005), Loevinsohn (2008)	India	2 contracts: one with NGOs for training, outreach and monitoring and subcontracts between NGOs and private providers for changing their proactive behaviors.	Childhood illnesses. Training and follow-up aimed at improving case management. Intervention in 10 villages	NGOs were reimbursed on the basis of expenses.	Before and after design in which household surveys were undertaken with the parents of children under 5 who were ill the last 2 weeks.	Large improvement in the management of childhood illnesses by private practitioners
Loevinsohn and Harding (2005)	Bangladesh	NGOs train, supervise, pay and support the community nutrition promoters within the Bangladesh Integrated Nutrition Project	Rural community nutrition services		Controlled before and after study with 6 experimental and 2 control sub districts	Reductions in rates of moderate and severe malnutrition were slightly greater in project areas compared with control. Significant improvements in other health services. Results achieved at a high cost.

Authors	Country	Description/ target of incentive	Area(s) incentivized	Payment	Evaluation Methodology	Finding
Loevinsohn and Harding (2005)	Bangladesh	NGO contracted to provide outreach services and to operate health centers.	Urban primary healthcare	$0.65 per capita per year given to the NGO	Controlled before and after study with 15 contracts compared.	Significant improvement in maternal and child health (except for immunization). NGO was able to provide more and better quality health services
Loevinsohn and Harding (2005)	Bolivia	Management contract with NGO.	Primary healthcare in El Alto district		Controlled, B&A design. Issues: reliance on reporting system data of unknown accuracy, poor availability of data, short periods of observation and comparison of only 2 districts.	Deliveries increased by 41% compared with 20% in the control district. Increase in outpatient services.
Loevinsohn and Harding (2005)	India		TB control in Hyderabad		Controlled design with only after data from recording system	

Authors	Country	Description/ target of incentive	Area(s) incentivized	Payment	Evaluation Methodology	Finding
Loevinsohn and Harding (2005)	Madagascar and Senegal	NGOs contracted to deliver community based nutrition interventions.	Community nutrition services	Cost per direct beneficiary was $48 in Senegal and $15 in Madagascar.	In Madagascar, only project records on participants were available. In Senegal, before and after (17 months) + household survey on nutrition.	Modest effect on malnutrition rates.
Loevinsohn and Harding (2005)	Pakistan	NGO the Punjab Rural Support Program was given a management contract to run all the basic health units in Punjab	Primary healthcare in rural areas in a poorly performing district of Punjab.	NGO is given the same amount of budget as had previously been allocated for the Basic health units (BHU).	Retrospective controlled before and after design with a nearby similar district serving as the control area.	Coverage of preventive services is low in both districts and the rates of progress are similar. However, contracting resulted in an improvement in BHU use, patient satisfaction, and reduced OOP for BHU services.

Authors	Country	Description/ target of incentive	Area(s) incentivized	Payment	Evaluation Methodology	Finding
Peabody et al. (2010)	Philippines	Target payments	Improved management of common childhood illnesses, patient outcomes and patient satisfaction	Intervention designed as a study in public district hospitals	3 groups: bonus payment for doctors meeting higher quality of care; increased enrolment into Phil Health insurance for indigent children; no change group	Average number of monthly inpatients does not increase with bonus but increases with health insurance. Quality of care improved with PBF as well as patient outcomes.
Quy et al. (2003)	Vietnam	Performance incentives	Increased testing, treatment and referral of TB patients	Fixed incentive payment for private practitioners invited to join a public private mix project	No control group but information from other districts used to indicate the trend without the intervention	Improvement in case detection in intervention areas.

Authors	Country	Description/ target of incentive	Area(s) incentivized	Payment	Evaluation Methodology	Finding
Schwartz and Bhushan (2004a)	Cambodia		Immunization with equity goals.		Focus on fully immunized children defined as the variation of the proportion of fully immunized children across different levels of household wealth in contracted and not contracted) areas	Fully immunized children coverage increased for poorest and richest but the difference between rich and poor household decreased from 9.1% point to 5.7% before and after contracting.
Soeters (2009)	Burundi	Performance incentives with variable bonus for quality	Preventive care, management of conditions, patient education	Performance incentives in 2 provinces with fund holder organizations that negotiate contracts with individual health facilities, verify and pay for the performance.	2 PBF provinces compared to 2 provinces with input-based funding.	Better performance for institutional deliveries and use of bed nets. PBF also generated improvement in quality of care. OOP increased in control areas.

Authors	Country	Description/ target of incentive	Area(s) incentivized	Payment	Evaluation Methodology	Finding
Soeters et al. (2005)	Rwanda	Performance incentives	OPD, deliveries, vaccination, family planning, prenatal care and bed net use	Two provinces implemented different PBF method (different targets and payments)	Comparison of 4 provinces: 2 implementing PBF, 1 supported by bilateral donor with no PBF, 1 with no donor support but more government staff	OPD, family planning, measles immunization and institutional deliveries increased in treatment districts. Better quality score.
Soeters et al. (2011)	Democratic Republic of Congo	Performance incentives with variable top-up for quality	HIV, TB, deliveries, IPD, OPD, preventive care	Bonus for quantitative targets. 15% bonus if all quality indicators met	Two intervention districts funded by NGO implement PBF compared to 2 districts with input-based funding from another NGO	Positive effect only on knowledge of HIV and institutional deliveries. OOP increased in treatment areas.

Authors	Country	Description/ target of incentive	Area(s) incentivized	Payment	Evaluation Methodology	Finding
Sondorp et al. (2009)	Afghanistan	EC, USAID, WB implement different contracting mechanisms (with NGOs). WB incorporates performance bonuses and flexibility to use funds. EC and USAID do input-based reimbursements.	Primary healthcare	WB: output-based; EC and USAID: input-based	Balanced scorecard including health worker satisfaction index, equipment functionality index, drug availability index, lab functionality index, staff received training last year, infrastructure index.	All contracting schemes resulted in better access to services, better health outcomes and reduction of inequities among provinces. Better results in PBF NGOs
Vergeer and Chansa (2008)	Zambia	Performance incentives	IPD, deliveries, VCT, drug availability	Mission hospitals and health centers paid for meeting targets.	Control sites chosen retrospectively and non-randomly	Improvements in VCT in both groups. No change in institutional deliveries and ANC.

Appendix 2: Descriptive statistics from the satisfaction surveys (2008)

	Control group			Treatment group			Total			T-test of difference in means
	Obs.	mean	SE	Obs.	mean	SE	Obs.	mean	SE	
Adult care										
Public	675	63%	0.018	664	66%	0.018	1339	65%	0.010	0.227
Prescription	675	50%	0.019	664	54%	0.019	1339	52%	0.013	0.143
Laboratory test	675	4%	0.007	664	5%	0.008	1339	4%	0.005	0.553
Has primary education	675	39%	0.018	664	35%	0.018	1339	37%	0.013	0.158
Male	675	40%	0.018	664	37%	0.018	1339	38%	0.013	0.035
Age	675	39	0.609	664	39	0.622	1339	39	0.435	0.935
Has health insurance	675	95%	0.008	664	97%	0.005	1339	96%	0.005	0.007
Prenatal care										
Public	666	64%	0.018	693	68%	0.017	1359	66%	0.013	0.107
Drug prescription	666	6%	0.009	693	5%	0.008	1359	5%	0.006	0.594
Laboratory tests	666	1%	0.004	693	2%	0.005	1359	1%	0.003	0.121
Has primary education	666	43%	0.019	693	40%	0.018	1359	41%	0.013	0.222
Age	666	28	0.248	693	28	0.231	1359	28	0.169	0.525
Has health insurance	666	91%	0.010	693	93%	0.009	1359	92%	0.007	0.304
Waiting time (hours)	666	2.25	0.065	693	2.43	0.072	1359	2.34	0.049	0.066
Months pregnant	666	6.04	0.659	693	5.88	0.069	1359	5.96	0.047	0.111
First prenatal visit	666	67%	0.018	693	67%	0.018	1359	67%	0.013	0.868
Number of children	666	2	0.070	693	2	0.067	1359	2	0.048	0.568

	Control group			Treatment group			Total			T-test of difference in means
	Obs.	mean	SE	Obs.	mean	SE	Obs.	mean	SE	
Child care										
Public	505	63%	0.021	459	69%	0.020	964	66%	0.010	0.046
Drug prescription	505	39%	0.021	459	52%	0.023	964	45%	0.016	0.000
Laboratory tests	505	3%	0.007	459	7%	0.012	964	5%	0.006	0.001
Has primary education	505	44%	0.022	459	44%	0.023	964	44%	0.160	0.957
Male	505	9%	0.125	459	10%	0.014	964	10%	0.009	0.418
Age of respondent	505	30.2	0.334	459	30.1	0.385	964	30.1	0.253	0.842
Has health insurance	505	88%	0.014	459	91%	0.013	964	90%	0.009	0.102
Age of the child	505	2	0.060	459	2	0.057	964	2	0.042	0.769

Appendix 3: Maternal health sample baseline (2006) characteristics

	Lower group								Upper group								Total							
	Treatment			Control					Treatment			Control					Treatment			Control				
	Obs	Mean	SD	Obs	Mean	SD	Diff.	P-Value	Obs	Mean	SD	Obs	Mean	SD	Diff.	P-Value	Obs	Mean	SD	Obs	Mean	SD	Diff.	P-Value
Health facility characteristics																								
Public (=1)	415	0.70	0.09	432	0.60	0.10	0.10	0.500	205	0.63	0.10	238	0.70	0.11	-0.06	0.679	620	0.67	0.09	670	0.63	0.10	0.04	0.387
Household characteristics																								
Distance (km)	415	3.22	0.25	432	3.39	0.29	-0.17	0.657	205	3.29	0.29	238	3.42	0.30	-0.13	0.762	620	3.24	0.24	670	3.40	0.27	-0.16	0.666
Number of household members	415	5.10	0.14	432	5.26	0.15	-0.16	0.442	205	5.26	0.17	238	5.66	0.17	-0.39	0.124	620	5.2	0.11	670	5.40	0.12	-0.25	0.927
Women's characteristics																								
Married or live with a partner (=1)	415	0.93	0.02	432	0.89	0.02	0.05	0.117	205	0.97	0.03	238	0.95	0.03	0.02	0.566	620	0.95	0.02	670	0.91	0.02	0.04	0.107
Partner lives in household (=1)	415	0.98	0.01	432	0.97	0.01	0.02	0.110	205	0.98	0.01	238	0.98	0.01	0.00	0.837	620	0.98	0.01	670	0.97	0.01	0.01	0.162
Total number children alive	415	3.37	0.16	432	3.55	0.16	-0.19	0.426	205	3.45	0.15	238	3.44	0.15	0.00	0.988	620	3.39	0.12	670	3.51	0.12	-0.12	0.755
Total number pregnancies	415	4.34	0.24	432	4.41	0.27	-0.07	0.855	205	4.26	0.20	238	4.17	0.19	0.09	0.759	620	4.32	0.18	670	4.33	0.20	-0.01	0.515
Has primary education (=1)	415	0.35	0.04	432	0.37	0.04	-0.02	0.762	205	0.34	0.05	238	0.33	0.05	0.01	0.902	620	0.35	0.03	670	0.36	0.04	-0.01	0.555
Age<20 years (=1)	415	0.04	0.01	432	0.27	0.01	-0.23	0.382	205	0.01	0.01	238	0.00	0.01	0.01	0.649	620	0.03	0.01	670	0.62	0.01	-0.59	0.161
Age>35 years (=1)	415	0.21	0.03	432	0.34	0.04	-0.13	0.537	205	0.25	0.03	238	0.26	0.03	-0.01	0.876	620	0.29	0.03	670	0.31	0.03	-0.02	0.713
Health insurance (=1)	406	0.45	0.04	430	0.44	0.04	0.02	0.386	203	0.73	0.05	237	0.66	0.06	0.07	0.367	609	0.55	0.05	667	0.52	0.05	0.03	0.334
Dependent variable (utilization)																								
Institutional deliveries	349	0.35	0.04	362	0.31	0.03	0.03	0.506	173	0.35	0.06	205	0.45	0.04	-0.10	0.189	522	0.35	0.04	567	0.36	0.04	-0.02	0.800
4+ PNC visits	387	0.17	0.03	404	0.11	0.01	0.07	0.025**	200	0.20	0.03	232	0.13	0.03	0.08	0.094*	587	0.18	0.02	636	0.11	0.02	0.07	0.028**
PNC 1st quarter	389	0.12	0.02	405	0.09	0.02	0.03	0.268	199	0.10	0.03	234	0.10	0.03	-0.01	0.872	588	0.11	0.02	639	0.09	0.02	0.02	0.547

Note: *** p<0.01, ** p<0.05, * p<0.1

Appendix 4: Family planning sample baseline (2006) characteristics

	Lower group								Upper group								Total							
	Treatment			Control					Treatment			Control					Treatment			Control				
	Obs	Mean	SD	Obs	Mean	SD	Diff.	P-Value	Obs	Mean	SD	Obs	Mean	SD	Diff.	P-Value	Obs	Mean	SD	Obs	Mean	SD	Diff.	P-Value
Health facility characteristics																								
Public (=1)	503	0.67	0.09	546	0.64	0.10	0.04	0.779	246	0.65	0.10	297	0.71	0.11	-0.06	0.709	749	0.67	0.09	843	0.66	0.10	0.01	0.968
Household characteristics																								
distance (km)	503	3.36	0.23	546	3.34	0.25	0.02	0.946	246	3.36	0.27	297	3.39	0.28	-0.03	0.943	749	3.36	0.23	843	3.35	0.25	0.01	0.987
number of household members	503	5.03	0.18	546	5.10	0.19	-0.07	0.781	246	5.22	0.18	297	5.46	0.17	-0.24	0.350	749	5.09	0.14	843	5.23	0.15	-0.14	0.512
Women's characteristics																								
Married or live with a partner (=1)	503	1.00	0.00	546	0.99	0.00	0.00	0.561	246	1.00	0.01	297	0.99	0.01	0.00	0.788	749	1.00	0.00	843	0.99	0.00	0.00	0.573
Partner lives in the household (=1)	503	0.99	0.01	546	0.97	0.01	0.02	0.026**	246	0.98	0.01	297	0.97	0.01	0.01	0.640	749	0.98	0.01	843	0.97	0.01	0.02	0.108
Total number children alive	503	3.34	0.19	546	3.33	0.20	0.01	0.481	246	3.32	0.12	297	3.38	0.11	-0.06	0.634	749	3.34	0.14	843	3.35	0.15	-0.01	0.957
Delivered at health center/last pregnancy (=1)	363	0.28	0.03	356	0.24	0.03	0.05	0.335	197	0.26	0.05	225	0.35	0.05	-0.09	0.335	560	0.27	0.03	581	0.28	0.03	-0.01	0.870
Has primary education (=1)	503	0.36	0.02	546	0.36	0.02	0.00	0.969	246	0.30	0.05	297	0.32	0.05	-0.02	0.765	749	0.34	0.03	843	0.34	0.03	-0.01	0.865
Age in years	503	31.20	0.49	546	31.20	0.51	0.00	0.988	246	30.51	0.36	297	30.51	0.31	0.00	0.993	749	30.98	0.35	843	30.95	0.36	0.02	0.961
Health insurance (=1)	495	0.45	0.04	543	0.43	0.04	0.02	0.738	242	0.71	0.05	296	0.68	0.05	0.03	0.591	737	0.54	0.05	839	0.52	0.05	0.02	0.388
Dependent variable (utilization)																								
Family Planning	503	0.08	0.01	546	0.09	0.02	0.00	0.833	246	0.11	0.01	297	0.19	0.03	-0.09	0.009***	749	0.09	0.02	843	0.12	0.02	-0.03	0.154

Note: *** p<0.01, ** p<0.05, * p<0.1

Appendix 5: Child sample baseline (2006) characteristics

	Lower group								Upper group								Total							
	Treatment			Control					Treatment			Control					Treatment			Control				
	Obs	Mean	SD	Obs	Mean	SD	Diff.	P-Value	Obs	Mean	SD	Obs	Mean	SD	Diff.	P-Value	Obs	Mean	SD	Obs	Mean	SD	Diff.	P-Value
Health facility characteristics																								
Public (=1)	1035	0.67	0.09	1042	0.61	0.10	0.05	0.698	500	0.65	0.10	581	0.70	0.11	-0.05	0.759	1535	0.66	0.09	1623	0.64	0.10	0.02	0.899
Household characteristics																								
Distance (km)	1035	3.30	0.22	1042	3.29	0.25	0.01	0.986	500	3.27	0.28	581	3.26	0.30	0.01	0.979	1535	3.29	0.22	1623	3.28	0.24	0.01	0.979
Number of household members	1035	5.34	0.12	1042	5.42	0.13	-0.08	0.648	500	5.54	0.13	581	5.74	0.13	-0.20	0.296	1535	5.40	0.09	1623	5.53	0.09	-0.13	0.304
Mother has primary education (=1)	1035	0.99	0.00	1042	1.00	0.00	-0.01	0.357	500	1.00	0.00	581	1.00	0.00	0.00	0.945	1535	1.00	0.00	1623	1.00	0.00	0.00	0.333
Child characteristics																								
Age (years)	1035	2.35	0.05	1042	2.35	0.05	0.00	0.973	500	2.21	0.07	581	2.34	0.06	-0.13	0.235	1535	2.30	0.04	1623	2.35	0.04	-0.04	0.487
Female (=1)	1035	0.51	0.01	1042	0.49	0.01	0.02	0.429	500	0.52	0.02	581	0.51	0.01	0.00	0.920	1535	0.51	0.01	1623	0.50	0.01	0.01	0.501
Health insurance (=1)	991	0.44	0.03	1012	0.42	0.03	0.02	0.708	487	0.69	0.04	563	0.65	0.05	0.04	0.591	1478	0.52	0.04	1575	0.51	0.04	0.01	0.770
Dependent variable (utilization)																								
Received care at health center in the event of illness	476	0.20	0.03	478	0.22	0.03	-0.01	0.737	183	0.27	0.05	255	0.27	0.05	-0.00	0.987	659	0.22	0.03	733	0.24	0.03	-0.01	0.749

Note: *** p<0.01, ** p<0.05, * p<0.1

Appendix 6: Regression results for institutional deliveries

	Specification 1			Specification 2			Specification 3			Specification 4		
	Lower	**Upper**	**Total**	**Lower**	**Upper**	**Total**	**Lower**	**Upper**	**Total**	**Lower**	**Upper**	**Total**
Treatment*post	-0.019	0.186***	0.074*	0.002	0.194***	0.071*	-0.043	0.208***	0.063	-0.051	0.197***	0.069
	(0.061)	(0.064)	(0.043)	(0.061)	(0.063)	(0.042)	(0.065)	(0.065)	(0.045)	(0.071)	(0.064)	(0.044)
Wave=0 if 2006, Wave=1 if 2008	0.170***	0.056	0.134***	0.157***	0.036	0.115***	0.175***	0.027	0.119***	0.142***	0.036	0.108***
	(0.043)	(0.045)	(0.030)	(0.044)	(0.045)	(0.031)	(0.045)	(0.046)	(0.032)	(0.049)	(0.045)	(0.032)
interaction between PBF and insurance							0.135**	-0.082	0.027			
							(0.061)	(0.077)	(0.047)			
Age < 20 years (=1)				0.149	-0.304*	0.052	0.153*	-0.301*	0.052	0.149	-0.304*	0.051
				(0.093)	(0.172)	(0.087)	(0.091)	(0.173)	(0.086)	(0.092)	(0.173)	(0.087)
Age > 35 years (=1)				-0.042	-0.000	-0.029	-0.044	-0.001	-0.029	-0.046	-0.002	-0.029
				(0.040)	(0.043)	(0.029)	(0.040)	(0.043)	(0.029)	(0.041)	(0.044)	(0.030)
Has primary or more education (=1)				-0.056*	-0.018	-0.039*	-0.054*	-0.019	-0.038*	-0.054*	-0.019	-0.039*
				(0.030)	(0.036)	(0.023)	(0.030)	(0.036)	(0.023)	(0.032)	(0.036)	(0.024)
Currently married/union (=1)				-0.004	-0.037	-0.008	-0.000	-0.037	-0.007	0.004	-0.036	-0.002
				(0.056)	(0.077)	(0.045)	(0.056)	(0.076)	(0.045)	(0.058)	(0.077)	(0.045)
Partner present (=1)				0.057	0.089	0.076	0.066	0.095	0.076	0.019	0.089	0.053
				(0.087)	(0.088)	(0.062)	(0.085)	(0.089)	(0.062)	(0.095)	(0.088)	(0.065)
Number of pregnancies				-0.018**	-0.024**	-0.022***	-0.018**	-0.024**	-0.022***	-0.021**	-0.023**	-0.024***
				(0.009)	(0.010)	(0.007)	(0.009)	(0.010)	(0.007)	(0.009)	(0.010)	(0.007)
Health insurance (=1)				0.039	0.142***	0.088***	-0.025	0.183***	0.075**	-0.022	0.143***	0.086***
				(0.031)	(0.039)	(0.024)	(0.042)	(0.054)	(0.033)	(0.042)	(0.039)	(0.024)
Public facility (=1)				-0.071**	-0.111***	-0.089***	-0.072**	-0.111***	-0.089***	-0.085***	-0.112***	-0.096***
				(0.030)	(0.033)	(0.022)	(0.030)	(0.033)	(0.022)	(0.032)	(0.033)	(0.023)
Number of household members				-0.004	-0.006	-0.002	-0.004	-0.005	-0.002	-0.002	-0.006	-0.000
				(0.010)	(0.011)	(0.008)	(0.010)	(0.011)	(0.008)	(0.011)	(0.011)	(0.008)
Household-Facility distance (in Km)				-0.027***	-0.023***	-0.024***	-0.027***	-0.023***	-0.024***	-0.025***	-0.023***	-0.022***
				(0.008)	(0.009)	(0.006)	(0.008)	(0.009)	(0.006)	(0.009)	(0.009)	(0.006)
Interaction between PBF and asset score										-0.634*	-0.010	-0.005
										(0.360)	(0.018)	(0.018)
Observations	1,112	996	2,108	1,092	987	2,079	1,092	987	2,079	972	987	1,959

Note: *** p<0.01, ** p<0.05, * p<0.1

Appendix 7: Regression results for prenatal care during the first trimester

	Specification 1			Specification 2			Specification 3			Specification 4		
	Lower	Upper	Total	Lower	Upper	Total	Lower	Upper	Total	Lower	Upper	Total
Treatment*post	0.009	0.022	0.006	0.003	0.026	0.005	-0.014	0.038	0.007	0.024	0.027	0.016
	(0.049)	(0.046)	(0.033)	(0.050)	(0.046)	(0.033)	(0.050)	(0.047)	(0.034)	(0.058)	(0.046)	(0.035)
Wave=0 if 2006, Wave=1 if 2008	0.140***	0.142***	0.145***	0.133***	0.153***	0.145***	0.140***	0.145***	0.145***	0.122***	0.153***	0.141***
	(0.034)	(0.032)	(0.022)	(0.034)	(0.033)	(0.023)	(0.034)	(0.033)	(0.023)	(0.038)	(0.033)	(0.024)
interaction between PBF and insurance							0.048	-0.078	-0.005			
							(0.042)	(0.058)	(0.033)			
Age < 20 years (=1)				0.022	0.002	0.014	0.022	0.001	0.014	0.017	0.002	0.010
				(0.066)	(0.140)	(0.061)	(0.066)	(0.142)	(0.061)	(0.066)	(0.140)	(0.061)
Age > 35 years (=1)				-0.023	-0.030	-0.025	-0.024	-0.031	-0.025	-0.020	-0.031	-0.024
				(0.028)	(0.033)	(0.022)	(0.029)	(0.033)	(0.022)	(0.029)	(0.033)	(0.022)
Has primary or more education (=1)				0.013	0.074**	0.039**	0.014	0.073**	0.039**	0.004	0.073**	0.035*
				(0.022)	(0.029)	(0.018)	(0.023)	(0.029)	(0.018)	(0.023)	(0.029)	(0.018)
Currently married/union (=1)				-0.070	-0.042	-0.063*	-0.068	-0.040	-0.063*	-0.061	-0.042	-0.059
				(0.044)	(0.071)	(0.038)	(0.045)	(0.071)	(0.038)	(0.044)	(0.071)	(0.038)
Partner present (=1)				-0.054	0.041	-0.008	-0.051	0.046	-0.008	-0.089	0.041	-0.025
				(0.065)	(0.070)	(0.048)	(0.065)	(0.070)	(0.048)	(0.070)	(0.070)	(0.050)
Number of pregnancies				0.003	-0.008	-0.001	0.003	-0.009	-0.001	0.000	-0.008	-0.003
				(0.006)	(0.008)	(0.005)	(0.006)	(0.008)	(0.005)	(0.006)	(0.008)	(0.005)
Health insurance (=1)				0.004	0.008	0.007	-0.019	0.045	0.009	-0.031	0.009	0.004
				(0.021)	(0.029)	(0.017)	(0.027)	(0.037)	(0.022)	(0.027)	(0.029)	(0.017)
Public facility (=1)				0.022	0.008	0.016	0.022	0.008	0.016	0.022	0.008	0.015
				(0.022)	(0.026)	(0.017)	(0.022)	(0.026)	(0.017)	(0.023)	(0.026)	(0.017)
Number of household members				0.008	0.000	0.003	0.008	0.001	0.003	0.012	0.000	0.005
				(0.008)	(0.008)	(0.006)	(0.008)	(0.008)	(0.006)	(0.008)	(0.008)	(0.006)
Household-Facility distance (in Km)				-0.005	-0.011**	-0.008*	-0.005	-0.011**	-0.008*	-0.004	-0.011**	-0.007*
				(0.006)	(0.005)	(0.004)	(0.006)	(0.005)	(0.004)	(0.007)	(0.005)	(0.004)
Interaction between PBF and asset score										-0.352	-0.004	-0.006
										(0.250)	(0.013)	(0.012)
Observations	1,184	1,039	2,223	1,165	1,030	2,195	1,165	1,030	2,195	1,047	1,030	2,077

Note: *** p<0.01, ** p<0.05, * p<0.1

Appendix 8: Regression results for 4+ prenatal care visits

	Specification 1			Specification 2			Specification 3			Specification 4		
	Lower	**Upper**	**Total**	**Lower**	**Upper**	**Total**	**Lower**	**Upper**	**Total**	**Lower**	**Upper**	**Total**
Treatment*post	-0.002	-0.018	-0.009	0.005	-0.010	-0.005	-0.007	-0.004	-0.006	-0.032	-0.008	-0.016
	(0.051)	(0.051)	(0.035)	(0.052)	(0.052)	(0.035)	(0.054)	(0.053)	(0.037)	(0.062)	(0.052)	(0.037)
Wave=0 if 2006, Wave=1 if 2008	0.130***	0.126***	0.132***	0.110***	0.118***	0.117***	0.115***	0.113***	0.117***	0.141***	0.117***	0.128***
	(0.035)	(0.033)	(0.023)	(0.036)	(0.035)	(0.024)	(0.036)	(0.036)	(0.025)	(0.041)	(0.035)	(0.025)
interaction between PBF and insurance							0.032	-0.042	0.002			
							(0.047)	(0.061)	(0.036)			
Age < 20 years (=1)				-0.006	-0.134	-0.044	-0.006	-0.135	-0.044	-0.016	-0.135	-0.049
				(0.066)	(0.118)	(0.058)	(0.066)	(0.118)	(0.058)	(0.066)	(0.117)	(0.058)
Age > 35 years (=1)				-0.070**	-0.018	-0.047**	-0.071**	-0.018	-0.047**	-0.068**	-0.019	-0.045*
				(0.030)	(0.036)	(0.023)	(0.030)	(0.036)	(0.023)	(0.031)	(0.036)	(0.023)
Has primary or more education (=1)				-0.000	0.012	0.005	0.000	0.012	0.005	-0.014	0.011	-0.002
				(0.024)	(0.030)	(0.018)	(0.024)	(0.030)	(0.018)	(0.025)	(0.030)	(0.019)
Currently married/union (=1)				0.003	0.021	0.008	0.004	0.022	0.008	0.014	0.021	0.015
				(0.040)	(0.068)	(0.034)	(0.040)	(0.069)	(0.035)	(0.040)	(0.068)	(0.034)
Partner present (=1)				0.096**	0.033	0.066	0.098**	0.036	0.066	0.075	0.033	0.054
				(0.048)	(0.077)	(0.043)	(0.049)	(0.076)	(0.043)	(0.053)	(0.077)	(0.046)
Number of pregnancies				0.014**	-0.000	0.008	0.014**	-0.000	0.008	0.011	-0.000	0.005
				(0.007)	(0.009)	(0.005)	(0.007)	(0.009)	(0.005)	(0.007)	(0.009)	(0.005)
Health insurance (=1)				0.025	0.063**	0.041**	0.010	0.083**	0.040*	0.016	0.063**	0.042**
				(0.023)	(0.030)	(0.018)	(0.030)	(0.037)	(0.023)	(0.030)	(0.030)	(0.018)
Public facility (=1)				-0.008	-0.030	-0.020	-0.008	-0.031	-0.020	-0.017	-0.032	-0.026
				(0.024)	(0.029)	(0.018)	(0.024)	(0.029)	(0.018)	(0.025)	(0.029)	(0.019)
Number of household members				-0.009	-0.007	-0.008	-0.009	-0.007	-0.008	-0.006	-0.007	-0.006
				(0.008)	(0.009)	(0.006)	(0.008)	(0.009)	(0.006)	(0.008)	(0.009)	(0.006)
Household-Facility distance (in Km)				-0.011*	-0.010*	-0.010**	-0.011*	-0.010	-0.010**	-0.014**	-0.010*	-0.011**
				(0.007)	(0.006)	(0.004)	(0.007)	(0.006)	(0.004)	(0.007)	(0.006)	(0.005)
Interaction between PBF and asset score										-0.115	-0.009	-0.008
										(0.271)	(0.014)	(0.013)
Observations	1,183	1,040	2,223	1,164	1,031	2,195	1,164	1,031	2,195	1,046	1,031	2,077

Note: *** p<0.01, ** p<0.05, * p<0.1

Appendix 9: Regression results for use of modern contraceptives

	Specification 1			Specification 2			Specification 3			Specification 4		
	Lower	Upper	Total	Lower	Upper	Total	Lower	Upper	Total	Lower	Upper	Total
Treatment*post	-0.076*	0.116***	0.018	-0.134***	0.172***	0.034	-0.101*	0.174***	0.054	-0.082	0.175***	0.069*
	(0.039)	(0.043)	(0.028)	(0.052)	(0.055)	(0.037)	(0.055)	(0.057)	(0.039)	(0.061)	(0.055)	(0.039)
Wave=0 if 2006, Wave=1 if 2008	0.235***	0.163***	0.218***	0.206***	0.065	0.136***	0.191***	0.064	0.126***	0.154***	0.065	0.118***
	(0.029)	(0.031)	(0.020)	(0.041)	(0.042)	(0.028)	(0.042)	(0.042)	(0.029)	(0.046)	(0.042)	(0.029)
interaction between PBF and insurance							-0.100**	-0.012	-0.068*			
							(0.045)	(0.070)	(0.038)			
Age				-0.000	-0.001	-0.001	-0.000	-0.001	-0.001	0.000	-0.001	-0.001
				(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)
Has primary or more education (=1)				-0.006	0.014	-0.003	-0.007	0.013	-0.003	-0.013	0.013	-0.006
				(0.023)	(0.033)	(0.019)	(0.023)	(0.033)	(0.019)	(0.023)	(0.033)	(0.020)
Currently married/union (=1)				-0.024	0.382***	0.188**	-0.016	0.383***	0.192**	0.141***	0.384***	0.284***
				(0.151)	(0.032)	(0.089)	(0.150)	(0.032)	(0.089)	(0.029)	(0.032)	(0.030)
Partner present (=1)				-0.085	0.053	-0.035	-0.092	0.055	-0.035	-0.088	0.054	-0.026
				(0.069)	(0.091)	(0.056)	(0.069)	(0.092)	(0.056)	(0.075)	(0.091)	(0.058)
Number of pregnancies				-0.016**	-0.014	-0.015**	-0.016**	-0.014	-0.015**	-0.015**	-0.014	-0.015**
				(0.007)	(0.010)	(0.006)	(0.007)	(0.010)	(0.006)	(0.007)	(0.010)	(0.006)
Health insurance (=1)				0.031	0.011	0.034*	0.079**	0.016	0.067**	0.048	0.011	0.030
				(0.023)	(0.035)	(0.019)	(0.033)	(0.051)	(0.027)	(0.033)	(0.035)	(0.019)
Public facility (=1)				0.029	0.039	0.028	0.031	0.039	0.028	0.025	0.037	0.035*
				(0.022)	(0.030)	(0.019)	(0.022)	(0.030)	(0.019)	(0.022)	(0.030)	(0.019)
Total number alive child				0.011	0.017	0.011	0.011	0.017	0.011	0.009	0.017	0.009
				(0.010)	(0.018)	(0.010)	(0.011)	(0.018)	(0.010)	(0.009)	(0.018)	(0.009)
Number of household members				0.010	0.011	0.015*	0.010	0.011	0.015*	0.011	0.011	0.016**
				(0.010)	(0.015)	(0.009)	(0.010)	(0.015)	(0.009)	(0.009)	(0.015)	(0.008)
Household-Facility distance (in Km)				0.005	0.008	0.006	0.006	0.008	0.007	0.009	0.008	0.009*
				(0.007)	(0.007)	(0.005)	(0.007)	(0.007)	(0.005)	(0.007)	(0.007)	(0.005)
Delivery assisted by a skilled attendant				0.020	0.042	0.039**	0.026	0.042	0.040**	0.024	0.042	0.042**
				(0.025)	(0.030)	(0.020)	(0.025)	(0.030)	(0.020)	(0.026)	(0.030)	(0.020)
Interaction between PBF and asset score										0.345	-0.010	-0.001
										(0.264)	(0.014)	(0.015)
Observations	1,706	1,566	3,272	1,059	966	2,025	1,059	966	2,025	942	966	1,908

Note: *** p<0.01, ** p<0.05, * p<0.1

Appendix 10: Regression results for curative care for children

	Specification 1			Specification 2			Specification 3			Specification 4		
	Lower	**Upper**	**Total**	**Lower**	**Upper**	**Total**	**Lower**	**Upper**	**Total**	**Lower**	**Upper**	**Total**
Treatment*post	0.048	0.02	0.039	0.063	0.004	0.027	0.035	0.024	0.027	0.016	0.006	0.017
	(0.048)	(0.056)	(0.035)	(0.05)	(0.057)	(0.039)	(0.053)	(0.06)	(0.039)	(0.06)	(0.057)	(0.038)
Wave=0 if 2006, Wave=1 if 2008	0.055*	0.061*	0.072***	0.014	0.024	0.024	0.027	0.013	0.024	0.044	0.024	0.036
	(0.032)	(0.037)	(0.024)	(0.034)	(0.039)	(0.026)	(0.034)	(0.04)	(0.026)	(0.039)	(0.039)	(0.026)
interaction between PBF and insurance						0.006	0.078*	-0.093	0.006			
						(0.037)	(0.046)	(0.062)	(0.037)			
Age				-0.022***	-0.009	-0.016***	-0.023***	-0.009	-0.016***	-0.021***	-0.008	-0.015**
				(0.007)	(0.009)	(0.006)	(0.007)	(0.009)	(0.006)	(0.007)	(0.009)	(0.006)
Sex				0.029	-0.064**	-0.013	0.031	-0.065**	-0.013	0.024	-0.064**	-0.021
				(0.023)	(0.028)	(0.018)	(0.023)	(0.028)	(0.018)	(0.024)	(0.028)	(0.018)
Mother has primary or more education (=1)				-0.02	0.04	0.007	-0.019	0.039	0.007	-0.024	0.042	0.007
				(0.023)	(0.029)	(0.018)	(-0.023)	(0.029)	(0.018)	(0.024)	(0.029)	(0.019)
Household-Facility distance (in Km)				-0.015**	-0.013*	-0.014***	-0.015**	-0.013*	-0.014***	-0.016**	-0.013*	-0.015***
				(0.006)	(0.007)	(0.005)	(0.006)	(0.007)	(0.005)	(0.006)	(0.007)	(0.005)
Health insurance (=1)				0.154***	0.204***	0.179***	0.117***	0.245***	0.179***	0.112***	0.205***	0.180***
				(0.023)	(0.031)	(0.024)	(0.031)	(0.039)	(0.024)	(0.033)	(0.031)	(0.019)
Number of household members				-0.018***	0.004	-0.008	-0.019***	0.004	-0.008	-0.016**	0.004	-0.006
				(0.007)	(0.008)	(0.005)	(0.007)	(0.008)	(0.005)	(0.007)	(0.008)	(0.005)
Interaction between PBF and asset score										-0.505*	-0.018*	-0.014
										(0.292)	(0.01)	(0.011)
Observations	1,469	1,150	2,619	1,370	1,074	2,444	1,370	1,074	2,444	1,215	1,074	2,289

Note: *** p<0.01, ** p<0.05, * p<0.1

Appendix 11: Regression results for preventive care for children

	Specification 1			Specification 2			Specification 3			Specification 4		
	Lower	**Upper**	**Total**	**Lower**	**Upper**	**Total**	**Lower**	**Upper**	**Total**	**Lower**	**Upper**	**Total**
Treatment*post	0.077***	0.098***	0.093***	0.092***	0.092***	0.092***	0.081***	0.098***	0.092***	0.064**	0.093***	0.092***
	(0.025)	(0.025)	(0.017)	(0.026)	(0.025)	(0.019)	(0.028)	(0.026)	(0.019)	(0.031)	(0.025)	(0.018)
Wave=0 if 2006, Wave=1 if 2008	-0.023	-0.029*	-0.030**	-0.018	-0.011	-0.018	-0.013	-0.015	-0.018	-0.006	-0.011	-0.019
	(0.017)	(0.017)	(0.012)	(0.018)	(0.018)	(0.013)	(0.019)	(0.019)	(0.013)	(0.021)	(0.018)	(0.013)
interaction between PBF and insurance						0.008	0.033	-0.038	0.008			
						(0.019)	(0.025)	(0.031)	(0.019)			
Age				-0.037***	-0.045***	-0.040***	-0.037***	-0.045***	-0.040***	-0.034***	-0.045***	-0.039***
				(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)
Sex				0.015	0.008	0.012	0.015	0.008	0.012	0.014	0.008	0.011
				(0.012)	(0.013)	(0.009)	(0.012)	(0.013)	(0.009)	(0.013)	(0.013)	(0.009)
Mother has primary or more education (=1)				-0.007	0.014	0.003	-0.007	0.012	0.003	-0.012	0.014	0.002
				(0.012)	(0.013)	(0.009)	(0.012)	(0.013)	(0.009)	(0.013)	(0.013)	(0.009)
Household-Facility distance (in Km)				-0.005	-0.007**	-0.006***	-0.005	-0.007**	-0.006***	-0.006*	-0.006**	-0.006***
				(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)
Health insurance (=1)				0.019	0.027*	0.015	0.003	0.046**	0.015	0.005	0.028*	0.020**
				(0.013)	(0.016)	(0.014)	(0.018)	(0.021)	(0.014)	(0.019)	(0.016)	(0.01)
Number of household members				-0.002	0.003	0	-0.002	0.003	0	-0.002	0.003	0
				(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)
Interaction between PBF and asset score										-0.211	-0.008**	-0.009**
										(0.15)	(0.004)	(0.003)
Observations	3,200	2,762	5,962	2,964	2,595	5,559	2,964	2,595	5,559	2,660	2,595	5,255

Note: *** p<0.01, ** p<0.05, * p<0.1

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