

**National University of Rwanda**  
SCHOOL OF PUBLIC HEALTH  
ECOLE DE SANTE PUBLIQUE

ANALYSIS OF POTENTIAL ADVERSE  
EFFECTS OF PERFORMANCE BASED  
FINANCING IN RWANDA: THE CASE OF  
REFERENCE OF AT RISK PREGNANT  
WOMEN

Dissertation presented in order to obtain the  
degree of Masters in Public Health

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Kigali, June 2011.

## RESUME

### **Introduction et contexte :**

Le taux de mortalité maternelle reste élevé dans le monde et surtout dans les pays en développement y compris le Rwanda. Plusieurs stratégies pour réduire ce taux ont été développées dont le système de financement basé sur la performance après avoir montré son efficacité ainsi les mutuelles de santé. Le PBF étant une approche liée aux résultats produits, les efforts et aux initiatives entreprises pour y arriver, a été généralisée, en 2008, sur toute l'étendue du pays où deux indicateurs sont rémunérés pour les accouchements (accouchement assisté au centre de santé et référence d'urgence pour accouchement). Quelques auteurs critiquent cette approche en insistant sur les effets pervers néfastes qui seraient plus dangereux surtout dans le cadre de la santé maternelle. L'objectif général de l'étude est de rechercher les effets pervers du PBF dans la prise en charge des accouchements, spécialement la pertinence des transferts des Centres de Santé vers les hôpitaux de référence dans deux districts du Rwanda.

### **Matériels et méthodes :**

Il s'agit d'une étude descriptive et rétrospective réalisée sur les transferts des accouchements des CS vers les hôpitaux de référence en comparant deux districts, Kamonyi (non-PBF) et Rwamagana (PBF) durant la période de 2006 à 2008.

### **Résultats :**

Une augmentation significative des accouchements assistés a été observée pour les deux districts de 2006 à 2008 ainsi que des références des accouchements compliqués des CS vers les hôpitaux de districts. Pendant trois ans, il y a eu une augmentation non significative de la proportion des transferts non pertinents à Rwamagana (PBF) avec une différence de 4% tandis qu'à Kamonyi (non PBF) cette augmentation a été significative avec une différence de 15%. Cela pourrait signifier que dans la zone PBF, il y a moins de transferts non-pertinents qu'ailleurs même si le montant d'argent rémunéré est le même pour un accouchement réalisé au CS et pour celui transféré à l'hôpital.

Le taux de mortalité maternelle à l'hôpital de Rwamagana n'avait pas statistiquement changé de 2006 à 2008 ainsi que celui des césariennes comme proportion de tous les accouchements compliqués. A Kamonyi, le taux de mortalité maternelle dans les CS a augmenté tandis qu'il a non significativement diminué à l'hôpital. Une augmentation significative de la comparabilité des raisons de transferts des CS vers les hôpitaux a été observée dans les deux districts ainsi que l'utilisation correcte du partogramme.

### **Recommandations et implications politiques :**

Nous recommandons le renforcement du PBF par tous les partenaires avec un monitoring continu, l'amélioration de la prise en charge d'une femme enceinte par les formations sanitaires dans le cadre d'éviter les transferts des accouchements non pertinents et réduire les décès maternelle et périnatale. Une recherche de ce type au niveau national est hautement recommandée.

## **ABSTRACT**

### **Introduction and background:**

The maternal mortality rate is still high in the world particularly in the developing countries including Rwanda. Several strategies to reduce it have been developed of which the Performance Based Financing (PBF) has been implemented by Rwanda after showing its effectiveness with community health insurance. The PBF being an approach related to results, efforts and undertaken initiatives to achieve it, has been generalized at national level where two indicators were remunerated in the case of delivery (assisted delivery at health center and emergency transfers to hospital for obstetric care during delivery). Some authors criticize this approach insisting on negative perverse effects which would be dangerous especially in the case of maternal health. The overall objective of the study is to look up the perverse effects of PBF in the management of deliveries in health facilities especially the appropriateness (the relevance) of the transfers from health centers to referral hospitals in two health districts of Rwanda.

### **Materials and methods:**

This is a descriptive and retrospective study carried out on transfers of deliveries from health centers towards references hospitals comparing two districts, Kamonyi (non-PBF) and Rwamagana (PBF) from 2006 to 2008.

### **Results:**

A significant increase of institutional deliveries was observed for both non PBF district from 2006 to 2008 as well for the references of complicated deliveries from health centers to districts hospitals. During three years, there has been a non significant increase of the proportion of transferred women for deliveries as non relevant references at Rwamagana (PBF) with a difference of 4% while at Kamonyi (non-PBF), this increase have been significant with a difference of 15%. This would mean that in PBF area, there are less non relevant transfers than elsewhere even if the amount of money remunerated is the same for a delivery performed at health center and for the one referred at hospital.

The maternal mortality rate at Rwamagana district hospital had not statistically changed from 2006 to 2008 as well as the rate of cesarean section as proportion of all complicated deliveries. In Kamonyi, the maternal mortality rate at health centers had increased while it had been no significant decreased at hospital. A significant increase of comparability of reasons of transfers of Health Centers towards hospital had been observed in both districts as well as the correct utilization of the partogram.

### **Recommendations and policy implications:**

We recommend the reinforcement of the PBF by stakeholders with a continuous monitoring, the improvement of the management of pregnant women by health facilities in order to avoid the non relevant transfer for deliveries and reduce the maternal and perinatal deaths. The research of this kind at national level is highly recommended.

## DEDICATION

To God, my creator and source of wisdom,  
To my loved wife GAHONGAYIRE Berthilde, for your love and support,  
To my loved children INEZA HAGABE Aldo and IGIRANEZA HAGABE Bruno, for your  
encouragements and patience during my absence,  
To my parents and sisters, for the job you've done in my education.  
To all of you who supported me physically and spiritually, you have been the source of joy and  
courage of the completion of my studies.  
To you, this work is dedicated.

HAFASHIMANA Valens, MD

## AKNOWLEDGEMENTS

I thank everyone who can find in this work, the proportion of his contribution either spiritually, physically or materially.

Many thanks to the director and joint-director to this dissertation respectively Dr BASINGA Paulin and Dr UMUBYEYI Aline; through your help in the design and analysis, your patience in guiding me and your consistent comments I found the way and the courage to finish easily this dissertation. Similarly thanks are addressed to all of the staff of the National University of Rwanda especially professors of the school of public health.

We are grateful for the Government of Rwanda through the MOH and the University of TULANE, district hospitals of Remera Rukoma and Rwamagana through their head director as well as their staff and my colleagues of Rwamagana Hospital. Without your assistance, this study would not have been possible.

My acknowledgments to all women who are the source for these data and to anyone who help them without hesitation or asking anything to them, you do a good job because. I believe that, in maternal and child health care, asking money or others requirements to a pregnant women requiring emergency obstetric care may contribute to the maternal and the neonatal deaths. Help the mother and the child, the reward will come after and God will double your reward.

Thanks to all my colleagues of the MPH, fifth cohort at School of Public Health/NUR, especially Dr Anaclet, Rigobert, Angelique, Stella, Sylvie, Cathy and Francoise among others, you have been the source of my joy during the two yours and you will continue to be the source of my love for human beings and for the country.

HAFASHIMANA Valens, MD

## ABBREVIATIONS AND ACCRONYMS

CHU: Centre Hospitalier Universitaire de Kigali

CHWs: Community health workers

CS: Centre de santé

DH: District hospital

DHS: Demographic and Health Surveys

Gr: Gram

HC: Health center

HIV/AIDS: Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome

IP: initiative for performance

IUFD: Intrauterine fetal death

Max.: Maximum

MDGs: Millennium Development Goals

Min.: Minimum

MMR: Maternal mortality rate

MoH: Ministry of health

MSH: Management science of health

NGOs: Non Government Organization

NUR: National University of Rwanda

OR: Odds Ratio

P4P: Pay for Performance

PBF: Performance based financing

SPSS: Statistical Package for Social Sciences

Std.: Standard

WHO: World Health Organization

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# 1. GENERAL INTRODUCTION AND GENERALITIES

## 1.1 Introduction and background

The maternal mortality rate is still high in the world and particularly in the developing countries including Rwanda which counted 750/100000 live births in 2005 (Institut National De La Statistique, 2005) and the estimates had shown a maternal mortality rates of 383 (249-584) per 100 000 livebirths in 2008 (Hogan et al., 2010).

To illustrate the extent of the problem, we only need to look about some of the estimation of the maternal deaths. In 2006, among the estimated total of 536 000 maternal deaths worldwide, developing countries accounted for 99% (533000) of the deaths. Among the developing regions, sub-Saharan Africa had the highest Maternal Mortality Rate (MMR) at 900 maternal deaths per 100 000 live births in 2005, followed by South Asia (490), Oceania (430), South-Eastern Asia (300), Western Asia (160), North Africa (160), Latin America and the Caribbean (130), and Eastern Asia (50) (UNICEF, 2008).

Rwanda still faces important challenges in maternal and child health as well as many other countries in Sub-Saharan Africa. Concerning Rwanda, in 2005, the Demographic and Health Surveys (DHS) showed a maternal mortality rate (MMR) of 750/100 000 live births (Institut National De La Statistique, 2005); This MMR was lower than the one of the estimation of Hogan MC and al where the MMR with uncertainty bounds for Rwanda in 2008 was 383 (249–584) per 100 000 live births (Hogan et al., 2010) and 540 (320-910) per 100 000 live births in 2008 according to the estimates developed by WHO, UNICEF, UNFPA and The World Bank (WHO, UNICEF, UNFPA, 2007).

Nowadays, several strategies like basic emergency obstetric care, coverage and quality of skilled attendance at birth, post-abortion care, safe abortion, better reproductive health services for adolescents, family planning care, new developments in malaria, nutrition, violence and HIV/AIDS in relation to maternal health, human rights approach (Campbell & Graham, 2006) as well as Performance Based Financing (PBF) have been developed to improve maternal and child health. Those strategies were developed in the context of the achievement of two Millennium

Development Goals (MDGs) in relation of the reduction of the infantile mortality and the improvement of the maternal health.

One promising intervention to improve worker productivity is to pay for performance (P4P), which provides incentives in the form of bonus to health care providers for improvements in the use and quality of care indicators. P4P may affect medical care in two ways: first by motivating providers to put much more effort in the specific activities, and secondly by increasing the amount of resources available to fund the provision of services (Borghi, Ensor, Somanathan, Lissner, & Mills, 2006). A multicenter study in Rwanda, Benin, Jamaica and Equator showed that the knowledge and skills of health personnel to deal with obstetric emergencies were very weak and fall to 40-60% of standard norms (Abouzahr C & T, 2001).

In Rwanda, at the demand side, the government through the Ministry of Health implemented the “mutuelle de santé” and the PBF at the supply side as strategy to motivate health care providers in the public sector to improve the quality of services of health facilities in order to achieve the MGDs. The PBF being an approach related to results, efforts and undertaken initiatives to achieve it, has been generalized at national level where it covers all the minimum package activities as well as the HIV/AIDS services. In the case of deliveries, 2 indicators are remunerated by PBF that are assisted delivery at health center and emergency transfers to hospital for obstetric care during delivery (Rwanda Ministry of Health (MOH) [Rwanda], 2009). After showing its efficiency in the increase of the quantity of the activities since the years 2002 by the pilot phases in the south of the country (Meessen, J.-P. I. Kashala, & Musango, 2007) (Basinga, Gertler, & Vermeersch, 2010; Meessen, Musango, J.-pierre I. Kashala, & Lemlin, 2006), it has been extended at national level in 2006.

Because the country of Rwanda is one of the countries where the PBF especially showed its efficiency, other countries are looking at Rwanda as the first country to have implemented PBF national wide, it's important to share less in learned from the Rwandan experience to others countries. Nowadays, more than 20 countries are in the process of introducing or scaling up PBF in Africa especially in neighboring countries like Burundi, Democratic Republic of the Congo, Cameroon, Benin... (Bruno Meessen, 2011; Soeters, Habineza, & Bob, 2006).

As we have seen that PBF had an impact on health in Rwanda, some authors think that there are side effects but there is no evidence shown for Rwanda. One of them is Kalk Andreas, in 2011,

where he argued that: *“Finally, it can be stated that P4P in Rwanda successfully promoted those activities with incentives attached, brought about considerable side effects such as ‘gaming’ and created a new spirit of labour whose appropriateness will remain a topic of discussion”*(Kalk, Paul, & Grabosch, 2010).

## 1.2 Rationale:

Even though this strategy of PBF had been efficient, it makes himself/itself that this last could generate perverse effects. Who knows that some health providers would be looking to benefit the PBF like a tool of fraud? Who knows that some health facilities would not be thinking in term of money than the quality of the cares, especially in the case of safe motherhood (maternal health), and to make transfers useless of the health center toward the hospitals of reference as well as the purchase of a childbirth well done at the level of health center and a transfer toward a superior structure have the same amount of money of Rwf 2500? Or who knows that some health facilities don't keep women uselessly in labor of childbirth whereas they are not capable to take them in charge? Such behavior in the case of maternal health (motherhood) would be dangerous. This is our problematic question and the reason of this study is to see if there would not be perverse effects of the intervention of the PBF in the case of the maternal health regarding references of pregnant women on labor for delivery.

This work will concern references of the childbirths at risk payed by the PBF done by health facilities of Kamonyi and Rwamagana districts and is attending to look about the potential adverse effects like appropriateness of transfers in the management of deliveries.

## 1.3 Definition of concepts

**Partogram:** According to World Health Organization, the definition of the partogram is the following: "graphic registration of the progress of labor and the main data on the state of the mother and the fetus"(World Health Organization, 1994).

**Performance-based financing (PBF):** The Performance-Based Financing (or Contractual Approach) is a strategy of financing the services of health that aims to increase the quantity and the quality of preventive and curative health care provided to the population in the respect of

norms, through “the buying of care” (Ministere de la Sante, 2008) . Performance-based financing can be defined also as a mechanism by which health providers are, at least partially, funded on the basis on their performance (Bruno Meessen, 2011).

**Performance-Based Financing**, in contrast to other labels using “performance”, is a form of RBF distinguished by three conditions. Incentives are directed only to providers, not beneficiaries; awards are purely financial-payment is by free for service for specified services; and payment depends explicitly on the degree to which services are of approved quality, as specified by protocols for processes or outcomes (Musgrove, 2010).

**PBF implementation phases in Rwanda (phase 0, 1 and 2):** in Rwanda the performance based financing was implemented in three phase: Phase 0: had 11 districts initiated in Rwandan PBF pilot projects during 2002-2005 then phase 1 which have been initiated in 2006 with 12 districts while in the 7 remaining districts, the PBF was implemented in the phase 3 in April 2008 (Ministere de la Sante, 2008). The concerned districts in our study are in phase 1 (Rwamagana District) and in phase 2 (Kamonyi District).

**Assisted delivery:** a delivery assisted by skilled attendants. WHO defines a skilled attendant as “an accredited health professional – such as a midwife, doctor or nurse-who has been educated and trained to proficiency in the skills needed to manage normal (uncomplicated) pregnancies, childbirth and the immediate postnatal period, and in the identification, management and referral of complications in women and newborns (WHO, ICM, 2004).

**Transfer (or reference):** Reference is an evacuation towards a specialized center of a pathology in which the treatment is beyond the capacity of the antenatal consultation team (we have used transfer as the same as reference). In other words, *transfer* means the physical transfer of a woman from primary maternity unit or home to a base hospital before, during or after labor (New Zealand College of Midwives, 2008).

**Relevant transfer:** In this study, we had retained as a “relevant transfer” all evacuation of women for one of the following obstetric reason (Box 1) from health center to the district hospital (Herni De Tourris, 2000; National Institute for Health and Clinical Excellence, 2007; Southern Health, 2009) :

**Box 1:** Criteria for classifying reference as “relevant” or “not relevant” for health centers referring to district hospital level

**Criteria related to the mother or appendage abnormalities**

- To be operated (cesarean sections, hysterectomies and laparotomies);
- To have had a dystocic delivery or instrumental (forceps / suction cups, twin pregnancy, breech presentation with manipulation or malpresentation);
- To have had an obstetric emergency ( antepartum hemorrhage, cord presentation/prolapsed, postpartum hemorrhage in hospital, maternal collapse);
- Being dead at the district hospital or referral hospital;
- Have had an obstructed delivery (vacuum extraction, forceps, breech presentation and twin pregnancy with manual );
- Arrived with or developed a shock to the District Hospital;
- Having received Cytotec for labor induction or oxytocin at the hospital (except for the expulsion of the placenta);
- Have had at least one previous uterine scar or having uterine rupture;
- Erased diastolic blood pressure (over 90 mmHg) or raised systolic blood pressure (over 140 mmHg) or two consecutive readings taken 30 minutes apart or preeclampsia ;
- Pyelonephritis
- prolonged pregnancy (>42 weeks gestation) or prolonged rupture of membranes over 24 hours
- Have had a diagnosis of retained placenta;
- Have been transferred to another hospital for a relevant cause;

**Criteria related to the child**

- Have a child who has had specialized care or neonatal resuscitation (oxygen, radiation, infection ...);
- To have had a dead baby macerated or stillbirth or death within 24 hours to the district hospital;
- The baby had born with malformation (spina bifida, monster,...)
- The baby have had a low Apgar at first minute (0-3) or low birth weight;
- fetal heart rate anomalies before transfer

## 2. LITERATURE REVIEW

In most low-income countries, maternal health is still one of the greatest health challenges. It is estimated that over 500,000 women die each year during pregnancy or following it. Maternal mortality is an important indicator of maternal health. It reflected not only the level of access to health services but also the quality and functioning of health facilities. The risk of dying during pregnancy or breastfeeding is far superior to women in developing countries than for women in developed countries. In poor countries one woman in six have a chance of dying from causes related to pregnancy against a woman on 30,000 in European countries (Ronsmans & Graham, 2006). In Rwanda, the 2005 DHS show a marked increase in maternal mortality ratio between 1992 (500/100 000 live births) and 2000 (1071/100 000 live births) and a tendency to decrease in the rate in 2005 (750/100 000 livebirths) (Institut National De La Statistique, 2005) and 2008 (383/100000 livebirths) (Hogan et al., 2010).

Strategies have been developed to reduce the maternal mortality rate such as basic emergency obstetric care, coverage and quality of skilled attendance at birth, post-abortion care, safe abortion, better reproductive health services for adolescents, family planning care, new developments in malaria, nutrition, violence and HIV/AIDS in relation to maternal health, human rights approach (Campbell & Graham, 2006; Ronsmans & Graham, 2006). Many single interventions are available, but none alone can reduce the rate of maternal mortality in a population. This was the idea of *Campbell & al and they propose that “the main priority should be for women to have the choice to deliver in health centers, in other words via a health centre intrapartum-care strategy. Countries in which this approach has already been implemented have maternal mortality ratios of less than 200 deaths per 100 000 livebirths, with some even lower”*(Campbell & Graham, 2006).

As we have seen above, a multicenter study in Rwanda, Benin, Jamaica and Equator showed that the knowledge and skills of health personnel to deal with obstetric emergencies were very weak and fall to 40-60% of standard norms (AbouZahr & Wardlaw, 2001). In Tanzania, recent surveys have highlighted the fact that the capacity to provide basic services to save mother’s lives is largely absent in health facilities below the hospital level. Pay for Performance will help them to make improvements in maternal health and this in turn holds the key to making progress on averting neonatal deaths and sustaining progress on MDG<sub>4</sub> (Smithson et al., 2007).

In the last years, several experiments of performance based financing (PBF) were initiated in Rwanda with an aim of reinforcing the motivation of the providers of care and of obtaining results (output) that the traditional financing (for input) was not previously achieved (Ronsmans & Graham, 2006). In 2002, the Non-Governmental Organizations Cordaid and HealthNet TPO have introduced performance-based contracting, respectively, in the provinces of Cyangugu and Butare in the general health services in Health Centers. In 2005, the Belgian Technical Cooperation has introduced it in the provinces of Kigali-Ngali and Gitarama (Meessen, J.-P. I. Kashala, & Musango, 2007; Meessen, Musango, J.-pierre I. Kashala, & Lemlin, 2006).

After seeing the encouraging results of these experiments, the PBF became one of the axes of Strategic planning 2005-2009 of the Ministry of Health. Since 2006, the PBF approach is applied to the entire health sector in Rwanda by the government, as well as by individual donors. Plans of extension of the PBF have been planned:

- Firstly, the PBF was introduced to all health facilities in 23 districts of the country for the minimum package of activities and HIV and complementary package of activities for district hospitals (Phase-0 and 1). Phase 0 had 11 districts and phase 1 had 12 districts
- Secondly, the PBF was introduced in April 2008 in 7 districts of the "Phase 2" (Rwanda Ministry Of Health (MOH) [Rwanda], 2009). Currently, in Rwanda, this approach of PBF is in all health facilities in the country since 2008.

It's now well known that the performance based-financing had shown the effectiveness or impact in addressing maternal health and in Rwanda since his implementation in 2002; there have been an increased institutionalized deliveries. In 2006, Robert Soeters et al showed that the percentage of institutional deliveries conducted by skilled persons in Rwanda increased and there have been a difference 2005/2003 of 144% (Soeters et al., 2006). Rusa et al in 2001 (Rusa, Schneidman, Fritsche, & Musango, 2009) found the same increasing of institutionalized deliveries with PBF.

Basinga Paulin found also that PBF was statistically significant and had a large impact on the childhood of an institutional delivery for the last pregnancy. For women living in the catchment area of PBF treatment facilities, he has seen an increased likelihood of 7.3% on institutional delivery which represent a 21% increase from baseline. He found also that the PBF were having also an important impact on the proportion of assisted delivery where from 2006 to 2008,

facilities increased the proportion of institutional deliveries by 13% (Basinga et al., 2011; Basinga, Gertler, & Vermeersch, 2010).

Meessen B et al showed main possible effects of output-based payment on other dimensions of health centre performance at each incentive such as to inflate records for the remunerated activities, to induce unnecessary demand for the remunerated activities, to neglect activities that are not remunerated, to neglect quality attributes, on the basis that only quantity matters, of the activities that are delivered. For Rwanda, they respond to some observers who have raised the concern that buying outputs may induce a shift in staff values or expectations (e.g. create the perverse perception that any behavior deserves a specific payment) because to avoid this problem, the bonus contracts in Kabutare clearly refer to medical ethics and describe possible sanctions that would be imposed in case of fault (Meessen, J.-P. I. Kashala, & Musango, 2007).

For Meessen & al, Performance-based financing has limits (some dimensions of performance are difficult to measure and, therefore, to remunerate) and is difficult to design and implement correctly while some conditions are necessary for its success. They continue to show that according to their experience, the PBF can catalyse comprehensive reforms and help address structural problems of public health services, such as low responsiveness, inefficiency and inequity (Bruno Meessen, 2011).

Contrarily, some authors like Cynthia Eldridge and Natasha Palmer do not believe in the improvement in health attributed to Performance-based payment because of the lack of controls and the interference of confounding factors and they seem to be convinced that PBF may not be solely responsible for improvements in health indicators (Eldridge & Palmer, 2009).

Other critics are being made by researchers and arguments advanced are the phenomena known as “gaming” (distortion of information to maximize reported results and neglecting activities not remunerated by the PBF) (Kalk et al., 2010). Kalk & al wrote about Rwanda that: *“The question arises if the promoted P4P schemes are not just second-class substitutes for such a way of appreciating labour. This question is even more valid as most of the side effects of P4P schemes (such as ‘gaming’) are clearly to be observed in Rwanda: overworked staffs invest all their energy into the remunerated activities and their proper documentation, and tend to neglect other core tasks for the sake of the incentives”* (Kalk et al., 2010).

### 3. RESEARCH QUESTIONS

In Rwanda, it was shown that the PBF progress were significant in quantitative terms for the whole of the activities remunerated by this approach. The most notable increases were at the level of maternal health and it moreover was shown that the installation of the contracts of performance involved big rises of the productivity of the personnel (Basinga, Gertler, & Vermeersch, 2010; Meessen, J.-P. I. Kashala, & Musango, 2007; Meessen, Musango, J.-pierre I. Kashala, & Lemlin, 2006; Rwanda Ministry Of Health (MOH) [Rwanda], 2009). Basing itself on these results, the Rwandan government decided to extend this strategy at the national level with the support of the various basic financial donors and NGOs.

One of the basic principles of PBF is to pay (remunerate) health facilities based on the number of procedures performed. In terms of delivery, two services were selected: the simple childbirth at the health centre and the transfer of a woman in labor towards a reference level (Rwanda Ministry Of Health (MOH) [Rwanda], 2009). For each one, remuneration was fixed at around USD 5 (2500 RWF), which is very attractive for a health provider. From the beginning, it was understood that the increase in the number of childbirth on the level of the health centers was not an aim in itself but is was primarily seen as the best channel to increase the detection of laboring women parturient requiring reference towards a hospital for further care. Thus, the remuneration of the transfers was motivated by the pursuit of the goal of reducing maternal mortality and the corollary desire to prevent any perverse effect on the level of the health centers (retention of women requiring a reference by attraction of money).

It is important to assess the soundness of these objectives, the quantitative increase not being an aim in itself. In fact, if the aim needed is to push the teams of the health centers to take positive measures to increase the number of assisted childbirth (integrating services, establish night guards, recruiting qualified health providers, ..), it is possible that some teams may also adopt more dangerous options for the health of the mothers and the children. In order to increase their incomes, certain health centers might be tempted to do more than they really are capable of both technically and in practice (number and qualification of the personnel, material available). The risk is particularly real for the parturient requiring more specialized care.

According to the health system in Rwanda, health centers are authorized only to carry out normal deliveries and the complicated one must be referred to district hospital for example the suction

cups, scar of the uterus, transverse presentation. As already mentioned, it was decided to remunerate the health centers even if the woman had only passed through the health center. If it was expected that this incentive will prevent the risk of retention of women in labor (and reduce the number of “false negative”, women not transferred which should have been transferred), it might also lead to unnecessary transfers (increased 'false' positive, transferred women which did not require an evacuation). Insofar as the PBF were a new experience, the designers took caution by accepting that the medical profit may involve a cost in terms of efficiency (namely the useless expenditure charged to the household, government and of NGOs for non-necessary transfers).

We should think ourselves if health centers are not being referring pregnant women for deliveries at district hospital only because it is easy instead of performing a delivery at health center when the amount remunerated are the same? Or even, who knows that some health facilities don't keep women uselessly in labor of childbirth whereas they are not capable to take them in charge? If it is proven that the number of evacuations has actually increased sharply (Basinga, Gertler, & Vermeersch, 2010; Meessen, Musango, J.-pierre I. Kashala, & Lemlin, 2006), it would be useful to check all these evacuations up to what point were relevant. Otherwise, the program of PBF would be creating some perverse effects for these health facilities by doing what is not in their competences or by referring deliveries without problems in order to be not tired itself (reduce the work because the remuneration of the delivery and a referred one is the same).

In Rwanda, the ministry of health, after having analyzed the success of the pilot experiments, initiated the national roll out of the PBF program in 23 districts starting 2006 and Rwamagana is among the districts that started in 2006. In 2008 the remaining 7 control districts also implemented PBF where Kamonyi district is one of them. It is important to ensure the relevance of this strategy and to identify the potential risks (possible hazards) of them by evaluating the quality of care of the cases since the periphery (health centers) up to the district hospital level of the health pyramid of Rwanda.

It is worth answering these questions by ensuring the relevance of transfers in the management of deliveries at Kamonyi as a non-PBF district and Rwamagana as a PBF district because we know that the PBF is currently having a major influence on health policy in Rwanda.

## 4. OBJECTIVES OF THE STUDY

### 4.1 General objective

The overall objective of the study is to look up the perverse effects of PBF in the management of deliveries in health facilities especially the appropriateness (the relevance) of the transfers from health centers to referral hospitals in two health districts of Rwanda.

### 4.2 Specific objectives

1. Determine the proportion of women who are transferred from health centers for maternal causes and who can be found at the district hospital levels;
2. Determine the proportion of concordant causes of transfer and the use of partogram between district hospital and health centers;
3. Construct criteria for classifying reference as “relevant” or “not relevant” for health centers referring to district hospital level;
4. Compare the proportion of “relevant references” of women with complication from health centers in Rwamagana (PBF) and Kamonyi districts (Non-PBF);
5. Compare neonatal and maternal outcome between the two study districts for 2006, 2007 and 2008;
6. Propose recommendations for the Performance based financing program as far as adverse effect control is concern.

## 5. STUDY METHODOLOGY

### 5.1 Type of study

Our work is a descriptive study, retrospective for deliveries referred to districts hospitals of Kamonyi and Rwamagana. It was conducted in two districts: a non PBF (Kamonyi) and a PBF district (Rwamagana) during the years 2006, 2007 and 2008. This study took advantage of the randomization done in 2006 while planning the impact evaluation of the PBF. We would take all 12 districts of phase 1 (which started PBF in 2006) and all 7 districts of the phase 2 (which started PBF in 2008) but we picked two comparable districts: one from the phase 1 and another one from the phase 2 because of the financial constraints.

### 5.2 Population and area of the study

The study was carried out on all women transferred from health centers towards hospitals of district and was made in two districts with a district that has began receiving the financing based on performance in 2006 (Phase 1) among 12 districts and one district having profited this PBF in 2008 (among 7 Districts). These districts were randomly selected.

In total, 1549 references from health centers in the two districts were identified and analyzed (health centers which do not have maternity services were excluded). The data were collected at the level of the district hospitals of Remera Rukoma and Rwamagana.

### 5.3 Inclusion and exclusion criteria

All health facilities providing assisted deliveries and referral are included in the analysis. Two health centers very close to the two hospitals and not providing deliveries was excluded from the analysis (those are: Rwamagana and Remera Rukoma health centers) as well as other health facilities which do not provide the service of delivery for pregnant women. Any other childbirth from the health facilities not included in the area of Kamonyi and Rwamagana District were also excluded. The referred deliveries analyzed were deliveries in which we found a partogram or a reference paper from health centers at the district hospital level.

## 5.4 Period of the study

The study concerned all women transferred from the health centers towards district hospitals during the years 2006, 2007 and 2008.

The reason for choosing this period is linked to the fact that the phase 1 of PBF began in 2006 and the Phase 2 began in 2008 after having seen the positive results in Phase 0 and it is important to know the situation of the districts that had benefited from this program in 2006 compared to that have began in 2008 and compare the results.

We assumed that all the interventions are the same except the PBF intervention. Those interventions are for example the CHWs program, community based insurance (“mutuelle de santé”), the sensitization by the political-administrative authorities, the behavior communication change and the improvement of geographical access of services.

## 5.5 Data Collection.

For the standardized way of collecting data, the activity was performed by a physician in charge of the study in the district hospitals of Kamonyi and Rwamagana.

Data collection was done at the level of the District Hospital:

With the research of all obstetric transfers for deliveries, even if associated with other pathologies carried out by the health centers of the 2 districts:

- A questionnaire was designed based on variables available to the level of the partogram and transfer paper of the health centers as well as the registers, medical record of the patients and the partogram on the level of district hospitals.
- This questionnaire was tested before use. The questionnaire (see annex) consists of two parts to allow to follow the path of women from the health center through the district hospital (if it is supervised by it). Another questionnaire also made up for assessing perinatal mortality at Kamonyi and Rwamagana Districts hospitals for referred childbirth only.
- The information at the health centers was collected from the transfer paper or the partograms.
- At district hospital level, the data were collected in the patient medical record in which there is a partogram, following of the patient, protocol of interventions and indications as well as registers from maternity and operating room.

## **5.6 Data entry and analysis**

A database was made on EPI INFO Version 3.3. October 5.2004 and was used for data entry. Then the base was transferred to SPSS for final analysis. Some variables with the codes were pre-coded on data collection phase to facilitate the keyboarding of data and others were coded in SPSS. Some tests of chi-square were calculated using the EpiTable for comparing the two districts according to the three years 2006-2008. A p-value less than 0.05 was considered as significant.

## **5.7 Ethical considerations**

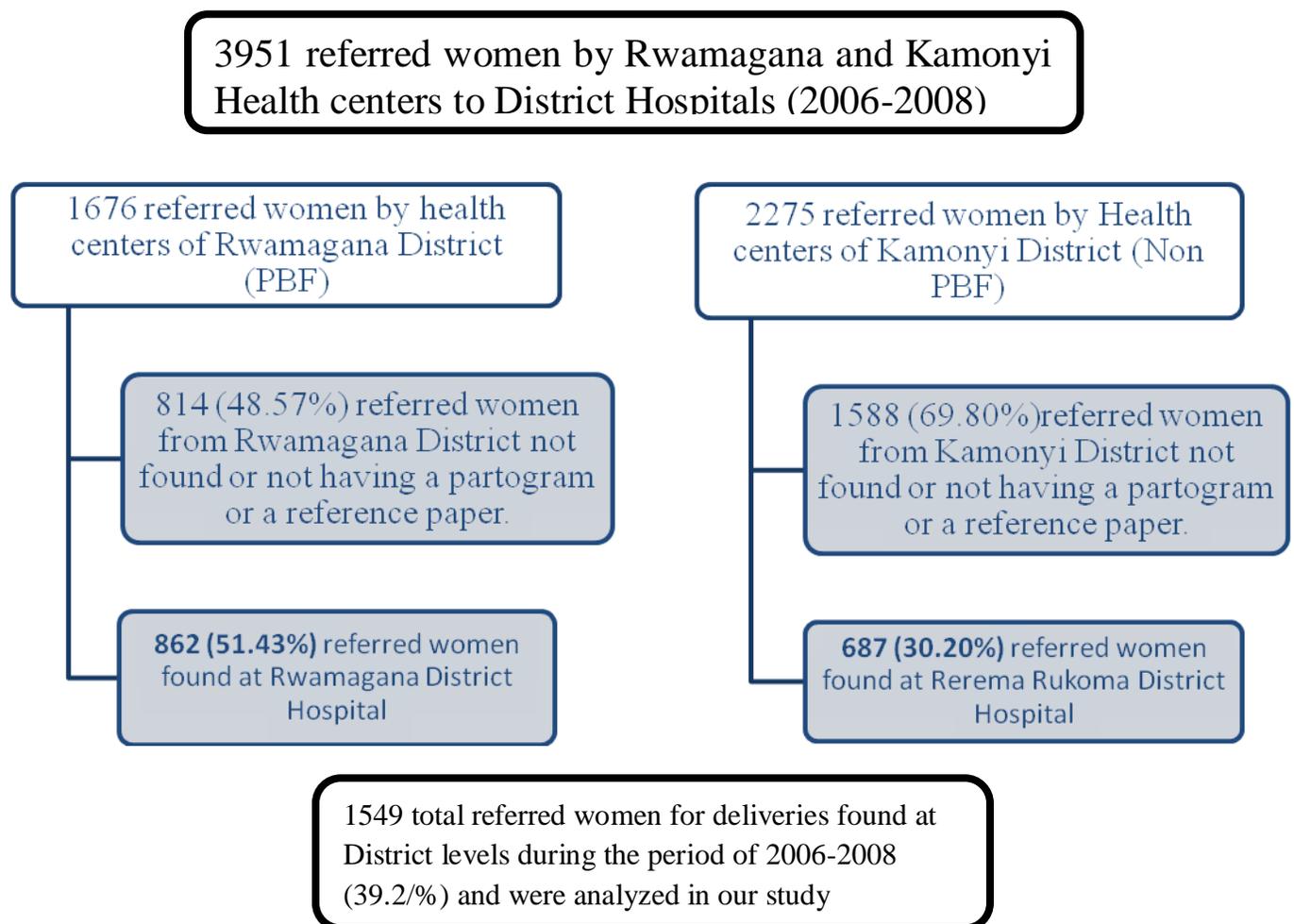
A recommendation letter for data collection at the level of district hospital was given to the researcher by the NUR, school of public health and an agreement of the MoH as well as the direction of the district hospitals. Any information regarding the identity of patients and the institution will be kept secret, thus is to say we have observed and we will continue to respect the following principles: confidentiality, respect of the person and institution as well as justice.

## 6. PRESENTATION OF THE RESULTS

After analyzing our data, we have come out with some results presented below. The results are presented in the following order: Proportion of women who are transferred from health centers for maternal causes and who can be found at the district hospital levels, proportion of concordant causes of transfer and the use of partogram between district hospital and health centers, criteria for classifying reference as “relevant” or “not relevant” for health centers referring to district hospital level, proportion of “relevant references” of women with complication from health centers, neonatal and maternal outcome between the two districts and finally recommendations which are presented after conclusion.

### 6.1 Proportion of women who are transferred from health centers for maternal causes and who can be found at the district hospital levels

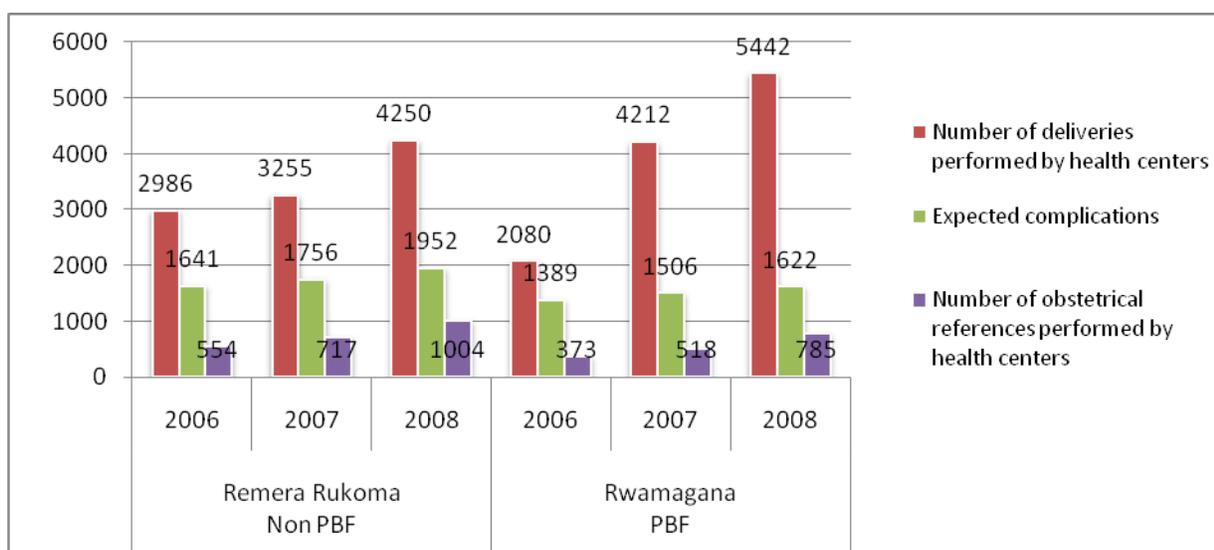
Figure 1: Number of referred women for deliveries during the year 2006-2008.



From 2006 to 2008, in total, 3951 women were referred by Rwamagana (PBF) and Kamonyi (Non PBF) Health centers to District Hospitals (DH). Among them, 1549 referred women for deliveries were found at District levels (39.2%) and included in our study; At Rerema Rukoma DH, 687 (30.20%) of the referred women were only found while 862 (51.43%) were found at Rwamagana DH. Others 1588 (69.80%) and 814 (48.57%) referred women respectively from Kamonyi and Rwamagana districts were not found at the level of district hospital. According to the health system in Rwanda, health centers report to the district hospital supervising them. Because of this, two main reasons seems to influence the low number of women referred for deliveries found at district level comparing of the number of referred women for deliveries by health centers during the years 2006 to 2008:

- Referred women for deliveries not fulfilling the condition of having a partogram or a reference paper. This may be due the fact that the paper or the partogram may lost in the maternity, archives or by the parturient itself, or even because it was not a sine qua non condition asked to health centers to send a women with a partogram or reference paper;
- Some women referred to district level may not come to the district hospital supervising the health center ; this may be to the presence of the other nearest hospital or even the women may not arrive at district level (for example she can deliver at home or on the way towards district hospital)

Figure 2: Number of deliveries performed and referred deliveries by health centers



The figure shows the evolution of deliveries at health centers, expected complications and references of women to district hospitals during the period of 2006 to 2008; for all, there has been an increase in both PBF and Non PBF districts:

- The institutionalized deliveries had increased from 2986 to 5250 deliveries (27.3% to 32.7%, an increase of 5.4%) in health centers of Kamonyi District and from 2080 to 5442 (22.5% to 50.3%, an increase of 27.8%) in health centers of Rwamagana District respectively in 2006 and 2008.
- For referred women for deliveries, there has been also an increase from 554 to 1004 referred pregnant women at risk for deliveries (33.8% to 51.4%, an increase of 17.6%) in health centers of Kamonyi District and from 373 to 875 (26.9% to 48.4%, an increase of 21.5% ) in health centers of Rwamagana District respectively in 2006 and 2008.

In BBF district, the increase is impressive either for institutionalized deliveries or referred women for emergency cases during labor for deliveries.

**Table 1: Age group of the referred women and state of the mother at exit from the hospital**

Mother's age group	District Hospital				Total	
	Remera Rukoma Non PBF		Rwamagana PBF			
	N	%	N	%	N	%
15-24 years	228	33.2	397	46.7	625	40.7
25-34 years	339	49.4	332	39.0	671	43.7
> 35 years	119	17.3	122	14.3	241	15.7
Total	686	100.0	851	100.0	1537	100.0
State of the mother at exit	District Hospital				Total	
	Remera Rukoma Non PBF		Rwamagana PBF			
	N	%	N	%	N	%
Died	9	1.3	1	0.1	10	0.6
Healed	192	28.0	249	28.9	441	28.5
Improved	426	62.1	584	67.7	1010	65.2
Others (transferred, escaped, complications, ...)	59	8.6	28	3.2	87	5.6
Total	686	100.0	862	100.0	1548	100.0

In general, the majority of the women referred are aged of 25-34 years (43.7%) followed by 15-24 years in 40.75. At Remera Rukoma District hospital, the group of 25-34 years is the most frequent with 49.4% while for Rwamagana district, the most frequent is the group of 15-24 years with 46.7%.

For all transferred women from health centers to district hospitals, 10 died (0.6%) and the high proportion of 1.3% is seen at Remera Rukoma hospital (9 cases) while it's 0.1% (1case) at Rwamagana hospital.

**Table 2: Referred deliveries by health center in the 2 District Hospitals from 2006-2008**

Remera Rukoma, Non PBF District			Rwamagana, PBF District		
Health center	N	%	Health center	N	%
CYERU	37	5.4%	KARENGE	44	5.1%
GIHARA	100	14.6%	MUNYAGA	96	11.1%
KABUGA	27	3.9%	MUSHA	82	9.5%
KAMONYI	97	14.1%	MUYUMBU	73	8.5%
KARANGARA	54	7.9%	NYAGASAMBU	158	18.3%
KAYENZI	108	15.7%	NYAKARIRO	33	3.8%
KIGESE	104	15.1%	NZIGE	104	12.1%
MUGINA	146	21.3%	RUBONA	110	12.8%
NYAGIHAMBA	14	2.0%	RUHUNDA	162	18.8%
<b>Total</b>	<b>687</b>	<b>100.0%</b>	<b>Total</b>	<b>862</b>	<b>100.0%</b>

The table shows the referred deliveries by health centers and by district. Patients were from 16 health centers with 8 HC in each district. Mugina HC had referred a lot of women in Kamonyi district than others in 21.3% and for Rwamagana district it's RUHUNDA HC with 18.8%.

We do believe that Nyagasambu Health Centre (located at 25 km from the hospital and next to the paved road) and CS Ruhunda (10 km from the hospital) of Rwamagana district and Mugina health center (33 km from the hospital) or Kamonyi (10 km from the hospital) of Kamonyi District have transferred more women than other health centers that are far away from the hospital. The most farthest health centers such as Nyakariro of Rwamagana District (55 km), Nyagihamba of Kamonyi (46 km) have referred less women respectively in 3.9% and 2%.

Given that the ambulance is not located at the health center but rather at the hospital, the most far health centers seem to call less for an ambulance than those closest and so they would refer fewer women. This would also mean that health centers closer to the hospital would transfer more than those far away. Another argument explaining why the health center located far from the hospital could not frequently call the ambulance is that during the years 2006 and 2007, patients had to pay the entire invoice price of transport by ambulance (100%) because the community health insurance has begun to pay user fees for the ambulance in 2008. The total

number of population of the catchment area may influence also the low of high number of referred women by health center to district hospitals. Briefly, being far from the hospital, the total population of the catchment area and the fact that before 2008, the patient had to pay the entire invoice price of transport by ambulance would explain the low frequency of transfers of women but also the high frequency of transfers for health centers nearest the District Hospital.

**Table 3: Transferred deliveries or not to another hospital and mode of delivery by District Hospitals**

<b>Patient referred to another Hospital</b>	Remera Rukoma, Non PBF District		Rwamagana, PBF District		Total	
	N	%	N	%	N	%
No	674	98.8	851	99.0	1525	98.9
Yes	8	1.2	9	1.0	17	1.1
<b>Total</b>	<b>682</b>	<b>100.0</b>	<b>860</b>	<b>100.0</b>	<b>1542</b>	<b>100.0</b>

<b>Mode of delivery</b>	Remera Rukoma, Non PBF District		Rwamagana, PBF District		Total	
	N	%	N	%	N	%
Caesarean section	279	40.7	488	56.6	767	49.5
Eutocic (normal delivery)	310	45.2	323	37.5	633	40.9
Has not given birth there (transferred)	9	1.3	4	0.5	13	0.8
Hysterectomy and Laparotomy	16	2.3	9	1.0	25	1.6
Obstructed (dystocia) labor	72	10.5	38	4.4	110	7.1
<b>Total</b>	<b>686</b>	<b>100.0</b>	<b>862</b>	<b>100.0</b>	<b>1548</b>	<b>100.0</b>

Among 1542 women, 1525 (98.9%) have been managed at District hospital levels and 17 women (1.1%) were only referred for better management to CHUK or another hospital. At Remera Rukoma (Non PBF), only 1.2% was referred to CHUK or another hospital and in 99.8% the referred women were treated at Remera Rukoma Hospital while 1.0% was referred to another hospital by Rwamagana hospital and 99% were treated by it.

Regarding the mode of delivery, in general, cesarean sections (49.5%) were the most frequent mode of delivery for parturient referred from HC to district hospitals during the period of 2006-2008. It seems that there is a lot of cesarean section in PBF district (56.6%) than in non PBF district (40.7%) and less a lot of normal delivery at PBF district (37.5%) than in non PBF (45.2%) during the period of our study. Laparotomies and hysterectomies were performed at 2.3% in Remera Rukoma hospital versus 1.0% at Rwamagana hospital. The hypothesis advanced of having a high frequency of Cesarean section at Rwamagana Hospital (PBF area) than at Remera Rukoma hospital (Non PBF area) would be that PBF health centers have referred women that needed really transfers and received the emergency care than in the Non PBF health centers.

## 6.2 Proportion of concordant causes of transfer and use of partogram between district hospital and health centers

### 6.2.1 Concordant causes of transfer between district hospital and health centers

**Table 4: Reasons of health centers for transfer for three years**

Health Centers' reasons for transfer	Kamonyi (Non PBF)		Rwamagana (PBF)		Total	
	N	%	N	%	N	%
Abnormalities of appendages	57	<b>8.3</b>	39	4.6	96	6.2
Acute fetal distress	30	4.4	89	<b>10.4</b>	119	7.7
Dystocic presentation	49	7.1	66	7.7	115	7.5
Maternal pathology	9	1.3	24	2.8	33	2.1
Mechanic and dynamic dystocia	382	<b>55.7</b>	461	<b>53.9</b>	843	54.7
MFIU	20	2.9	13	1.5	33	2.1
Others	14	2.0	21	2.5	35	2.3
Prerupture and rupture of the uterine	2	.3	7	.8	9	.6
Scar of the uterus and uterine abnormalities	95	<b>13.8</b>	124	<b>14.5</b>	219	14.2
Twin pregnancy and prematurity	28	4.1	11	1.3	39	2.5
Total	686	100.0	855	100.0	1541	100.0

The table shows the reasons of the HC to transfer deliveries towards district hospitals. In general, the most prevalent reasons are mechanic and dynamic dystocia (54.7%) followed by scar of the uterus and uterine abnormalities (14.2%). The first three reasons of health centers to transfers women at district hospital at Kamonyi District are mechanic and dynamic dystocia (55.7%), scar of the uterus and uterine abnormalities (13.8%) and abnormalities of appendages (8.3%) while at Rwamagana district, there are mechanic and dynamic dystocia (53.9%), scar of the uterus and uterine abnormalities (14.5%) and acute fetal distress (10.4%).

**Table 5: Diagnosis at District Hospital by District Hospital in three years**

Diagnosis at District Hospital	Remera Rukoma (Non PBF)		Rwamagana (PBF)		Total	
Abnormalities of appendages	30	4.4%	13	1.5%	<b>43</b>	<b>2.8%</b>
Abnormality of the perinea	1	0.1%	5	0.6%	<b>6</b>	<b>0.4%</b>
Acute fetal distress	85	<b>12.4%</b>	133	<b>15.4%</b>	<b>218</b>	<b>14.1%</b>
Dystocic presentation	51	7.4%	58	6.7%	<b>109</b>	<b>7.0%</b>
Maternal pathology	5	0.7%	13	1.5%	<b>18</b>	<b>1.2%</b>
Maternal pathology associated with the pregnancy	1	0.1%	1	0.1%	<b>2</b>	<b>0.1%</b>
Mechanic and dynamic dystocia	183	<b>26.7%</b>	282	<b>32.6%</b>	<b>465</b>	<b>30.0%</b>
Intrauterine fetal death	18	2.6%	25	2.9%		<b>2.8%</b>
Normal delivery	156	<b>22.8%</b>	193	<b>22.3%</b>	<b>349</b>	<b>22.5%</b>
Others	8	1.2%	8	0.9%	<b>16</b>	<b>1.0%</b>
Post partum hemorrhage	3	0.4%	0	0.0%	<b>3</b>	<b>0.2%</b>
Pre-rupture and rupture of the uterine	34	5.0%	21	2.4%	<b>55</b>	<b>3.6%</b>
Scar of the uterus and uterine abnormalities	82	<b>12.0%</b>	105	<b>12.2%</b>	<b>187</b>	<b>12.1%</b>
Twin pregnancy and prematurity	28	4.1%	7	0.8%	<b>35</b>	<b>2.3%</b>
<b>Total</b>	<b>685</b>	<b>100.0%</b>	<b>864</b>	<b>100.0%</b>	<b>1549</b>	<b>100.0%</b>

In general, the majority of diagnosis were mechanic and dynamic dystocia in 30.0% (465 cases) followed by normal deliveries, acute fetal distress with scar of the uterus and uterine abnormalities respectively in 22.5% (349 cases), 14.1% (218 cases) and 12.1% (187 cases).

Regarding PBF and Non PBF districts, the first fourth diagnosis are in descending order: mechanic and dynamic dystocia (26.7% at Rermera Rukoma versus 32.6% at Rwamagana), normal deliveries (22.8% at Rermera Rukoma versus 22.3% at Rwamagana), acute fetal distress (12.4% at Rermera Rukoma versus 15.4% at Rwamagana) and finally scar of the uterus and uterine abnormalities (12.0% at Rermera Rukoma versus 12.2% at Rwamagana).

**Table 6: Comparison of reasons of transfer by HC with diagnosis at district level by year of admission.**

Admission year	Reasons are comparable with diagnosis at District Hospital level	Kamonyi Non PBF District		Rwamagana PBF District		Total		P Value
		N	%	N	%	N	%	
		2006	No	112	61.2%	155	73.8%	
	Yes	71	<b>38.8%</b>	55	<b>26.2%</b>	126	<b>32.1%</b>	
	Total	183	100.0%	210	100.0%	393	100.0%	
2007	No	63	46.7%	59	50.9%	122	48.6%	0.507
	Yes	72	<b>53.3%</b>	57	<b>49.1%</b>	129	<b>51.4%</b>	
	Total	135	100.0%	116	100.0%	251	100.0%	
2008	No	187	35.6%	111	29.5%	298	33.0%	0.058
	Yes	339	<b>64.4%</b>	265	<b>70.5%</b>	604	<b>67.0%</b>	
	Total	526	100.0%	376	100.0%	902	100.0%	
P-value		<b>0.000</b>		<b>0.0000</b>				

The table shows if the reasons of transferring pregnant women at risk for deliveries were comparable with the diagnosis at district hospital assuming that the diagnosis at district hospitals is the most correct one than that one from health centers.

During the years 2006, 2007 and 2008, there has been an increase in comparison of reasons of transfer of a health center and diagnosis at district hospital in both districts from 32.1% to 67.0% (about 2 times from 2006 to 2008).

If we compare health centers with district, we realize the increase of the comparability of the diagnosis in both districts and the difference is highly statistically significant in both districts:

- In Kamonyi district (non-PBF), through three years, the proportions of how reasons were comparable have been increased 1.7 times or increase of 25.6% from 38.8% in 2006 to 64.4% in 2008.
- In Rwamagana district, that proportion had also increased 2.7 times or increase of 44.3% from 26.2% in 2006 (the beginning of PBF intervention) to 70.5% in 2008. We can say that there had been much effort in health centers of Rwamagana district during three years.

If we compare districts during the period of our study, we may say that the proportion of comparable reasons for transferring pregnant women at risk for deliveries between health centers and district hospitals were high in Non PBF (38.8%) in 2008 than in PBF (26.2%) as well as in 2007 (53.3% at Kamonyi versus 49.1% at Rwamagana). Contrary in 2008, the proportion was higher in PBF district than in non PBF district (70.5% at Rwamagana versus 64.4% at Kamonyi). The difference is statistically significant in 2006, the beginning of PBF at Rwamagana district ( $p=0.008 < 0.05$ ) while it's not for 2007 ( $p=0.507 > 0.05$ ) and 2008 ( $p=0,058 > 0.05$ ).

Thus, we may conclude that there is no difference between PBF and Non PBF district regarding how reasons of transfer are comparable between health centers and district hospitals. These would mean that health centers may refer when the diagnosis is correct and much with the one of the district hospital. We could explain this by the fact that there have been formative supervision of health centers, training of health providers, the increase in qualified personnel, the role of emergency obstetrical care etc which were put in place in the health system of Rwanda and emphasized around 2006-2008. We may remind that in 2006-2007, non qualified health providers were not allowed to work in the Rwandan health sector and most of them (almost Auxiliaires de la santé) returned in schools to complete their studies.

### 6.2.2 Use of partogram between district hospital and health centers

**Table 7: Comparison of the completeness of partogram by HC in Non PBF and PBF district**

Admission year	District Hospital	Number (%)	Partogram properly completed		Total (%)	P
			No	Yes		
2006	Remera Rukoma (Non PBF)	N (%)	7 (41.2%)	10 ( <b>58.8%</b> )	17 (100.0%)	0.037
	Rwamagana (PBF)	N (%)	13 (76.5%)	4 ( <b>23.5%</b> )	17 (100.0%)	
	Total	N (%)	20 (58.8%)	14 (41.2%)	34 (100.0%)	
2007	Remera Rukoma (Non PBF)	N (%)	26 (51.0%)	25 ( <b>49.0%</b> )	51 (100.0%)	0.221
	Rwamagana (PBF)	N (%)	27 (39.7%)	41 ( <b>60.3%</b> )	68 (100.0%)	
	Total	N (%)	53 (44.5%)	66 (55.5%)	119 (100.0%)	
2008	Remera Rukoma (Non PBF)	N (%)	86 (32.3%)	180 ( <b>67.7%</b> )	266 (100.0%)	0.115
	Rwamagana (PBF)	N (%)	102 (26.6%)	281 ( <b>73.4%</b> )	383 (100.0%)	
	Total	N (%)	188 (29.0%)	461 (71.0%)	649 (100.0%)	
Overall Total			<b>261 (32.5%)</b>	<b>541(67.5%)</b>	<b>802 (100.0%)</b>	

Regarding the completeness of the partogram, generally they have been an increase of the proportion of partogram properly completed during 2006 to 2008 (41% to 71%). The difference is significant only in 2006 ( $p=0.037 < 0.05$ ) with 23.5% at Rwamagana district and 58.8% at

Kamonyi district but the following years there is no significant difference which would mean the effort to complete properly the partograms was almost similar in PBF and Non PBF districts. The particularity in 2006 may be due to the fact that the requirement of partogram from health centers was not essential condition (a sine qua non condition) to refer a pregnant woman on labor and there was no availability of emergency obstetrical care in 2006. And at Rwamagana district, health facilities began this Emoc at the beginning of 2007 which may explain why the proportion of the good completeness increased about three times from 23.5% to 60.3% comparing 2006 and 2008. Totally, for 802 partograms from HC found at District Hospitals, the majority were properly completed (67.5%) while others (32.5%) were not from 2006 to 2008.

**Table 8: completeness of a partogram by health centers in the two districts during 2006-2008**

Partogram properly completed if necessary			Admission year			Total	P Value
			2006	2007	2008		
Remera Rukoma, Non PBF District	No	N (%)	7 (41.2%)	26 (51.0%)	86(32.3%)	119 (35.6%)	0.035
	Yes	N (%)	10 (58.8%)	25 (49.0%)	180 (67.7%)	215 (64.4%)	
	Total	N (%)	17 (100.0%)	51 (100.0%)	266 (100.0%)	334 (100.0%)	
Rwamagana, PBF District	No	N (%)	13 (76.5%)	27 (39.7%)	102 (26.6%)	142 (30.3%)	0.000
	Yes	N (%)	4 (23.5%)	41 (60.3%)	281 (73.4%)	326 (69.7%)	
		N (%)	17 (100.0%)	68 (100.0%)	383 (100.0%)	468 (100.0%)	

The completeness of the partogram has increased during the three years for both PBF (Rwamagana, from 23.5% to 73.4%) and Non PBF (Kamonyi, from 58.8% to 67.7%) district and the difference is statistically significant ( $p=0.000$  for PBF and  $0.035$  for non PBF). This would mean that there is no difference between non PBF and PBF districts considering the completeness of the partograms during three years but it seems that there is a great number at Rwamagana than at Kamonyi.

The introduction of emergency obstetrical care (Emoc) at Rwamagana district at the beginning of 2007 and at Kamonyi district in 2005 may influence the increase of the completeness of the partogram as required in both PBF and Non PBF districts. But in PBF district, the proportion may increase because of the monthly formative supervision and incentives to health providers which would be frequent in PBF district than in non-PBF district during 2006 to 2008 or may be due to a turnover of the personnel in non-PBF district especially for those who were trained on the partogram use.

### **6.3 Criteria for classifying reference as “relevant” or “non-relevant” for health centers referring to district hospital level**

To know if a transfer from a health center to district hospital is relevant or non relevant, we have used some criteria. Criteria for classifying reference as relevant or non relevant for health centers referring to district hospital as seen in the definition of concepts were picked according to the scheme of health system in Rwanda. Because there are a minimum package in health centers and personnel, there are some activities which cannot be performed at health center and the health center must refer to the superior hierarchy which is a district hospital. Those criteria were constructed from the scientific base regarding maternal health (obstructed labor, mechanic and dynamic dystocia, postpartum hemorrhage, scar of the uterus and uterine abnormalities, etc) ((Herni De Tourris, 2000; National Institute for Health and Clinical Excellence, 2007; Southern Health, 2009). Thus, we had retained as a “relevant transfer” all women evacuated for obstetric reasons from health centers to district hospitals which met at least one of the criteria in the box 1 (see at page 3 ) and others were considered as “non-relevant transfers”.

#### 6.4 “Relevant references” of women with complication from health centers for both Rwamagana district (PBF) and Kamonyi district (Non-PBF);

**Table 9: Indicators of the use of emergency obstetrical services at District levels**

	RWAMAGANA DISTRICT (PBF)				KAMONYI DISTRICT (Non-PBF District)			
	2006	2007	2008	p-value <sup>6</sup>	2006	2007	2008	p-value <sup>6</sup>
<b>Information on population</b>								
a. Population <sup>1</sup>	205724	223141	240265		243051	260073	289174	
b. Crude Birth rate <sup>2</sup>	0.045	0.045	0.045		0.045	0.045	0.045	
c. Expected deliveries (a x b)	9258	10041	10812		10937	11703	13013	
d. Expected complications (c x 0,15)	1389	1506	1622		1641	1755	1952	
<b>Data of health facilities<sup>3</sup></b>								
e. Number of deliveries performed by health centers	2080	4212	5442		2986	3255	4250	
f. Number of obstetrical references performed by health centers	373	518	785		554	717	1004	
g. Met need realized at hospital level <sup>4</sup>	126	129	607		267	122	298	
h. Number of cesarean section in hospital	76	84	337		136	49	108	
i. Number of maternal deaths in health centers	0	1	2		1	2	4	
j. Number of maternal deaths in district hospital	0	0	1		3	2	4	
<b>Indicators</b>								
k. Proportion of assisted deliveries (skilled birth attendance) (e/c)	22.47%	41.95%	50.33%	0.000	27.30%	27.81%	32.66%	0.000
l. Proportion of obstetrical references performed by health centers	26.86	34.39	48.4	0.000	33.77%	40.84%	51.44%	0.000
m. Proportion of complications treated (g/d)	9.07%	8.56%	37.43%	0.000	16.27%	6.95%	15.27%	0.000
n. Rate of cesarean section as proportion of all deliveries (h/c)	0.82%	0.84%	3.12%	0.000	1.24%	0.42%	0.83%	0.000
o. Rate of cesarean section as proportion of all complicated deliveries (h/d)	5.47%	5.58%	20.78%	0.560	8.29%	2.79%	5.53%	0.000
p. Maternal mortality rate at health center (i/e)	0.00%	0.02%	0.04%	0.010	0.03%	0.06%	0.09%	0.610
q. Maternal mortality rate in district hospital among referred women (j/f)	0.00%	0.00%	0.13%	0.809	0.54%	0.28%	0.40%	0.910
r. Proportion of non relevant references <sup>5</sup>	20.60%	19.40%	24.70%	0.319	19.90%	22.10%	34.90%	0.000

The proportion of assisted deliveries at health centers of Rwamagana District has been highly increased during the period of three years from 22.47% in 2006 to 50.33% in 2008 and the differences is statistically highly significant ( $p = 0.000 < 0.05$ ). It is the same for proportion of treated complications and rate of cesarean section as proportion of all deliveries. The maternal mortality rate for mother at health centers had also increased and the difference is statistically significant ( $p = 0.010 < 0.05$ ). Contrary, the proportion of transferred women for deliveries as not relevant references increased in certain manner with 20.60% in 2006, 19.40% in 2007 and

24.70% in 2008 but the difference is not statistically significant (difference of 4.1%,  $p=0.319 > 0.05$ ). Thus the relevant transfers of women still the most frequent during the period of 2006 to 2008. The maternal mortality rate at Rwamagana district hospital had not statistically changed (almost 0%) during 2006 to 2008 ( $p=0.809 > 0.05$ ) and it was the same for rate of cesarean section as proportion of all complicated deliveries ( $p=0.560 > 0.05$ ).

As in Rwamagana District, the proportion of assisted deliveries at health centers of Kamonyi District (Non PBF) has been slightly also increased during the period of three years 27.30% in 2006 to 32.66% in 2008 and the differences is statistically highly significant (difference of 15%,  $p=0.000 < 0.05$ ). It is the same for proportion of treated complications. But there is a decrease of rate of cesarean section as proportion of all deliveries, rate of cesarean section as proportion of all complicated deliveries ( $p=0.000 < 0.05$ ). The maternal mortality rate at health centers had increased but the difference is not statistically significant ( $p=0.610 > 0.05$ ) and the MMR at Remera Rukoma district hospital had been decreased but not statistically significant during 2006 to 2008 ( $p=0.910 > 0.05$ ). Thus, the proportion of maternal death stills the same for health centers as well as for the district hospital.

Considering relevant and non relevant transfers, the proportion of transferred women for deliveries as not relevant references increased from 19.90% in 2006 to 34.90% in 2008 at Kamonyi district (non PBF District); the difference is highly statistically significant ( $p=0.000 < 0.05$ ). Thus, the relevant transfers of women for deliveries decrease in Kamonyi District (Non PBF) during the period of 2006 to 2008 and increased the non relevant transfers.

Comparing the two districts, we realize that in non-PBF District (Kamonyi), there are a lot of non relevant transfers than in the PBF district (Rwamagana), the maternal death (health center of district hospital) is high in Non-PBF district than in PBF district. But the proportion of assisted deliveries, proportion of complications treated and Rate of cesarean section as proportion of all deliveries increased in the two districts. Thus, the intervention of PBF does not have an adverse effect on references of women for deliveries for example for non relevant transfers by health centers to district hospital as the amount of money remunerated is the same for a delivery held in health centers and a for a transferred women at district hospital.

**Table 10: Relevant and non relevant transfers by year of admission in non PBF and PBF district**

Admission year	District Hospital	Number (%)	Relevant transfers and non relevant transfers		Total (%)	P Value
			Non Relevant	Relevant		
2006	Remera Rukoma (Non PBF)	N (%)	53 (19.9%)	214 (80.1%)	267 (100.0%)	0.856
	Rwamagana (PBF)	N (%)	26 (20.6%)	100 (79.4%)	126 (100.0%)	
	Total	N (%)	79 (20.1%)	314 (79.9%)	393 (100.0%)	
2007	Remera Rukoma (Non PBF)	N (%)	27 (22.1%)	95 (77.9%)	122 (100.0%)	0.591
	Rwamagana (PBF)	N (%)	25 (19.4%)	104 (80.6%)	129 (100.0%)	
	Total	N (%)	52 (20.7%)	199 (79.3%)	251 (100.0%)	
2008	Remera Rukoma (Non PBF)	N (%)	104 (34.9%)	194 (65.1%)	298 (100.0%)	0.001
	Rwamagana ( PBF)	N (%)	150 (24.7%)	457 (75.3%)	607 (100.0%)	
	Total	N (%)	254 (28.1%)	651 (71.9%)	905 (100.0%)	

Comparing non-PBF and PBF districts for relevant and non relevant transfers sent by health centers to district hospitals, the difference is not significant in 2006 (p=0.856) and 2007 (p=0.591) but in 2008 the difference is highly significant (p=0.001) where 34.9% are non-relevant transfers in Kamonyi (non PBF) district and 24.7% in Rwamagana (PBF) district. This may be explained by the frequency of quantitative and qualitative supervision by District PBF team at the level of district in health centers which may be not regular and frequent in non PBF district during 2006 to 2008 and those supervisions may influence the quality of management of the pregnant women on labor of delivery.

## 6.5 Neonatal and maternal outcome between two study districts for 2006, 2007 and 2008.

**Table 11: Estimation of the risk for the State of the mother and the intervention made by district**

District Hospital		Mother State (Die or live) at exit of the hospital		Total	p	OR	95% CI	
		Died	Lived				Lower Bound	Upper Bound
Remera Rukoma, Non PBF District	N (%)	9 (1.3%)	668 (98.7%)	<b>677 (100.0%)</b>	0.003	11.47	1.449	90.723
Rwamagana, PBF District	N (%)	1 (0.1%)	851 (99.9%)	<b>852 (100.0%)</b>				
<b>Total</b>	N (%)	<b>10 (0.7%)</b>	<b>1519 (99.3%)</b>	<b>1529 (100.0%)</b>				
District Hospital		Intervention performed at district hospital		Total	p	OR	1.110	1.670
		No	Yes					
Remera Rukoma, Non PBF District	N (%)	306 (44.6%)	380 (55.4%)	<b>686 (100.0%)</b>	<b>0.003</b>	<b>1.36</b>	<b>1.110</b>	<b>1.670</b>
Rwamagana, PBF District	N (%)	320 (37.2%)	541 (62.8%)	<b>861 (100.0%)</b>				
<b>Total</b>	N (%)	<b>626 (40.5%)</b>	<b>921 (59.5%)</b>	<b>1547 (100.0%)</b>				

The state of the mother at exit seems to depend, according to our data, on the fact that the district is PBF or Non PBF; at Remera Rukoma district hospital, 9 women (1.3%) died while it is 1 woman (0.1%) at Rwamagana District Hospital and 98.9% lived at Rwamagana while it's 98.7% at Remera Rukoma during three years. We would say that the high frequency of died women at Remera Rukoma, a non-PBF district, may be due to the absence of PBF intervention and the difference is highly statistically significant ( $p=0.003 < 0.05$ ). The OR of dying for Remera Rukoma, a non PBF district, is 11.466 times than at Rwamagana, a PBF district, during three years from 2006 to 2008. Note that this is the maternal mortality rate within the hospital.

Regarding the intervention performed or not (not normal deliveries) at district hospitals for referred deliveries, we have realized that being a PBF District would expose to do a lot of interventions (62.8%) and to be a PBF district may be associated with performing interventions or not ( $p$  is 0.003 and OR 1.361); thus, the references of women for delivery in a PBF district (Rwamagana) may be relevant than in non PBF district (Remera Rukoma). There are a great proportion of interventions in PBF which push us to think that they refer proper cases of pregnant women on labor for delivery and who need really interventions.

**Table 12: State of the baby a birth by year of admission in district hospitals**

District Hospital	State Of the baby a birth		Admission year			Total	Proportion of total deaths	P Value
			2006	2007	2008			
Remera Rukoma Non PBF	Death before 24 hours of live	N %	22 8.3%	9 7.6%	9 3.1%	40 5.9%	16.3%	0.000
	Death in utero (macerated)	N %	10 3.8%	6 5.0%	0 0.0%	16 2.4%		
	Liveborn	N %	207 78.4%	92 77.3%	269 91.2%	568 83.8%		
	Stillborn	N %	25 9.5%	12 10.1%	17 5.8%	54 8.0%		
	Total	N %	264 100.0%	119 100.0%	295 100.0%	678 100.0%		
Rwamagana PBF	Death before 24 hours of live	N %	1 0.8%	6 4.7%	13 2.2%	20 2.3%	13.4%	0.009
	Death in utero (macerated)	N %	2 1.6%	4 3.1%	7 1.2%	13 1.5%		
	Liveborn	N %	107 84.9%	105 81.4%	548 90.9%	760 88.6%		
	Stillborn	N %	16 12.7%	14 10.9%	35 5.8%	65 7.6%		
	Total	N %	126 100.0%	129 100.0%	603 100.0%	858 100.0%		

The proportion of death before 24 hours, the death in utero (macerated) and stillborn had decreased from 2006 to 2008 in the in the PBF district (Rwamagana). The proportion of liveborn (from 84.9% in 2006 to 90.9% in 2008) had increased and there has been also an increase of death before 24 hours (from 0.8% in 2006 to 2.2% in 2008) but there has been a decrease of stillborn from 12.7% in 2006 to 5.8% in 2008. The difference during the three years is statistically significant ( $p=0.009$ ). The proportion of total deaths (from death in utero to death before 24 hours of live) is 13.4% during three years.

In the non PBF (Kamonyi), there has been a decrease of all baby deaths: from 8.3% to 3.1% for deaths before 24 hours, 3.8% to 0.0% for death in utero and from 9.5% to 5.8% for stillborn at Remera Rukoma district hospital; the difference is highly statistically significant ( $p=0.000 < 0.05$ ). The proportion of total deaths (from death in utero to before 24 hours of life) is 16.3% among children born to women referred for deliveries at district hospital. It seems that the proportion of total deaths is higher in Non PBF (16.3%) than in PBF area (13.4).

**Table 13: Indicators on the state of the baby at birth district levels**

Data of health centers	Kamonyi District				Rwamagana District			
	2006	2007	2008	p value	2006	2007	2008	p value
a. Number of deliveries performed by health centers	2986	3255	4250		2080	4212	5442	
b. Number of obstetrical references performed by health centers	554	717	1004		373	518	785	
c. Met need realized at hospital level	267	122	298		126	129	607	
d. Number of neonatal deaths at health centers (in utero & stillborn)	53	86	61		28	NA*	50	
e. Number of neonatal deaths among referred and received at hospital (before 24 of live, in utero and stillborn)	57	27	26		19	24	55	
f. Number of neonatal deaths before 24 hours of live at district Hospital	22	9	9		1	6	13	
g. Number of deaths in utero (macerated) among referred to hospital	10	6	0		2	4	7	
<b>Indicators on the state of the baby at birth</b>								
h. Proportion of neonatal deaths at health centers (in utero & stillborn) (d/a)	1.77%	2.64%	1.44%	0.001	1.35%	NA	0.92%	0.102
i. Proportion of perinatal and neonatal deaths among referred and received at hospital (before 24, in utero and stillborn) (e/c)	21.30%	22.10%	8.70%	0.000	15.10%	18.60%	9.10%	0.003
j. Proportion of neonatal deaths before 24 hours among referred to district hospital (f/c)	8.20%	7.40%	3.00%	0.022	0.80%	4.70%	2.10%	0.430
k. Proportion of deaths in utero (macerated) among referred to district hospital (g/c)	3.70%	4.90%	0.00%	0.001	1.60%	3.10%	1.20%	0.256

NA= Not available

\*= all data in 2007 were not available for the number of death (perinatal and neonatal) at health centers

In Kamonyi district, the indicators of the state of the baby at birth during the period of 2006-2008 are presented below:

- Proportion (rate) of deaths in health centers of Kamonyi district was high in 2007 (26.4%) but it decreases in 2008. The difference is statistically significant ( $p=0.000 < 0.05$ ). This is the same for the proportion of perinatal and neonatal (all deaths from in utero to death before 24 hours of live) where the high increase is 22.1% in 2007 and decreased considerably at 8.7% in 2008 ( $p=0.000 < 0.05$ ).
- The proportion of neonatal deaths before 24 hours among babies born to referred women at district hospital decreased from 8.2% in 2006 to 3.0% in 2008 ( $p=0.02$ ) as well as the proportion of deaths in utero which decreases to 3.7% to 0% ( $p=0.001 < 0.05$ ).

The reasons of those changes could be the impact of Emoc and the role of CHWs.

At Rwamagana district Hospital, the proportion of perinatal and neonatal deaths at health centers (in utero and stillborn) as reported by them decreased from 1.35% (13.5/1000) in 2006 to 0.92% in 2008 with a difference not statistically significant ( $p=0.102 > 0.05$ ).

The proportion of perinatal and neonatal death among referred women to Rwamagana Hospital decreased from 2006 (15.1%) to 2008 (9.1%) but there is a peak in 2007 (18.6%). The difference was highly statistically significant ( $p=0.000 < 0.05$ ).

For the proportion of neonatal deaths before 24 hours among referred to district hospital, there is a great proportion in 2007 (4.7%) compared with 2006 (0.8%) and 2008(2.1%); this proportion remain almost the same during three years because the difference is not statistically significant ( $p=0.230 > 0.05$ ). It is the same for the proportion of perinatal deaths in utero among referred women to district level, 1.6% in 2006, 3.1% in 2007 and 1.2% in 2008 with a difference which is not statistically significant ( $p=0.253 > 0.05$ ).

**Table 14: Comparison of the state of the baby at birth (lived or died) by non PBF and PBF district**

Admission year	State of the baby a birth (lived or died)	Kamonyi Non PBF District		Rwamagana PBF District		Total		P Value
		N	%	N	%	N	%	
2006	Died	57	21.6%	19	15.1%	76	19.5%	0.129
	Lived	207	78.4%	107	84.9%	314	80.5%	
	Total	264	100.0%	126	100.0%	390	100.0%	
2007	Died	27	22.7%	24	18.6%	51	20.6%	0.427
	Lived	92	77.3%	105	81.4%	197	79.4%	
	Total	119	100.0%	129	100.0%	248	100.0%	
2008	Died	26	8.8%	55	9.1%	81	9.0%	0.874
	Lived	269	91.2%	547	90.9%	816	91.0%	
	Total	295	100.0%	602	100.0%	897	100.0%	

Among babies born on referred women for deliveries, during the year 2006-2008, there have been an increase of deaths (in utero, stillbirth or death before 24 hours of live) in 2007 (22.7% in Kamonyi and 18.6% in Rwamagana) than in 2006 and 2008. In 2008, it decreases for both districts. The different is not statistically significant for the state of the baby at birth (dying or living) between the PBF (Rwamagana) and non PBF (Kamonyi) districts ( $p > 0.05$ ) during the three years. We may explain this by the role or the impact of Emoc (both district) 2006 and the PBF (Rwamagana) as well as the role of the CHWs. At the beginning (2006), the impact was not seen but after 2 years (in 2008) we may see it like the increase of antenatal care, skilled birth attendant, institutionalized deliveries.

## 7. DISCUSSION OF THE RESULTS

In Rwanda, with the PBF system, a skilled birth attendance at health center is remunerated as the same of a referred one towards a district hospital. Thus, our study wants to explore the perverse effects of PBF in comparing one PBF-district (Rwamagana) and another non -PBF district (Kamonyi) during the period of 2006-2008 in the case of maternal health.

This was realized for the two districts assuming that there are some interventions which can influence the improvement of maternal health in Rwanda such as, performance based financing, sensitization of politico-administrative authorities, the district performance known as “IMIHIHO”, the important role of CHWs, training of the personnel and formative supervision of health facilities, community health insurance and other health insurance, etc. We have considered that all those interventions present the similarities for both districts with exception of PBF intervention present at Rwamagana and absent at Kamonyi despite some differences related to the performance of the health providers and resources during the year 2006, 2007 and 2008.

### **Number of deliveries assisted by qualified health providers and general characteristics**

According to the current health system of Rwanda, there are three level (health center, district hospital and National referral hospital) and in soon there will be five levels (Regional referral hospital, National referral hospitals, Provincial hospital, District Hospital and health centers); thus, when a patient needs care must use this health system structure from health centers to regional referral hospital (King Faycal Hospital). It is the same for the management in the maternal health care where when a health center is not able to manage a pregnant woman must refer to district hospital. It would be better if all women referred by health centers are found at district hospital but as we have seen all referred women were not found. Reasons of the absence of similarity may be: lack of the fulfillment of the condition fixed at the study of having a partogram or a reference paper, the poor keeping of the medical file by the record office, the fact that a woman may consult another health facility or never go to any health facility and deliver at home, etc. Because of some of them, only 39.2% of referred women for deliveries by health centers were found at district hospital level and all were included in the study.

Our study shows that at Rwamagana, the institutionalized deliveries were 22.47% in 2006 (39% according DHS 2005), 41.95% in 2007 and 50.33% in 2008. This last proportion was like the same than 52% from IDHS 2007-8 (Rwanda Ministry of Health (MOH) [Rwanda], 2009). For Kamonyi district, institutionalized deliveries are still lower than the one of IDHS 2007-8 (Rwanda Ministry Of Health (MOH) [Rwanda], 2009) because in 2006 the assisted deliveries were 27.30%, in 2007 it was 27.81% and 32.66% in 2008. What is more important is that there is a remarkable increase of institutional deliveries in a progressive manner due to the effort put in place by the Government of Rwanda through the policy of the MOH.

**Age of the mother:** Our results shows that the majority of referred women were aged between 20-34 years 72.3% (1111 referred women); it's the same for Chakraborty N et al in Bangladesh where the age-group of 20-34 years represents 61.3% (Nitai Chakraborty, M. Ataharul Islam, Rafiqul Islam Chowdhury, 2003). Our results are similar also for those of Minoos Rajaei & al in Iran; the most frequent age group was aged from 19-34 years in 79.7% (Rajaei, Amirzadeh, Mirbloom, Soltani, & Abbas, 2010) and Christine L Roberts where the most frequent age group is 20-34 years with 76.6% (Christine L Roberts, David Henderson-Smart, 2000).

In our study, the mean age was 27.90 years for Non PBF District and 26.60 years in PBF District (overall mean is 27.17 years with a range of 16-48 years); and for Basinga et al in Rwanda, the mean age is 30.89 years in treatment group and in 31.22 years in comparison group (Basinga, Gertler, & Vermeersch, 2010) and it's like the same for Steven L. Bloom & all (Bloom, Leveno, Spong, & Gilbert, 2006) with a mean of 26.1 years (range of 12-51). In Mali, Traore et al found the mean age of 29.5 years (Traore B, Thera A. T, Kokaina C, Beye S A, Mounkoro N, Teguet I, Traore Y, 2010) while it is 26.3 years in Burkina Faso with the range of 16-49 years (Ouedrago C, Zoungrana T, Dao B., Duhardin B, Ouedrago A, Theba B, Lankoande J, 2001).

**Use of the partogram:** In our study, 32.5% of partograms (261 partograms) were incorrectly completed, the proportion which is likely 2 times higher than the one found in Mali where Diarra & al. found that 287 partograms (18.85%) were incorrectly filled (Diarra I., 2010). We may not find the differences in PBF and Non PBF district, because the availability of emergency obstetric care began almost at the same time with training on the partogram use, increase of qualified personnel (nurses A<sub>2</sub>), availability of equipment in health centers, etc. An effort in

completing correctly the partogram is needed in order to improve the management of the pregnant women on labor.

**Mode of delivery :** In our study cesarean section represents the most frequent mode of delivery in 49.5% among referred women, proportion which not far from that found by Patrick Thonneau et al in Conakry, Guinea where of the women transferred, 161 (46%) had a caesarean section (Thonneau, Xu, & Toure, 1994).

In 2008 the rate of cesarean section as proportion of all complicated deliveries was 20.78% at Rwamagana district, rate which is similar of that found in the literature (15 to 20%) (Herni De Tourris, 2000) but that rate was lower with 5.53% at Remera Rukoma. For Ouedraogo C., Burkina Faso, for 478 caesareans from August 1999 to January 30th 2000 on 2209 deliveries, the rate was 21.6 % (Ouedragogo C, Zoungrana T, Dao B., Duhardin B, Ouedraogo A, Theba B, Lankoande J, 2001).

### **Indications or diagnosis among referred women at district hospital and relevance of transfers**

The most frequent indications in our study were Mechanic and dynamic dystocia (54.7%), scar of the uterus and uterine abnormalities (14.2%), acute fetal distress (7.7%) and dystocic presentation (7.5%). Except for the mechanic and dynamic dystocia which represents the high proportion, other indications have a low frequency than other studies as it's shown by Picaud et al., Jamet et al., Cisse et al. and Ouedragogo et al. (Cisse, Martin, Ngoma, & Mendes, 1996; Jamet F, Benos P, Hedon B, 1996; Ouedragogo C, Zoungrana T, Dao B., Duhardin B, Ouedraogo A, Theba B, Lankoande J, 2001; Picaud A., Nlome-Nze A.R., Kouvahe V., Faye A, 1990) (see annex D) .

Among referred women by health centers to district hospitals, 10 (0.6% or 600/100000 livebirths) died during three years while regarding maternal mortality, 25 (7%) transferred women died during the study in Conakry by Patrick Thonneau (Thonneau et al., 1994). Our results are similar to those one of Rahlenbecka S. & Hakizimana C. in a Byumba district hospital 0.6% (Soeters et al., 2006).

In our study the overall perinatal mortality in the two districts is 13.5% or 135/1000 births (208 cases) during three years. Comparatively with other studies in low income countries it is low Ouedraogo (15.9%) (Ouedragogo C, Zoungrana T, Dao B., Duhardin B, Ouedrago A, Theba B, Lankoande J, 2001), Gaye (18 %) (Gaye A., 1998), Boullin (24 %)(Bouillin D., Fournier G., Gaye A., Fadel D., 1994), Bellier (22 %)(Bellier G, 1975), and Cisse (24 %)(Cisse et al., 1996).

Our study shows an increase in number of skilled birth attendance (5.4% in Kamonyi and 27.8% in Rwamagana) in HC as well as the number of referred women for deliveries (17.6% in Kamonyi and 21.5% in Rwamagana) towards district hospitals during the period of 2006-2008. This has been shown by others studies in Rwanda (Basinga P, Condo J, Meessen B, Ilunga Kashala J P, Musango L, n d; Meessen, J.-P. I. Kashala, & Musango, 2007).

Our study had also shown that the proportion of complications managed at district levels (PBF and non PBF) during the period of 2006-2008 had increased for the two districts as well as the rate of cesarean sections. These show the same confirmation as the study of Louis Rusa et al where between 2001 and 2004; the PBF group saw an increase of institutional deliveries of close to 11 percentage points, while the non-PBF group increased by only 3.0 percentage points(Rusa et al., 2009).

While the majority of transfers were relevant before the IP (initiative for performance) and did not change after the introduction of this IP (Soeters et al., 2006), the relevant transfers have increased for Rwamagana (PBF) but have decreased at Kamonyi (non PBF). This would mean that the PBF intervention does not lead to non relevant transfers of pregnant women for deliveries by health centers towards district hospitals but the increase of quality as shown by Rusa et al in 2001-2003 where for the quality, scores were considerably higher for effective management of deliveries and referral systems(Rusa et al., 2009).

The remaining proportion of non relevant transfers for deliveries from health centers towards district hospitals in 2008 with 24.47% at Rwamagana, a PBF district, may be probably due to the training or education of the health providers during their studies or due to the low availability of emergency obstetrical care or turner over of the personnel which is new in the services or to needs simply to be trained This was shown by a multicenter study in Rwanda, Benin, Jamaica and Equator showed that the knowledge and skills of health personnel to deal with obstetric

emergencies were very weak and fall to 40-60% of standard norms (Abouzahr C &T, 2001). We have assumed that a non relevant transfer may have almost consequences for both family of the women and the health facilities. We can explain this in term of economy and time. For example, a family for which a women had been referred to district hospital being in 55 km, there a expenditure s like money for transport, buying food and drinks, preparing all the necessary for a pregnant women and even for buying medicines. For the time spend at district hospital as well as the psycho-social influence of a women who has recently given birth would receive cannot be measured. The loss to the health facilities (health center or a district referral hospital) may be thought in term of money (for the fuel and maintenance of the ambulance), stress or overwork to the health providers especially for those of the district hospital. For health providers in healthy centers they can be discredited either by his colleagues or by women of the family because when a health provider refers someone must explain to him the reason of this reference and when that reason is not true for one or several time, it may be a doubt on the competence of those health providers.

Like some authors believe that the bad design of indicators can lead to perverse effect and negative effect on the quality of care (Werner R.M., 2007), we didn't observe them in our study. Any adverse potential effect had been observed due to the intervention of PBF, which may have been seen in Rwamagana district,; no increase of non relevant transfers of women for deliveries at district level during the three years (2006-2008) as seen above. Contrary, we have seen the increase of those non relevant transfers in the non-PBF district (Kamonyi); thus the PBF had brought an improvement in the management of the emergency of maternal cases.

This may answers the questions raised by some observes as Bruno Meessen and colleagues wrote *“Some observers have raised the concern that buying outputs may induce a shift in staff values or expectations (e.g. create the perverse perception that any behavior deserves a specific payment). To avoid this problem, the bonus contracts in Kabutare clearly refer to medical ethics and describe possible sanctions that would be imposed in case of fault”*(Meessen, Musango, J.-pierre I. Kashala, & Lemlin, 2006).

In the case of maternal health, because the normal delivery performed at health center is remunerated at the same amount as the referred women at district level for delivery, we would

expect to have as negative impact a great number of “non relevant transfers” in the PBF area than in the non PBF area. This greater number of “non relevant transfers” would have been due to (possible hypothesis):

- **Lack of competent personnel:** the health center may refer because their personnel are not able to manage a normal delivery.
- **Laziness of the health providers** at health center that would refer women on labor for delivery to district hospital while it was a simple normal delivery.
- **Fear to have problems** related to the delivery (like maternal deaths, fetal distress, postpartum hemorrhage, etc) and health provider prefer to send a woman at district hospital. We can say that because of that fear, the health care provider in health center would prefer to get rid of women on labor for delivery in order to be free.
- **Insufficient qualified health providers** that in some cases they may not be a qualified person to do a night duty or even, if he/she is present can be overworked (because of that health centers may refer as well as there is a remuneration to a referred women for delivery).
- **Insufficient or absence of equipment** (or even equipment in bad condition) which may influence the health provider in health centers to refer to district hospital.
- **The issue of infrastructure in a health center** (health center not far from the hospital, health center without appropriate infrastructures, transportation easily available) may also bring their health providers to refer women towards district hospitals.

Briefly, in our study, these reasons did not influence the transfers of women for maternal reasons which would have induced an increase of “non relevant transfers” in the PBF area but at the contrarily we have seen a significant increase in the non-PBF area.

The proportion of death before 24 hours, the death in utero (macerated) and stillborn have decreased from 2006 to 2008 in the PBF (Rwamagana) and Non PBF (Remera Rukoma) district hospitals while the number of liveborn had increased. This is a bit different for the study of Paulin where there was a slight increase of still born but not statistically significant (Basinga P, Condo J, Meessen B, Ilunga Kashala J P, Musango L, n d).

## 8. CONCLUSION AND RECOMMENDATIONS

### 8.1 Conclusion

By the end of this study, we conclude that there has been increase of institutional deliveries and references of pregnant women at health centers to districts hospitals in both PBF (Rwamagana) and non PBF (Kamonyi) districts during the years 2006-2008.

For the reasons of references of pregnant women from health centers to districts hospitals, there has been a significantly increases of the comparability reasons between health centers and district hospitals in both PBF and non PBF districts. Formative supervisions by district hospitals, training of health providers, increases in qualified personnel put in place in the health system of Rwanda may have been contributing to this. There has been also an increase of the proportion in the correct use of partogram in health centers referring to district hospitals from 2006 to 2008.

Results show that there are no potential risks especially non-relevant transfers due to performance based financing intervention in the district which has used this approach from 2006 to 2008 but in the non-PBF district, there has been a significant increase of non relevant transfers of women for maternal reasons during that period.

Auditing the cases of perinatal deaths, stillbirths and death before 24 hours, we observed that in PBF District (Rwamagana), the overall perinatality (from death in utero to death before 24 hours) was 13.4% during three years and the proportion of death before 24 hours had increased while the ones of stillborn had decreased. In the non PBF (Kamonyi), there has been a decrease of all baby deaths from death in utero to deaths before 24 hours with an overall perinatality of 16.3% among children born to women referred for deliveries at district level.

### 8.2 Limits of our study

Our study presents some limits. These results came from a lower number of referred deliveries compared with the reality; this is a retrospective study and then the total number of transfers of women from Health centers to district hospitals is underestimated by lack of data because of by bad medical record keeping especially at Rwamagana district hospital. Only transfers to district

hospitals with a reference paper or a partogram and only for deliveries (preterm, term or post term) were considered. In addition, women transferred and went to the other hospitals without passing to their district hospital were not included. However, we believe that the number found is representative for the transfers from health centers to district hospitals.

Our study is only based on the comparison of two districts and even though those two districts cover many health centers there is an issue of intracluster correlation. This means that all HC covered by one district may be correlated between them in terms of inputs, process, output and outcomes and then affect the external validity of our study.

### 8.3 Recommendations

After analyzing the results, some recommendations have been formulated and addressed to different levels:

- To MOH, donors and decision makers in health sector, recommendations are:
  - Continue the reinforcement of the PBF by formative supervision in order to avoid or reduce the perverse effects especially the sustainability of this strategy;
  - Reinforce the training and education of health providers in all health facilities;
  - Reinforce and sensitize the population to deliver at health facilities in order to increase the proportion of assisted deliveries;
  - Analyze the causes of deaths either for mother or babies in order to improve the health system and achieving the MDGs.
- To Health facilities and health providers:
  - Improvement of the management of pregnant women (refer when necessary and at time, using the partogram correctly, training and follow up) in order to avoid the non relevant transfer for deliveries, to detect pregnancy with risk and then to reduce maternal and perinatal deaths.
- To researchers
  - Conduct a similar study to see if there are no potential adverse effects due to PBF intervention at the national level in the other field.
  - Contact a research that address others potentials negative effects for all indicators remunerated by PBF.

## REFERNCIES

- Abouzahr C & T, W. (2001). Maternal mortality at the end of a decade: signs of progress? *Bulletin of the World Health Organization*, 79(6), 561-568.
- AbouZahr, C., & Wardlaw, T. (2001). Maternal mortality at the end of a decade: signs of progress? *Bulletin of the World Health Organization*, 79(6), 561-568. World Health Organization. Retrieved from <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2566451&tool=pmcentrez&rendertype=abstract>.
- Basinga P, Condo J, Meessen B, Ilunga Kashala J P, Musango L, D. G. A. (n.d.). Rémunérer les accouchements et les références obstétricales, une stratégie acceptable? L'expérience de l'Initiative pour la Performance au Rwanda.
- Basinga, P., Gertler, P. J., Binagwaho, A., Soucat, A. L. B., Sturdy, J., & Vermeersch, C. M. J. (2011). Effect on maternal and child health services in Rwanda of payment to primary health-care providers for performance : an impact evaluation. *The Lancet*, 377(April 23), 1421-1428. Elsevier Ltd. doi: 10.1016/S0140-6736(11)60177-3.
- Basinga, P., Gertler, P. J., & Vermeersch, C. M. J. (2010). Paying Primary Health Care Centers for Performance in Rwanda. *Policy Research Working paper 5190*.
- Bellier G. (1975). 390 césariennes en deux ans à la maternité de N'Djaména. *Méd. Trop.*, 34, 301-4.
- Bloom, S. L., Leveno, K. J., Spong, C. Y., & Gilbert, S. (2006). Decision-to-Incision Times and Maternal and Infant Outcomes. *Obstetrics & Gynecology*, 108(1), 6-11.
- Borghj, J., Ensor, T., Somanathan, A., Lissner, C., & Mills, A. (2006). Mobilising financial resources for maternal health. *Lancet*, 368(October 21), 1457-65. doi: 10.1016/S0140-6736(06)69383-5.
- Bouilllin D., Fournier G., Gaye A., Fadel D., C. C. T. (1994). Surveillance épidémiologique et couverture chirurgicale des dystocies obstétricales au Sénégal. *Cahiers Santé*, 4, 399-406.
- Bruno Meessen, A. S. & Claude S. (2011). Performance-based financing : just a donor fad or a catalyst towards comprehensive health-care reform ? *Bull World Health Organ*, 89(March 2010), 153-156. doi: 10.2471/BLT.10.077339.
- Campbell, O. M. R., & Graham, W. J. (2006). Maternal Survival 2 Strategies for reducing maternal mortality : getting on with. *Lancet*, 368, 1284-1299. doi: 10.1016/S0140-6736(06)69381-1.
- Christine L Roberts, David Henderson-Smart, D. A. E. and the H. R. O. and perinatal A. W. G. (2000). Antenatal transfer of rural women to perinatal centres. *Aust N Z J obstet Gynecol*, 40(4), 377-384.
- Cisse, C. T., Martin, S. L., Ngoma, S. J., & Mendes, V. (1996). Mortalité néonatale précoce à la maternité du chu de Dakar : Situation actuelle et tendances évolutives entre 1987 et 1994. *Medecine d'Afrique Noire* 43(5), 254-258.

- Eldridge, C., & Palmer, N. (2009). Performance-based payment : some reflections on the discourse , evidence and unanswered questions. *Health Policy and Planning*, 24(February), 160-166. doi: 10.1093/heapol/czp002.
- Gaye A., D. B. L. (1998). Césarienne et qualité des soins. Etude de 177 césariennes en 6 mois au Centre de Santé Roi Baudouin de GUEDIA WAYE (Dakar). *Communication, 5ème Congrès SAGO*.
- Herni De Tourris, G. M. et F. P. (2000). *Gynécologie et Obstétrique* (7th ed., p. 244). Paris: Masson.
- Hogan, M. C., Foreman, K. J., Naghavi, M., Ahn, S. Y., Wang, M., Makela, S. M., et al. (2010). Maternal mortality for 181 countries , 1980 – 2008 : a systematic analysis of progress towards Millennium Development Goal 5. *The Lancet*, 375(April), 1609-1623. Elsevier Ltd. doi: 10.1016/S0140-6736(10)60518-1.
- Institut National De La Statistique. (2005). *Rwanda Enquête Démographique et de Santé 2005 Rapport Préliminaire*.
- Jamet F, Benos P, Hedon B, L. F. (1996). La césarienne en situation précaire. *Rev. Fr Gynecol. Obstet*, 91(10), 486-92.
- Kalk, A., Paul, F. A., & Grabosch, E. (2010). “ Paying for performance ” in Rwanda : does it pay off ? *Tropical Medicine and International Health*, 15(2), 182-190. doi: 10.1111/j.1365-3156.2009.02430.x.
- Meessen, B., Kashala, J.-P. I., & Musango, L. (2007). Output-based payment to boost staff productivity in public health centres: contracting in Kabutare district, Rwanda. *Bulletin of the World Health Organization*, 85(2), 108-15.
- Meessen, B., Musango, L., Kashala, J.-pierre I., & Lemlin, J. (2006). Reviewing institutions of rural health centres : the Performance Initiative in Butare , Rwanda. *Tropical Medicine and International Health*, 11(8), 1303-1317. doi: 10.1111/j.1365-3156.2006.01680.x.
- Ministere de la Sante. (2008). *Guide de l' Approche Contractuelle Pour les Centres de Santé. Manuel de Utilisateur Gestion*.
- Musgrove, P. (2010). Financial and Other Rewards for Good Performance or Results : A Guided Tour of Concepts and Terms and a Short Glossary. *The World Bank Report*, (September), 1-9.
- National Institute for Health and Clinical Excellence. (2007). Intrapartum care: care of healthy women and their babies during childbirth. *NICE clinical guideline 55-intrapartum care*, 55(September), 1-65. Retrieved from www.nice.org.uk.
- New Zealand College of Midwives. (2008). Transfer Guidelines. *Transfer Guidelines* (pp. 1-10).
- Nitai Chakraborty, M. Ataharul Islam, Rafiqul Islam Chowdhury, W. B. and H. H. A. (2003). Determinants of the use of maternal health services in rural Bangladesh. *Health Promotion International*, 18(4), 327-337. doi: 10.1093/heapro/dag414.

- Ouedrago C, Zougrana T, Dao B., Duhardin B, Ouedrago A, Theba B, Lankoande J, K. B. (2001). Césarienne de qualité au Centre Hospitalier Yalgado Ouedrago de Ouagadougou. Analyse des déterminants à propos de 478 cas colligés dans le service de gynécologie obstétrique. *Medecine d'Afrique Noire*48(11), 441-451.
- Picaud A., Nlome-Nze A.R., Kouvahe V., Faye A, O.-M. R. (1990). Les indications de césariennes et leur évolution au Centre Hospitalier de Libreville. *Rev. Fr Gynecol. Obstet*, 5(6), 93-98.
- Rajaei, M., Amirzadeh, S., Mirbloom, F., Soltani, M. A., & Abbas, B. (2010). The Effect of Maternal Age on Pregnancy Outcome 1. *Asian Journal of Medical Sciences*, 2(3), 159-162.
- Ronsmans, C., & Graham, W. J. (2006). Maternal mortality: who, when, where, and why. *Lancet*, 368(9542), 1189-200. doi: 10.1016/S0140-6736(06)69380-X.
- Rusa, L., Schneidman, M., Fritsche, G., & Musango, L. (2009). Rwanda: Performance-Based Financing in the Public Sector. *Cnter for Global Development*, 10, 189-215.
- Rwanda Ministry Of Health (MOH) [Rwanda], N. I. O. S. O. R. N. A. I. M. (2009). *Rwanda Interim Demographic and Health Survey 2007-08. Methodology* (p. 190). Kigali.
- Smithson, P., Iteba, N., Mukasa, O., Mzige, A., Mapunda, M., Njaila, D., et al. (2007). *Performance-Based Financing Report on Feasibility and Implementation Options. Health (San Francisco)* (p. 62).
- Soeters, R., Habineza, C., & Bob, P. (2006). Performance-based financing and changing the district health system : experience from Rwanda. *Bulletin of the World Health Organization*, 84(11), 884-889.
- Southern Health. (2009). Midwifery primary carer ( all sites ) transfer criteria Guideline. *Southern Health*.
- Thonneau, P., Xu, Q., & Toure, B. (1994). Obstetric transfers and maternal mortality : a study in Conakry , Guinea. *Health Policy and Planning*, 9(1), 81-90.
- Traore B, Thera A. T, KokainaC, Beye S A, Mounkoro N, Teguede I, Traore Y, D. A. (2010). Les accouchements dystociques au Centre Hospitalier Régional de Ségou au Mali - A propos de 240 cas. *Medecine d'Afrique Noire*57(3), 161-165.
- UNICEF. (2008). *Progrès pour les enfants, mortalité maternelle, Bilan statistique* (p. 45).
- Werner R.M., D. A. A. (2007). Clinical concerns about clinical performance measurement. *Annals of Family Medecine*, 5(2).
- WHO, ICM, F. (2004). Making pregnancy safer : the critical role of the skilled attendant A joint statement by WHO , ICM and FIGO. *World health Organization* (p. 18).
- WHO, UNICEF, UNFPA, and T. W. B. (2007). *Maternal Mortality in 2005. World Health* (pp. 1-39).
- World Health Organization. (1994). *The partograph: the application of the WHO partograph in the management of labour. Report of WHO multicentre study, 1990-1991*.

## ANNEX

### A. QUESTIONNAIRE OF REFERRED DELIVERIES

#### A.1. At the health center

N°	Variable	Answers	Code
1.	Name of health center		
2.	District Hospital		
3.	ID card / Register		
4.	Name & first name of the patient		
5.	Name of husband / head of family		
6.	Age (in years)		
7.	Sector		
8.	Cell		
9.	Partogramme properly completed	1. Yes 2. No 3. Absent 4. Not needed	
10.	Payment options	1. Mutuelle de santé (mutual health) 2. Other health insurance (specify) 3. No health insurance	
11.	Date of arrival in HC		
12.	The hour of arrival in HC		
13.	Age of pregnancy	1. At term 2. Pre-term 3. Post term 4. IUFD or MFIU ( macerated Child)	
14.	Fetal Presentation	.....	
15.	Rupture of amniotic sac	1. Yes 2. No 3. Not Specified 4. Not applicable	
16.	Date of amniotic sac rupture		
17.	Hour of amniotic sac rupture		
18.	Appearance of amniotic fluid	1. Clear 2. Meconium 3. Tinted 4. Not applicable	
19.	Date of start of real labor		
20.	Start time of real labor		
21.	Fetal heart rate	1. Absent 2. < 120 beats/min 3. 120-160 beats/min	

		4. > 160 beats /min	
22.	Cervical dilation (cm)		
23.	Descent	Descent : 5/5 Descent : 4/5 Descent: 3/5 Descent : 2/5 Descent : 1/5 Descent : 0/5	
24.	Contractions (number of contraction/10 min) before transfer		
25.	Tonus of contractions (before transfer)	1. < 20 seconds 2. 20-40 seconds 3. > 40 seconds	
26.	Date of the Transfer		
27.	Hour of the Transfer		
28.	Reason for transfer		

#### A.2. At the District Hospital

N°	Variable	Answers	Code
29.	Date of arrival at the district hospital		
30.	Hour of arrival at the district hospital		
31.	Did she receive oxytocin?	1. Yes      2. No	
32.	Did she receive Cytotec ?	1. Yes      2. No	
33.	Mode of delivery and intervention	1.Eutocic (normal delivery) 2.Obstructed (dystocia) 3. Caesarean section 4.Laparotomy 5.Hysterectomy 6.Has not given birth there	
34.	Diagnosis (indication)	.....	
35.	State of the child at birth	1. Liveborn 2. Stillborn 3. Death before 24 hours 4. Death in utero	
36.	APGAR 10 points	1st :.... 5th :..... 10th :.....	
37.	Birth weight (in grams)		
38.	State of the mother at the exit	1. Healed 2. Improved 3. Died 4. Other to specify (transferred, escaped, complications, ...)	
39.	Date of exit of the patient		
40.	Date of transfer to CHUK		
41.	Time of transfer to CHUK		
42.	Reason for transfer to CHUK	.....	

**Preliminary Diagnosis**

43. 1. The delivery could take place in the health center:

- 1. Yes
- 2. No
- 3. Difficult to decide

43.2. The pregnancy risk was identified and referred to time:

- 1. Yes
- 2. No
- 3. Difficult to decide

**B. QUESTIONNAIRE OF PERINATAL MORTALITY**

N	Variable	Answers	Code
44.	Name of health center		
45.	Hospital of reference	1. Rwamagana. 2. Remera Rukoma (Kamonyi)	
46.	Name & first name of the patient		
47.	Age (years) of the patient		
48.	Sector		
49.	Cell		
50.	Date of Arrival in the HC		
51.	Hour of arrival in the HC		
52.	Age of pregnancy	1. Term 2. Pre-term (preterm) 3. Post term 4. IUFD or MFIU (Macerated child)	
53.	Twin pregnancy	1. Yes 2. No	
54.	Fetal Presentation	..... .....	
55.	Rupture of amniotic sac	1. Yes 2. No 3. Not Specified 4. Not applicable	
56.	Date of rupture of the amniotic sac		
57.	Time of rupture of the amniotic sac		
58.	Appearance of amniotic fluid	1. Clear 2. Meconium 3. Tinted	

		4. Not applicable	
59.	Date of start of real labor		
60.	Fetal heart rate before transfer	1. Absent 2. < 120 beats/min 3. 120-160 beats/min 4. > 160 beats/min	
61.	Dilation of the cervix (in cm) before the transfer		
62.	Contractions (number of contraction/10 min) before transfer		
63.	Tonus of contractions	1. < 20 seconds 2. 20-40 seconds 3. > 40 seconds	
64.	Date of birth		
65.	Hour of delivery		
66.	Diagnosis of the cause of death		
67.	APGAR (1st, 5th and 10h min)		
68.	Resuscitation of the baby	1. Yes 2. No	
69.	Treatment of the baby	Yes/No	
70.	Malformation of the baby	.....	
71.	Mode of delivery	1. Eutocic (normal delivery) 2. Obstructed (dystocia) 3. Caesarean section 4. Laparotomy 5. Hysterectomy 6. Has not given birth there	

**Prognosis of the baby:**

1. The baby could be saved at the health center
2. The baby could not be saved at the health center
3. Difficult to decide

### C. Explanations for the table 9

#### Box 2: Explanations for the table 9

<sup>1</sup> Total population of health centers of Kamonyi and Rwamagana Districts)

<sup>2</sup> Crude birth rate defined as number of live birth by 1000 habitant/year, is 45/1000 (DHS, 2000)

<sup>3</sup> The data are representing the health centers of Rwamagana and Kamonyi districts in which we found in HMIS report at district levels and patients file for referred women.

<sup>4</sup> Referred women in whom we found at district levels with partogram or a transfer paper from HC

<sup>5</sup> Criteria of judgment for relevant references are described in the part of “Definition of concept and analytic strategies”.

<sup>6</sup> The comparison of the three proportions by Chi-square. Every time the proportions are compared for the years 2006, 2007 and 2008.

Maternal mortality rate is due to causes during labor to the exit of the patient at health facility (direct causes)

### D. Comparison of indications or diagnosis in our study with others studies

Indications	Our study	(Picaud A., Nlome-Nze A.R., Kouvahe V., Faye A, 1990)	(Jamet F, Benos P, Hedon B, 1996)	(Cisse et al., 1996)	(Ouedragogo C, Zoungana T, Dao B., Duhardin B, Ouedrago A, Theba B, Lankoande J, 2001)
Mechanic and dynamic dystocia	54.7%	6.3 %:dynamic dystocia 22.3% : FPD	30% : mechanic dystocia) 16% : dynamic dystocia	9.3 % (dynamic dystocia) and 30.4 % (FPD)	25.1% (FPD), 11.1% (bone dystocia), 5.8% (dynamic dystocia)
Scar of the uterus and uterine abnormalities	14.2%	19.3 % (scar of the uterus)			15% (scar of the uterus)
Acute fetal distress	7.7%	11.1 %	4.2%	18.2 %	15.2%
Dystocic presentation	7.5%		9.4%		10%