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**Reduction of maternal mortality by 2015 in the District of
Huye, Rwanda : Bottlenecks in the working environment of
future midwives**

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1. Introduction

The right to life and health is a basic human right (DRH-WHO/AFRO, 2004). In Africa, maternal mortality comprises a silent emergency and has remained so for many years (DRH-WHO/AFRO, 2004).

In September 2000, the largest-ever assembly of Heads of State ushered in the new millennium by adopting the Millennium Declaration. This Declaration, ratified by 189 countries, was translated into a roadmap setting out eight goals to be accomplished by 2015. These Millennium Development Goals (MDGs), are built on agreements made at United Nations conferences in the 1990s and represent commitments to reduce poverty and hunger, to tackle ill-health, gender inequality, lack of education, lack of access to clean water and environmental degradation (UN Development Group, 2003).

Millennium Development Goal 5: Improve maternal health. This health target is set up to reduce the maternal mortality ratio (MMR) by three-quarters between 1990 and 2015. Two health indicators are implemented in order to achieve MDG 5. Indicator 16 is the 'Maternal Mortality Ratio' and indicator 17 specifies the proportion of births attended by skilled health personnel (World Health Organization, 2005). The maternal mortality ratio is 'the number of women who die from any cause related to or increased by pregnancy or its management during pregnancy and childbirth or within 42 days after delivery, independent of the duration and site of the pregnancy, per 100.000 live births' (DRH-WHO/AFRO, 2004; World Health Organization, 2005; UN Development Group, 2003). The proportion of births attended by 'skilled health personnel' is 'the percentage of deliveries attended by personnel trained to give the necessary supervision, care and advice to women during pregnancy, labour and the post-partum period, to conduct deliveries on their own and to care for newborn infants'. Skilled health personnel include only those who are properly trained and having appropriate equipment and drugs. Traditional birth attendants, even if they have received a short training course, are not considered as skilled health personnel (UN Development Group, 2003).

There is a high birth rate in Rwanda. In 2005 the total fertility rate per woman was 5,5 (World Health Organization, 2007). The prevalence of using contraception cited by the World Health Organization in 2005 is 13,2%, the prevalence cited by Cleland et al. (2006) is 17,3%. It is estimated that over 20% of the population has an unmet need for contraception (Cleland et al., 2006).

Rwanda carries an extra heavy burden since the genocide in 1994. The maternal mortality rate was in 2005, 1400 per 100000 live births in Rwanda. Globally, the maternal mortality ratio had been estimated to be 400 per 100000 live births (World Health Organization, 2007).

It is interesting to note that in Rwanda, a country that has about 9 million inhabitants, there were only 77 midwives working actively in 2004. This means that there is only 0,01 midwife per 1000 inhabitants (World Health Organization, 2007). Almost all these midwives are working in private and university hospitals, so that no midwives work in the rural regions of Rwanda. In Rwanda 39% of the deliveries in 2005 occurred under the responsibility of a skilled birth attendant (World Health Organization, 2007). A skilled birth attendant is defined 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 pregnancies, childbirth and the immediate postnatal period, and in the identification, management and referral of complications in women and newborns” (World Health Organization, 2007).

Each year about 515.000 women die from pregnancy related complications and most of these maternal deaths occur in developing countries (Tinker et al., 2005; World Health Organization, 1994). According to a systematic review conducted by Kahn et al. (2006), haemorrhage and hypertensive disorders together account for the largest proportion of maternal deaths in developing countries. In their analysis of joint causes of death, haemorrhage was the leading cause of maternal mortality in Africa, accounting about 34%. Hypertensive disorders and sepsis each account about 9% of maternal mortality. Anaemia and obstructed labour account each about 4% of maternal deaths (Kahn et al., 2006). Also Tinker et al. (2005) and the World Health Organization (1994) presented haemorrhage, sepsis, hypertensive disorders, obstructed labour and abortion as the major complications and leading causes to maternal mortality. The five major direct causes of maternal mortality identified from several studies were haemorrhage, sepsis, (pre)-eclampsia, ruptured uterus and abortion complications (Fawcus et al., 2005; Geelhoed et al., 2003; Oladapo et al., 2006; Olowonyo et al., 2005; Onah et al., 2005; Walraven et al., 2000). Around 20% of the pregnant or postnatal women die as a result of a non direct cause such as malaria, hepatitis and tuberculosis (World Health Organization, 1994).

Complications that affect women during pregnancy and childbirth can also affect the fetus. Each year around 8,1 million infants die, half of them within the first month of life. Most of these neonatal deaths are a direct consequence of poorly managed pregnancies and deliveries (World Health Organization, 1994).

Many complications and maternal mortality can be prevented through provision of quality antenatal, delivery and postpartum care (DRH-WHO/AFRO, 2004; World Health Organization, 1994). In the immediate term, reducing maternal mortality can be achieved through a combination of several interventions. Maternal mortality ratio can be decreased by reducing the total number of pregnancies by family planning. The numbers of obstetric complications can be reduced through the provision of a continuum of antenatal, delivery and postpartum care and the rate among women with complications can be reduced by ensuring that all women have access to skilled care. The deaths and disabilities of mothers can be greatly reduced with attainable skills and resources. This by ensuring that pregnant women have access to a skilled attendant at childbirth and to emergency obstetric care. Apart from skilled health workers, provision of an adequate supply of equipment, supplies and drugs are critical to the successful implementation of quality of care (DRH-WHO/AFRO, 2004; World Health Organization, 1994).

High indebtedness in countries, competing priorities, poverty and conflicts limit the allocation of adequate resources to maternal and newborn health care. Various global and continental efforts have achieved limited successes in reducing maternal morbidity and mortality in Africa (DRH-WHO/AFRO, 2004).

The World Health Organization started the 'Safe Motherhood Initiative' in 1987 to try to prevent and manage pregnancy related complications effectively. Reducing the number of high-risk and unwanted pregnancies, reducing the numbers of obstetric complications and reducing case fatality rate in women with complications. Hereby a practice guide has been implemented, the 'Mother-baby package: Implementing safe motherhood in countries'. Making motherhood safe requires action on three fronts. Strategies and interventions are available for dealing with each of those three aspects (World Health Organization, 1994).

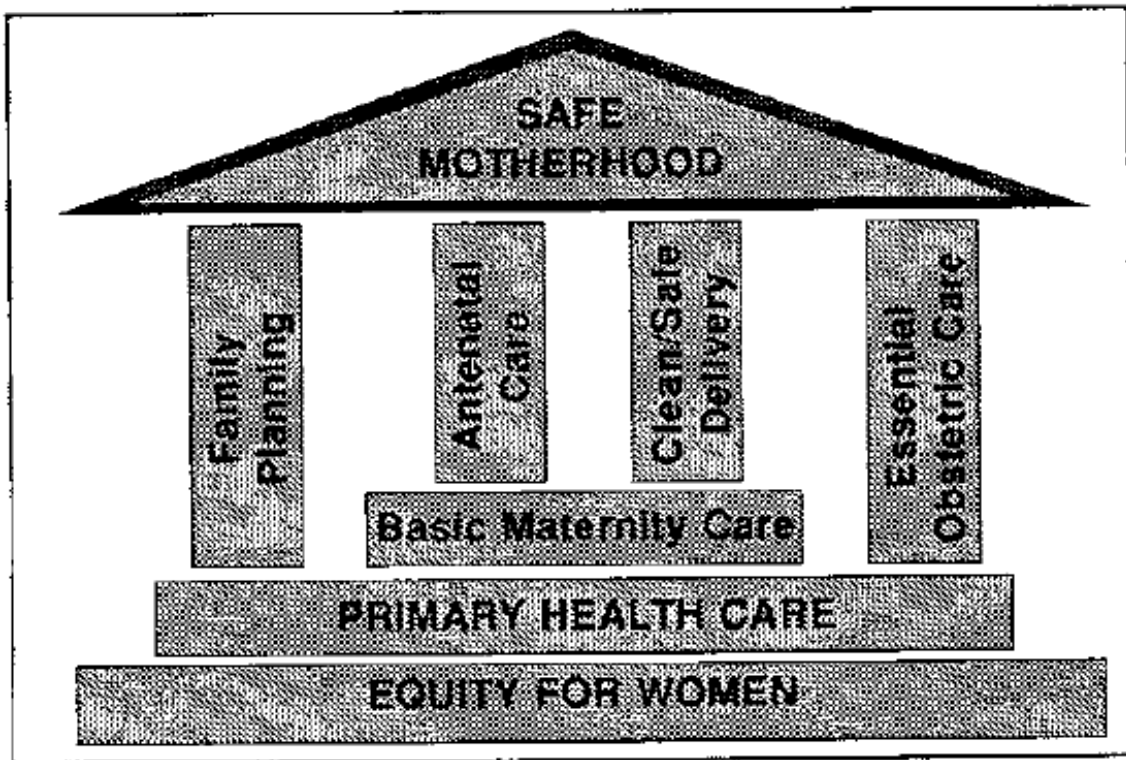
The basic principles of the 'Mother-baby Package' are considered on the four pillars of "safe motherhood" (figure 1).

- Family planning, to ensure that individuals and couples have the information and services to plan the timing, number and spacing of pregnancies.
- Antenatal care, to prevent complications where possible and ensure that complications of pregnancy are detected early and treated appropriately.
- Clean/safe delivery, to ensure that all birth attendants have the knowledge skills and equipment to perform a clean and safe delivery and provide postpartum care to mother and baby.

- Essential obstetric care, to ensure that essential care for high-risk pregnancies and complications is made available to all women who need it.

These four strategic interventions must be delivered through primary health care.

Figure 1: The “four pillars” of safe motherhood



(World Health Organization, 1994).

The mother-baby package describes each intervention needed to achieve safe motherhood. The package represents the synthesis of activities of the health care system and defines a basic set of health system interventions and activities. It describes simple interventions needed preconceptional, prenatal, perinatal and postnatal for mother and newborn infant (World Health Organization, 1994).

This study, in part fulfilment for a Master’s degree, is a part of the IMPORE project, ‘Improving Maternal and Paediatric Outcome: The Rwandan Experience’, a project of the University Hospital of Leuven and the Flemish Midwives Organization (VLOV). The IMPORE project has been designed from inception to support and work together with the local care providers taking into account the local healthcare context. This project was set up in 2006 with the goal of assisting the Rwandan population, to meet the Millennium Development Goals 4 and 5. The district of Huye, in the rural South of Rwanda was used as a pilot region.

An Important aim of the project in the longer range, in order to reduce maternal and neonatal mortality, is to have one midwife available for all childbearing women and in the meantime strive to have one midwife working in each health centre in the district of Huye. But will this be sufficient to reach the Millennium Development Goals? Other factors may also result in higher maternal mortality rates.

In this study attention will be given to the current bottlenecks which are supposed to contribute to an increased level of maternal mortality in the District of Huye, Rwanda.

In order to achieve the objectives of this thesis, two research questions had to be answered:

1. What are the recommendations about basic maternal infrastructure, equipment and medication and what is the situation in the district of Huye, Rwanda, anno summer 2007?
2. What are the recommendations about the procedure of referral of mother and newborn infant and what is the situation in the district of Huye, Rwanda, anno summer 2007?

Reported here is a qualitative study that collected information locally, in 12 health centres and one district hospital, to address these two research questions.

2. Methodology

2.1. Ethical approval

Ethical approval for the research project was given prior to the research by the ethics committee of the University Hospital of Leuven. Written invitations and approval was given by the general director of the district hospital Kabutare, who is responsible for the quality of care in the 12 health centres and the district hospital of the district of Huye, to collect the data in all health centres and the district Hospital Kabutare.

2.2. Study design

Empirical research using observations was used to gather the data. This master thesis is based on a qualitative research because there has been no knowledge on the current local situation. The research contains a 'case study', which is an in-depth investigation of a single entity or a small number of entities (Polit & Beck, 2004; Stake, 1995). Concretely the health care provided to mother and child has been studied in 12 health centres and one district hospital in one health district, Huye, in Rwanda. In a case study the researcher attempts to analyze and understand issues that are important to the history, development or circumstance of the entity under study (Polit & Beck, 2004; Stake, 1995). This study will try to detect which are the leading bottlenecks in the care of mother and child in order to prevent morbidity and mortality in the district of Huye.

An observational study was chosen in order to understand and sense the barriers in the working environment of future midwives. As a result of the study the researcher may gain a sharpened understanding of why the instance happened as it did, and what might become important (Polit & Beck, 2004; Stake, 1995). Data were obtained from both non-participatory and participatory observations. More explanation on this can be found in point 2.4, 'Data collection'. The observations were made by checking equipment and facilities against checklists and photo material.

2.3. Development of the checklists

A basic level of infrastructure, medical material and medication is essential if all women are to have access to maternal and neonatal health care. Therefore the World Health Organization implemented two annexes in the 'Mother-baby Package', which has been explained in point 1., 'Introduction'. Annex 1 is a list of essential drugs for the mother-baby package and annex 2 is a list of equipment for the mother-baby package for each level of the health care system (World Health Organization, 1994).

Based on these World Health Organization lists and experiences in field work in Gambia and Senegal the researcher started in May 2007 to construct several checklists to implement the research in the district of Huye, Rwanda. In August 2006 two students of the Catholic University of Leuven conducted an observational study of the local health care condition in the health centre of Simbi, one of the health centres in the district of Huye. This health centre was used as a pilot centre for all the other health centres (Dancet & De Pauw, 2007). The information that came out of this thesis was also used to develop the checklists. This resulted in a checklist for basic infrastructure, vital medical equipment, equipment needed to maintain hygiene, laboratory material and equipment and medications.

After a first version was finished and translated into English and French, the checklists were reviewed by the members of the IMPORE project team and by Prof. Dr. A. Thomson (visiting professor at the Catholic University of Leuven, University of Manchester). In July 2007 the checklists were finalized.

During the design and early testing of an intervention it is often appropriate to conduct a pilot study, this to test the data collection instruments (Polit & Beck, 2004). The study of Dancet & De Pauw (2007) in August 2006 can be considered as a pilot study for this study. Given the constrained time for collecting the data, the researcher has not conducted an additional pilot study.

Please find the checklists in appendix to this thesis, see point 8.

2.4. Data collection

Data were collected covering a period of 7 weeks from 17 July 2007 till 4 September 2007 through non-participatory observations and participatory observations in the 12 health centres and the district hospital Kabutare of the district of Huye. The study setting is described further, see 2.5., 'Study setting'.

Different functions of the health centres were observed. Most attention was directed through to the maternity services. All the data were recorded on the checklists, in a field diary and by using a recorder. Short field notes were made during observations. The observations were made in three phases. First, every health centre and the district hospital was visited, for half a day each. First data were gathered by observations. Data were hereby obtained from both non-participatory and participatory observations. The non-participatory observations were made by checking equipment and facilities against checklists and photo material. The researcher had access to the maternity, consultation room, delivery room, postnatal room, laboratory and stockage of each health centre. The researcher had also the opportunity to participate in daily tasks in five of them. Participatory observations were used because being active in the working environment should help to gain access to the field and daily activities (Polit & Beck, 2004). The researcher participated in prenatal consultations, deliveries and the care of newborn infants. The researcher first observed and listened to the nurses to obtain a broad view of the situation. She then participated in the care of mother and child. This to be able to study the nurses behaviours and reactions (Polit & Beck, 2004). These observations were completed with conversations with staff members of the health centres and of the district hospital and collecting statistics. Secondly, a summary of the observations was presented to the members of the IMPORE project team. Hereby a peer debriefing was hold. Thirdly, Following the debriefing the research sites were visited a second time to complete the data collection. Health care providers working in the maternity wards of the health centres were seen a third time at e three day workshop organised by the IMPORE project team in order to find out what the priorities were to improve the health for mother and child. This workshop was at the end of August 2007 and the researcher presented a summary of the findings for each health centre. On that occasion some observations were further clarified.

To gain access to the health centres and the district hospital the researcher needed to negotiate with the local authorities. Because of the already existing relationship between the IMPORE project team, the district hospital and the health centres, gaining consent to conduct the research was easy. Approval to collect the data was given by the general director of the

district hospital, who is responsible for the quality of care in the 12 health centres and the district hospital of the district of Huye. The local coordinator of the project team in the district of Huye introduced the researcher at the health centres and at the district hospital before gathering the data. The researcher benefited from a trustful relationship that was developed with the IMPORE project team during their mission of August 2006. The nurses, eager to improve their skills, cooperated with the researcher, being a midwife herself.

The observations are guided by the aim to understand the organisation of the health centres and the district hospital and to get an answer to the two research questions set out above. Attention was given to both clinical and organisational aspects of the care.

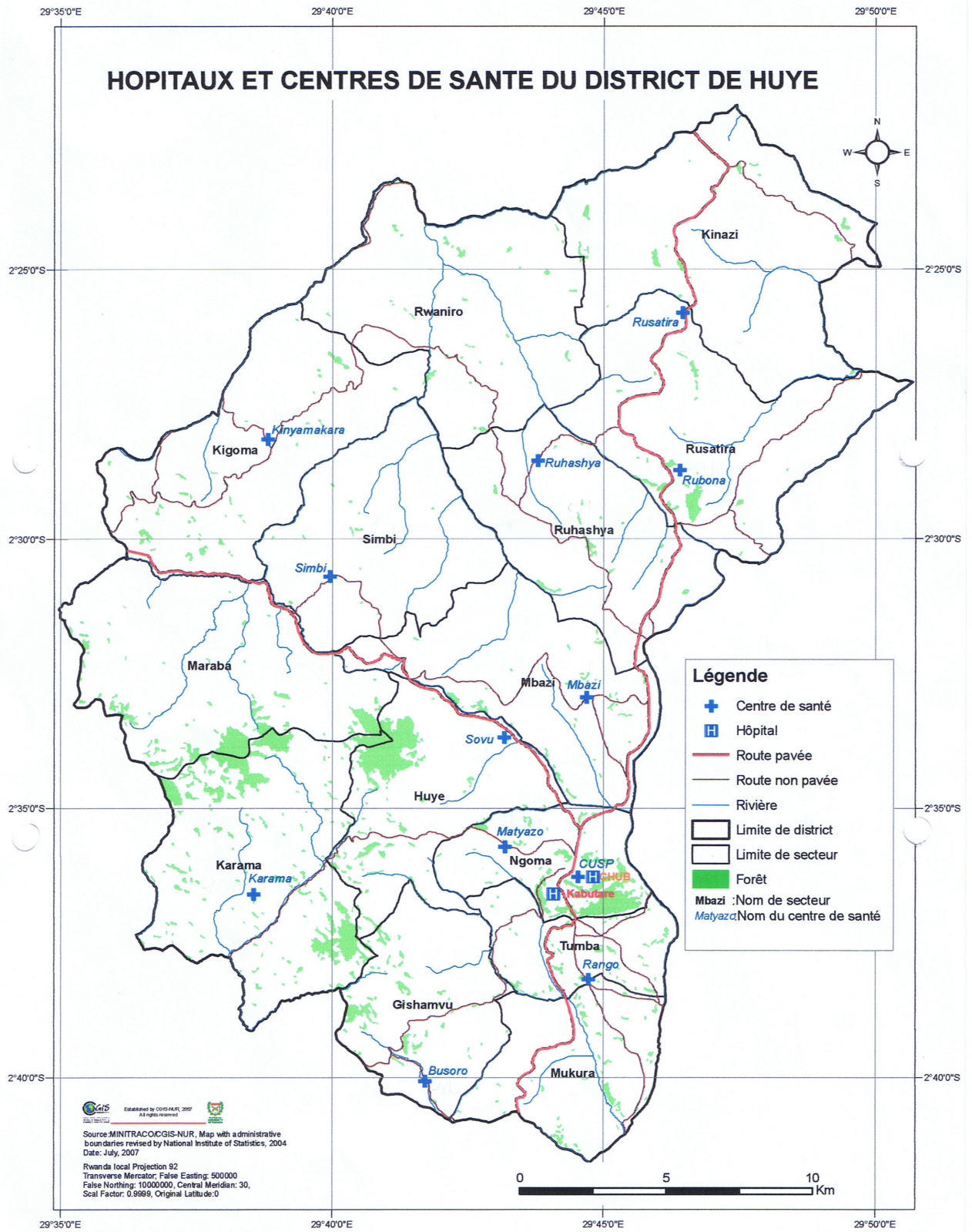
Information has been gathered concerning equipment for prenatal, perinatal and postnatal care, both for mother and baby. Given the theme of this thesis only equipment in relation to maternal care will be discussed. Obviously some environmental aspects (such as the availability of water and electricity) have an impact on both maternal and neonatal outcome.

2.5. Study setting

The data collection of the study was conducted in twelve rural health centres and one district hospital (figure 2, table 1). The main city of the district of Huye is Butare, where the district hospital Kabutare is situated. The nearest health centre to the district hospital is CUSP, a centre where only prenatal consultation occurs. The nearest health centre where all maternity activities occur is the health centre of Matyazo, at 5 kilometres. The health centre furthest away from the district hospital is the health centre of Kinyamakara, at 29 kilometres.

Time to get to the district hospital Kabutare by car from the health centres differs from centre to centre. For the nearest health centre, CUSP, it only takes 5 minutes. For getting from the health centre of Karama to Butare, it can take up to 1,5 hours, although this centre is only 16 kilometres away from the city. Difference in time to get to the district hospital is mostly due to the state of the road and the weather condition. Health centres such as Rubona and Rusatira are situated next to a highway road. Centres such as Karama, Kinyamakara and Simbi can only be reached by using dirt roads.

Figure 1: Health centres and referral Hospital of District Huye, Rwanda



(MINTRACO/CGIS-NUR, 2007)

Table 1: characteristics of the health centres

Health centres	Distance to hospital Kabutare	Time to Kabutare by car	Population served	Nursing Staff
Busoro (public)	18 km	1 h	11.648	4 A2 nurses
Karama (private)	16 km	1h30	15.882	5 A2 nurses 3 A2 nurses
Kinyamakara (public)	29 km	1h	21.556	8 A2 nurses
Matyazo (private)	5 km	15 min	12.529	1 A1 nurse 9 A2 nurses
Mbazi (public)	7 km	25 min	23.019	8 A2 nurses
Rango (public)	7 km	15 min	40.156	5 A2 nurses
Rubona (public)	18 km	35 min	15.611	6 A2 nurses 1 A3 nurse
Ruhashya (public)	21 km	1 h	40.165	7 A2 nurses
Rusatira (public)	20 km	45 min	20.845	6 A2 nurses
Simbi (private)	17 km	45 min	43.530	7 A2 nurses
Sovu (private)	6 km	30 min	17.953	9 A2 nurses
CUSP (public)	1 km	5 min	13.576	2 A2 nurses

Four health centres are run by Catholic congregations (Karama, Matyazo, Simbi and Sovu). The other health centres are public facilities, run by the government. The population served by the health centres varies from 11.648 in Busoro to 43.530 in Simbi.

There are no doctors or midwives working at the health centres. Most health centres are run by A2 nurses. In the centre of Matyazo there is one A1 nurse and in the centre of Karama there is one A3 nurse working. An A1 nurse is equivalent to a bachelor's degree, and A2 nurse is equivalent to an auxiliary nurse and an A3 nurse is equivalent to a nursing aide.

The district hospital Kabutare is situated in the centre of Butare. The population this hospital serves is the total population of the district of Huye, 278.533 persons. There are no midwives working at the district hospital. For the maternity service there are ten A2 nurses and one general practitioner.

2.6. Quality of the research

The validity of the data collected in the observations was checked using the criterion developed by Lincoln and Guba (Polit & Beck, 2004). This focuses on credibility, confirmability and transferability.

Credibility refers to confidence in the truth of the data and interpretations of them (Polit & Beck, 2004). Multiple triangulation was used to maintain rigor. In order to maintain person triangulation, data were collected from different types of persons, nurses, head nurses, doctors and cleaning persons. Data were collected on the same health centres at two different days, this to ensure time triangulation. Peer debriefing was done to increase the credibility. The data collection took seven weeks so there was a prolonged engagement, the researcher took the time to know the culture in order to build trust.

Confirmability refers to the objectivity or neutrality of the data (Polit & Beck, 2004). To enhance the confirmability the researcher maintained a reflexive journal.

Transferability refers to the generalizability of the data. The researcher will try to provide sufficient descriptive data in the report so that other researchers and readers can evaluate the applicability of the data to other contexts.

2.7. Data analysis

The data were analyzed during and after the stay in Rwanda. A comparative and correlational research method was used, to compare individual situations of each health centre and the district hospital with other health centres and with the recommendations of the World Health Organization (World Health Organization, 1994).

3. Results

In the results section two major subjects will be presented. First the observations about 'Infrastructure, basic equipment and medication' will be presented and secondly observations about 'Transferring patients to the district hospital'.

3.1. Observations about infrastructure, basic equipment and medication

In this section all observations about infrastructure, vital medical equipment, equipment needed to maintain hygiene, laboratory material and equipment and medication will be presented. Bottlenecks of this observations followed by recommendations will be presented in the discussion, see point 4.

3.1.1. Infrastructure

The section of infrastructure is divided into several parts. First the observations about buildings and their wards will be presented. Next electricity, water, material for communication and transfer and furniture and equipment of the wards and services will be presented. The original checklist was divided into three parts: Characteristics of the infrastructure, material for communication and referral, material for the interior of the consultation room, prenatal ward, delivery room and postnatal ward.

3.1.1.1. Buildings and wards

In table 2 the lay out characteristics of the infrastructure are presented.

One health centre was constructing a new building to enlarge their laboratory and an out patient department during the visits. For two health centres the shortage of space was paramount. One health centre had buildings large enough but did not use their space adequately.

In all health centres and the district hospital the waiting room was also the reception room for all their patients, so there was no separation for the different services. Therefore pregnant women came into contact with sick patients. In nine health centre this waiting room was placed outside. All health centres had a consultation room for prenatal consultations. In one

health centre the consultation room was also used as a general consultation room. There were no prenatal or postnatal consultations in the district hospital. Eleven health centres and the district hospital had a delivery room. In three health centres there was one delivery room with only one delivery bed. In seven health centres there was one delivery room with two delivery beds. In two of these health centres the delivery room was very small. One health centre had two delivery rooms and two delivery beds. In the district hospital there was one delivery room with three delivery beds and one theatre for caesarean sections. Eleven health centres and the district hospital had a maternity ward. In five of these health centres the postnatal ward was a separate room, with three or four beds. In six health centres the postnatal ward was also used as the labour ward, so that women in labour and postnatal women were not separated. In the district hospital there were two postnatal wards, one for post caesarean women and one for women who had delivered normally.

Neither the health centres nor the district hospital had a nursery. In the health centres the newborn infant stayed in the bed with the mother. In the district hospital, if necessary, there was a paediatric ward, but not specifically for preterm or sick newborn infants.

The health centre CUSP only performs prenatal consultations, so there is no delivery room or postnatal ward. Their pregnant women go to the district hospital Kabutare, for prenatal observation, delivery and postnatal care.

Table 2: Characteristics of the infrastructure

Material	Present in ... HC or hospital	Commentary/extra
Building	12 HC + Kabutare	In 1 HC new building in construction, in 2 very small buildings, in 1 not used adequately.
Waiting room	12 HC + Kabutare	In all 1 general waiting room for all services, in 9 outside.
Ex/consultation room	12 HC	In 11 HC separated room for pre and postnatal consultation, in 1 also general consultation. (In Kabutare no consultation occurred).
Delivery room	11 HC + Kabutare	In 10 HC 1 delivery room with 1 or 2 delivery beds, in 1 HC 2 delivery rooms, In Kabutare 1 delivery room with 3 delivery beds + 1 theatre. 3 HC with small rooms.
Maternity	11 HC + Kabutare	In 5 HC maternity separated, in 6 HC also labour ward. In Kabutare 2 maternity services + 1 post - caesarean.
Baby room	/	No nursery room.

3.1.1.2. Electricity

In table 3 all information about electricity and equipment for electricity is presented.

Eleven health centres and the district hospital had electricity. Eight health centres received electricity almost daily. For four health centres it depended from day to day if there was electricity. Two of these health centres used solar energy, but this was not working as well as it should. One health centre had the installation for using solar energy, but it was no longer working.

All the health centres and the district hospital had electric light sources, but the working of these depended on the electricity. Additionally they all had petroleum lamps and candles. In August 2007 all health centres received from the IMPORE project team a LCD flashlight which is rechargeable manually. The buildings of all health centres and the district hospital were provided by electric sockets.

Table 3: Electricity and equipment for electricity

Material	Present in ... HC or hospital	Commentary/extra
Electricity	11 HC + Kabutare	In 4 HC working badly, in 2 of these HC with solar energy but not working properly.
Light source	12 HC + Kabutare	All on electricity and petroleum. In 5 not working good.
Electric socket	12 HC + Kabutare	In 1 HC there was no electricity.

3.1.1.3. Water

In table 4 all information about water and equipment for water is presented.

Seven health centres and the district hospital had a system of running water, but in three of these health centres it was not always working. The other five health centres were using water tanks for collecting rainwater. In one health centre the water tank was broken during the genocide and has not been repaired ever since. Relatives of patients needed to get water from sources a few kilometres away from the health centre. The buildings in all health centres and the district hospital had washbasins, so that they can be provided by running water later. Only eight of them could use them, because there was no running water in five of them.

Table 4: Water and equipment for water

Material	Present in ... HC or hospital	Commentary/extra
Running water	7 HC + Kabutare	In 3 HC not always working. Other 5 HC were using watertanks.
Washbasin	12 HC + Kabutare	Only in 7 HC and the district hospital there was running water.

3.1.1.4. Material for communication and transfer

In table 5 all materials used for communication and transfer are described.

Three health centres had a fix telephone, but they were not working because there was no connection. All health centres used a mobile phone, usually from the women or their relatives to phone the district hospital. The district hospital had several telephones at the secretariat. Three health centres had a computer, but it was working only in one health centre. The district hospital used their computer for secretarial and administrative work. Only three health centres and the district hospital had stretchers. The other nine health centres were using a stretcher from the village. No health centres had an ambulance. The district hospital had three ambulance for serving the whole district and the 12 health centres.

table 5: Material for communication and transfer

Material	Present in ... HC or hospital	Commentary/extra
Telephone	3 HC + Kabutare	Three HC had a fix telephone but these were not working.
Fax	/	/
Computer	3 HC + Kabutare	In 2 HC the computer was not connected.
Internet	/	/
Stretcher	3 HC + Kabutare	9 HC were using these from the village.
Ambulance	Kabutare	Kabutare had 3 ambulances.

3.1.1.5. Furniture and equipment of the wards and services

In table 6 all furniture and equipment for consultation rooms, prenatal wards, delivery rooms and postnatal wards are described.

All health centres had examination couches for prenatal consultation. In one health centre this examination couch was also used for patients other than pregnant women. The district

hospital had no examination couches, because they did not perform prenatal consultation. Eleven health centres and the district hospital had delivery beds. Seven health centres had two delivery beds in one delivery room. One health centre had two delivery beds in two separate delivery rooms. Three health centres had only one delivery bed. In two health centres one delivery bed was in a bad condition. There were rips in the mattress and a lot of rust spots on the bed. Eleven health centres and the district hospital had several beds for perinatal and postnatal care. Five health centres had two separate wards, one labour ward and one postnatal ward. These wards contained between two and four beds. Six health centres had only one room for both labour and postnatal care and these contained between two and eight beds. The district hospital had three separate wards for labour, postnatal care and post caesarean care. In total these wards had 28 beds. Most beds had a plastic mattress, in some mattress there were rips. Because there was a shortage of beds in most health centres and the district hospital, some beds were occupied by more than one mother and their baby at the same time. There were no cots for babies in the health centres neither at the district hospital. Newborn infants stayed in the bed with their mother.

Eight health centres had bed sheets. Not all of them were using the sheets, because patients take them home after hospitalisation. Only two health centres had pillows, but only one health centre used them for the women, this for the same reason as for the sheets. There were no cot sheets neither in the health centres nor in the district hospital.

Neither the health centres nor the district hospital had heat sources. The blankets, if they had them, could be used to maintain the temperature of the newborn infant and the mother.

All the health centres and the district hospital had a refrigerator. Seven health centres were using the UNICEF refrigerator box, which runs on electricity, and if necessary on petroleum. Four health centres had both a UNICEF refrigerator box and a normal fridge. One health centre and the district hospital were using normal refrigerators.

Four health centres and the district hospital used trolleys, for nursing care in the delivery room, for their equipment. Other health centres were using tables to put their material on. All health centres had cupboards and racks to store their equipment. Nine health centres had between one and three perfusion stands for their maternity services. Other health centres and the district hospital were using coat hooks for hanging intravenous infusions. Six health centres were using portable screens to separate delivery beds or postnatal beds. One health centre and the district hospital were using curtains for this purpose.

Eleven health centres and the district hospital had individual mosquito nets that went over the beds. In one health centre there were no mosquito nets in the postnatal ward and in one health centre there were none in the labour ward. In most delivery rooms there were no mosquito nets.

Six health centres and the district hospital were using bins to collect waste in the maternity services. The other five health centres were using washbasins or buckets for this purpose. None of the health centres or district hospital used rubbish bags.

Because the health centre CUSP only performed prenatal consultation they did not have delivery beds, hospitalisation beds with mattresses, sheets and perfusion standards.

Table 6: Furniture and equipment for consultation rooms, prenatal wards, delivery rooms and postnatal wards

Material	Present in ... HC or hospital	Commentary/extra
Examination couches	12 HC	All HC had one or two examination for prenatal consultation.
Delivery bed	11 HC + Kabutare	All HC had one or two delivery beds. Kabutare has three delivery beds.
Beds	11 HC + Kabutare	In 5 HC and district hospital the labour ward and postnatal ward were separated, in 6 HC these were in the same room. All between 2 and 8 beds.
Plastic mattress	12 HC + Kabutare	Some mattress' were ripped.
Baby bed	/	/
Sheet	8 HC	Not all HC were using the sheets.
Pillow	2 HC	One HC did not used them.
Pillow-cover	/	/
Baby sheet	/	/
Heat source	/	/
Refrigerator	12 HC + Kabutare	7 HC had the Unicef fridge, 1 HC + Kabutare had a normal refrigerator, 4 HC had both.
First-aid chariot	4 HC + Kabutare	8 HC used tables to pose their first aid material.
Perfusion stands	9 HC	9 HC had between 1 and 3 perfusion stands.
cupboard/rack	12 HC + Kabutare	In all different services.
Partition	6 HC	All between 1 and 3 partitions.
Mosquito net	11 HC + Kabutare	Not in all HC all beds had a mosquito net.
Bins to collect waste	6 HC + Kabutare	Other 5 HC used a washbasin or bucket.
Rubbish bag	/	/
Clock	2 HC + Kabutare	In the delivery room.

3.1.2. Vital medical equipment

In this section the researcher will present the availability of vital medical equipment. The checklist was divided into four parts: equipment for the mother in general, for the women prenatally, for the care of labouring women and for the mother postnatally. Some equipment can be used at all three time periods, but are noted just once in the checklist.

3.1.2.1. Equipment for the mother in general

In table 7 the equipment for the mother in general are reported.

All health centres and the district hospital had one or two blood sphygmomanometers and stethoscopes in their maternity services. In seven health centres they were located both in the prenatal consultation rooms and in the delivery room. Four health centres only had blood sphygmomanometers and stethoscopes in their consultation rooms and none in the delivery room. In one health centre they were only in the delivery room. Eleven health centres and the district hospital had clinical thermometers. In three health centres the thermometers were only in the stock room and not directly available in the delivery or consultation rooms. All health centres and the district hospital had a weighing scale for the mother, non-sterile gloves and non-sterile compresses.

Only three health centres and the district hospital had sterile compresses. Eight other health centres put non-sterile compresses in hot water. One health centre putted non-sterile compresses in formol for at least one day and one health centre only used non-sterile compresses. Formol is a formaldehyde solution and is general toxic. It can be used as disinfectant for surfaces, instruments and sterilisation.

All health centres and the district hospital had syringes and needles for subcutaneous and intramuscular use. The health centre CUSP had no infusion canulla and infusion giving sets, because they only had prenatal consultation at their centre. Eight health centres had a pinch band. Seven health centres and the district hospital had bandage scissors. Only three health centres had a bedpan. Neither the health centres nor the district hospital had a reanimation set for adults.

Table 7: Equipment for the mother in general

Material	Present in ... HC or hospital	Commentary/extra
Blood sphygmomanometer	12 HC + Kabutare	7 HC in delivery room and prenatal consultation, 4 HC in prenatal consultation, 1 HC in delivery room.
Stethoscope	12 HC + Kabutare	7 HC in delivery room and prenatal consultation, 4 HC in prenatal consultation, 1 HC in delivery room.
Clinical thermometer	11 HC + Kabutare	3 HC only in stock room.
Weighing scale	12 HC + Kabutare	/
Non-sterile gloves	12 HC + Kabutare	/
Non-sterile compresses	12 HC + Kabutare	/
Steril compresses	3 HC + Kabutare	8 HC boiled compresses, 1 HC putted compresses in formol.
Syringe	12 HC + Kabutare	/
Needle SC	12 HC + Kabutare	/
Needle IM	12 HC + Kabutare	/
Infusion canulla	11 HC + Kabutare	1 HC only performed prenatal consultations.
Infusion giving set	11 HC + Kabutare	1 HC only performed prenatal consultations.
Pinch band	8 HC	/
Bandage scissors	7 HC + Kabutare	/
Pan	3 HC	/
Reanimationset	/	/

3.1.2.2. Equipment for the women prenatally

In table 8 all equipment for the care of women prenatally are presented. There are some equipment that can be used in pregnancy, but also for the mother in general, such as a stethoscope, needles, etc... These equipments are not noted again.

All the health centres used all the same prenatal record, set up by the government. Kabutare did not had these records because they did not perform prenatal consultations. Ten health centres and the district hospital used a pregnancy disc to estimate the expected date of birth. Two health centres did not have a pregnancy disc. All health centres and the district hospital had a tape measure and a fetal stethoscope. Four health centres only had one fetal stethoscope for both prenatal and labour care. The other eight health centres and the district hospital had between two and five fetal stethoscopes. Neither the health centres nor the district hospital had a doptone, contact gel or fingerstalls.

Eleven health centres and the district hospital used sterile gloves. In some health centres these were only in the stock room and not directly available in the different service areas. One health centre used non-sterile gloves, which they putted in formol.

Eleven health centres and the district hospital had speculae and all health centres and the district hospital had sterile forceps. Neither the health centres nor the district hospital had cervical smear spatulae.

Table 8: equipment for the women prenatally

Material	Present in ... HC or hospital	Commentary/extra
Prenatal record	12 HC	Kabutare did not performed prenatal consultation.
Pregnancy disc	10 HC + Kabutare	/
Tape measure	12 HC + Kabutare	/
Fetal stethoscope	12 HC + Kabutare	4 HC had only one fetal stethoscope.
Doptone	/	/
Contact gel	/	/
Fingerstall	/	/
Sterile gloves	11 HC + Kabutare	1 HC putted non-sterile gloves in formol.
Speculae	11 HC + Kabutare	/
Steril forceps	12 HC + Kabutare	/
Cervical smear spatulae	/	/

3.1.2.3. Equipment for the care of labouring women

In table 9 all equipment for the care of labouring women are presented. Some equipment that can be used in pregnancy and in general, such as a fetal stethoscope, needles, gloves, etc...are not noted again.

Eleven health centres and the district hospital had partograms to complete during labour. The nurses did not knew how to complete the partogram well. One health centre had amnihooks, but they did not knew how to use them neither the purpose of it. Six health centres used disposable urinary bladder catheters. Two health centres used steel bladder catheters.

Ten health centres and the district hospital had episiotomy scissors. At one health centre, bandage scissors were used for performing an episiotomy. Most health centres had between

one and five scissors. The district hospital had 12 delivery sets each with an episiotomy scissor. Eleven health centres and the district hospital had umbilical cord clamps. The health centres had between two and ten clamps and the district hospital had 24 clamps, two in each delivery set. Eight health centres and the district hospital had Kocher's forceps. Three health centres used normal forceps. Most health centres had between one and six Kocher's. The district hospital had 12 Kocher's forceps.

Eleven health centres and the district hospital had dissolvable sutures. Nine health centres and the district hospital had suture clamps. Only five health centres and the district hospital had suture scissors. The other health centres used episiotomy or bandage scissors.

Neither the health centres nor the district hospital had maternity sanitary towels, oxygen glasses or oxygen masks.

The health centre CUSP did not perform labour and postnatal care, so they do not need a partogram, urinary bladder catheters, episiotomy scissors, umbilical cord clamps, Kocher's forceps, sutures, suture clamps or suture scissors.

Table 9: Equipment for the care of labouring women

Material	Present in ... HC or hospital	Commentary/extra
Partogram	11 HC + Kabutare	1 HC did not perform deliveries.
Amnihooks	1 HC	This HC did not know how to use it or the purpose of it.
Bladder catheter (unique use)	6 HC	2 HC had iron bladder catheters.
Episiotomy scissor	10 HC + Kabutare	1 HC used a bandage scissor.
Umbilical cord clamp	11 HC + Kabutare	/
Kocher's forceps	8 HC + Kabutare	/
Suture	11 HC + Kabutare	All dissolvable.
Suture clamp	9 HC + Kabutare	/
Suture scissors	5 HC + Kabutare	Other used episiotomy or bandage scissors.
Maternity sanitary towel	/	/
Oxygen glasses	/	/
Oxygen mask	/	/

3.1.2.4. *Equipment for the mother postnatally*

Most equipment required for the mother postnatally are already presented in tables 7, 8 and 9.

The only thing that was not presented for postnatal care is a postnatal record. Neither the health centres nor the district hospital had a specific record for postnatal care. Notes could be made behind the partogram, but in reality no notes were made during postnatal care.

3.1.3. *Equipment needed to maintain hygiene*

In this section the researcher will report all equipment needed to maintain hygiene. This section is divided into four parts, equipment related to: hygiene of space and surfaces, hygiene of equipment, personal hygiene of staff members and hygiene of medical and nursing procedures.

3.1.3.1. *Equipment related to hygiene of space and surfaces*

In table 10 all equipment for hygiene of space and surfaces are presented. Some materials are already discussed in point 3.1.1.5, 'Furniture and equipment of the wards and services', such as bins to collect waste and rubbish bags.

All health centres and the district hospital had brushes, water, soap and water scrapers. Not all health centres had running water, as described in point 3.1.1.3, 'Water'. For those without running water, depending on the season, water in the reservoirs was not always available. The soap they used can vary between liquid soap and a block of soap. Only the district hospital used floor cloths for cleaning the rooms. All health centres and the district hospital had disinfectants for space and surfaces. Mostly the same disinfectant was used for both space and surfaces. The disinfectants they used were chloorhexidine, chloramine, alcohol, povidone iodium, dettol, javel and dakin.

Table 10: Equipment related to hygiene of space and surfaces

Material	Present in ... HC or hospital	Commentary/extra
Brush	12 HC + Kabutare	/
Water	12 HC + Kabutare	Running water or reservoir for rain water.
Soap	12 HC + Kabutare	Liquid or block.
Water scraper	12 HC + Kabutare	/
Floor cloth	Kabutare	/
Disinfectans for space	12 HC + Kabutare	Chloorhexidine, chloramine, alcohol, povidone iodium, dakin, dettol, javel.
Disinfectans for surface	12 HC + Kabutare	Chloorhexidine, chloramine, alcohol, povidone iodium, dakin, dettol, javel.

3.1.3.2. Equipment related to hygiene of equipment

In table 11 all equipment related to hygiene of equipment are presented. Some equipment has already been presented point 3.1.1.5 , 'Furniture and equipment of the wards and services', such as a rack for equipment. Water is already described in point 3.1.1.3, 'Water'.

Five health centres and the district hospital had a steriliser. Six health centres boiled their instruments in hot water to sterilize them. One health centre boiled their instruments in hot water, then putted them in chloorhexidine and then putted them in formol for at least 24 hours. All health centres and the district hospital had disinfectants and detergents for their equipment. They used chloorhexidine, dakin and alcohol as disinfectant and liquid soap as detergent.

Table 11: material related to hygiene of material

Material	Present in ... HC or hospital	Commentary/extra
Steriliser	5 HC + Kabutare	6 HC boiled their instruments.
Disinfectant for equipment	12 HC + Kabutare	Chloorhexidine, dakin, alcohol.
Detergent for equipment	12 HC + Kabutare	Liquide soap.

3.1.3.3. Equipment related to personal hygiene of staff

In table 12 all equipment related to personal hygiene of staff are presented. Water is already described in point 3.1.1.3, 'Water'. Some equipment is already presented in point 3.1.2, 'Vital medical equipment', such as gloves.

Neither the health centres nor the district hospital had a scrub room, scrub spon or towels. The district hospital did had a scrub room in services other than the maternity service. All health centres and the district hospital had liquid or a block soap for the use of personal hygiene. Eleven health centres and the district hospital used chloorhexidine, dakin, dettol, alcohol and povidone iodium as disinfectants for hand hygiene.

One health centre had protective glasses in the delivery room. Ten health centres and the district hospital used protective clothing during delivery. Neither the health centres nor the district hospital had protective masks.

Table 12: Equipment related to personal hygiene of staff members

Material	Present in ... HC or hospital	Commentary/extra
Scrub room	/	/
Soap	12 HC + Kabutare	Liquide and block.
Scrub spon	/	/
Towels	/	/
Disinfectant for hand hygiene	11 HC + Kabutare	Chloorhexidine, dakin, dettol, alcohol, povidone iodium.
Protective glasses	1 HC	/
Protective clothes	10 HC + Kabutare	/
Protective masks	/	/

3.1.3.4. Equipment related to hygiene of medical and nursing procedures

Most equipment related to hygiene of medical and nursing procedures has already been presented in point 3.1.2, 'Vital medical equipment' and in table 10, 11 and 12. Equipment like non-sterile gloves, sterile gloves, sterile and non-sterile compresses and soap.

All health centres and the district hospital used chloorhexidine, alcohol, povidone iodium as a disinfectant for skin.

3.1.4. Laboratory material and equipment

In this section and in table 13 all laboratory material and equipment will be presented.

All the health centres and the district hospital had between one and three microscopes and had slides. The microscopes functioned on sun light or on electricity. They washed the slides after use, to reuse them. Neither the health centres nor the district hospital had fixative spray. All the health centres and the district hospital had immersion oil.

Only two health centre had urine recipients. The other health centres and the district hospital used little bottles from vaccines to collect urine. Nine health centres and the district hospital had urine sticks. Four health centres had sticks to trace glucose and proteins. Two health centres had sticks to trace glucose, proteins and pH. Three health centres and the district hospital had urine sticks to trace glucose, bilirubines, ketones, blood, pH, leukocytes, nitrates and proteins.

Only two health centres and the district hospital had blood tubes. The other health centres only performed examinations with blood on slides.

Neither the health centres nor the district hospital had excrement recipients. They used little bottles from vaccines to collect excrement. Four health centres and the district hospital had a haemoglobin meter and all health centres and the district hospital had needle containers in carton.

table 13: Laboratory material and equipment

Material	Present in ... HC or hospital	Commentary/extra
Microscope	12 HC + Kabutare	Working with sun light or electricity.
Slide	12 HC + Kabutare	/
Fixative spray	/	/
Immersion oil	12 HC + Kabutare	/
Urine recipient	2 HC	The other used bottles from vaccines.
Urine sticks	9 HC + Kabutare	
Blood tube	2 HC + Kabutare	
Excrement recipient	/	They used bottles from vaccines.
Haemoglobin meter	4 HC + Kabutare	/
Needle container	12 HC + Kabutare	In carton.

3.1.5. Medication

The section of medication is divided into seven parts. First the observations about medication for general use and diseases will be presented. Next medication for the prevention and treatment of malaria, medication for the treatment of HIV, contraceptives, medication for the pregnant woman, medication for the labouring women and medication for the postnatal mother will be presented. The original checklist was divided into four parts: medication for general use and diseases, medication for the pregnant woman, medication for the labouring women and medication for the postnatal mother.

3.1.5.1. Medication for general use and diseases

In table 14 all medications for general use and diseases are described.

Eleven health centres and the district hospital had vials of 10 ml physiological serum. Neither the health centres nor the district hospital had oxygen.

All the health centres and the district hospital had paracetamol and acetyl salicylate acid in different doses and forms. They had paracetamol tablets of 100 mg and 500 mg, paracetamol syrup 125 mg/ 5 ml and paracetamol suppository of 125 mg. They also had acetyl salicylate acid tablets of 100 mg, 300 mg and 500 mg, acetyl salicylate 500 mg and 900 mg injectable solution and acetyl salicylate acid cream of 4 mg/ 500 gr. One health centre had vaseline.

Ten health centres and the district hospital had NaCl 0,9% infusion liquid of 500cc and glucose 5% infusion liquid of 500cc. One health centre only had serum gelatate.

Three health centres and the district hospital had a laxative, bisacodyl tablets of 5 mg. Six health centres and the district hospital had diuretics, furosemide tablets of 40 mg and furosemide injectable solution of 20 mg /2 ml.

All the health centres and the district hospital had antibiotics of different forms and doses. They had amoxicilline tablets of 250 mg and 500 mg, amoxicilline syrup of 125 mg/ 5 ml and syrup of 250 mg and amoxicilline cream of 250 mg. They also had ampicilline tablets of 250 mg and injectable solution of 500 mg, erythromycine tablets of 250 mg and syrup of 125 mg/ 5 ml and doxycycline tablets of 100 mg. They had gentamicine injectable solution of 80 mg/ 2

ml, sulfamethoxazol tablets of 480 mg, 120 mg and syrup of 480 mg norfloxacin tablets of 400 mg and ciprofloxacin tablets of 500 mg. They had penicillin tablets of 250 mg and injectable solution of 2,4 mg, benzathine penicillin injectable solution of 2,4 mg, procaine penicillin injectable solution of 2,4 mg and tetracycline cream.

Table 14: Medication for general use and diseases

Medication	Present in ... HC or hospital	Commentary/extra
Physiological serum	11 HC + Kabutare	Vials of 10ml.
Oxygen	/	/
Paracetamol	12 HC + Kabutare	Tablets 100mg – 500mg , syrup 125mg/5ml, suppository 125mg.
Acetylsalicylic acid	12 HC + Kabutare	Tablets 100mg – 300mg - 500mg, injectable 500mg - 900 mg, cream 4mg/500gr.
Vaseline	1 HC	/
NaCl 0.9% infusion	10 HC + Kabutare	500 cc.
Glucose 5% infusion	10 HC + Kabutare	500 cc.
Laxative	3 HC + Kabutare	Bisacodyl 5mg.
Diuretics	6 HC + Kabutare	Furosemide tablets 40mg, 2ml injectable solution.
Antibiotics	12 HC + Kabutare	Amoxicillin tablets 250mg, tablets 500mg, syrup 125mg/5ml, syrup 250mg, cream 250mg. Ampicillin tablets 250mg, injectable 500mg. Erythromycin tablets 250mg, syrup 125mg/5ml. Doxycycline tablets 100mg. Gentamicin injectable 80mg/2ml. Sulfamethoxazol tablets 480mg, tablets 120mg, syrup 480mg. Norfloxacin tablets 400mg. Ciprofloxacin tablets 500mg. Penicillin tablets 250mg, injectable 2,4mg. benzathine penicillin injectable 2,4mg. Procaine penicillin injectable 2,4mg. Tetracycline cream.

3.1.5.2. Medication for the prevention and treatment of malaria

In table 15 all medications for the prevention and treatment of malaria are described.

All the health centres and the district hospital had medication for the prevention and treatment of malaria. They all used the same medications. For the prevention of malaria they used sulfadoxine 500 mg with 25 mg pyrimethamine. For the treatment they used coartem,

quinine sulphate tablets of 300 mg, quinine sulphate injectable solution of 600 mg/ 2 ml or quinine sulphate syrup of 100 mg/ 5 ml.

Table 15: Medication for the prevention and treatment of malaria

Medication	Present in ... HC or hospital	Commentary/extra
Anti-malaria	12 HC + Kabutare	Sulfadoxine 500mg + pyrimethamine 25 mg.
Malaria treatment	12 HC + Kabutare	Coartem, Quinine Sulphate 300mg tablets, injectable 600mg/2ml, syrup 100mg/5ml.

3.1.5.3. Medication for the treatment of HIV

Only one health centre and the district hospital had drugs for the treatment of HIV. This is because they were funded by 'Global Fund'.

3.1.5.4. Contraceptives

In table 16 all contraceptives are described.

Nine health centres had different types of contraception methods. Eight health centres of these were public centres and one health centre was a private Catholic centre. Seven health centres had condoms, one health centre was the Catholic centre and this health centre also had female condoms. Eight used 'the pill' as contraception, they had three forms: lo-feminal, ovrette and microgynon. Seven health centres used depo-provera, an injectable contraception method. Three health centres had implanon, a progestogen for implant. One health centre had intra uterine contraceptive devices. They gave these to the women, the placement needs to be done by the doctor at the district hospital. Four health centres had cycle beads to explain women their cycles and to help them use different methods in combination.

Table 16: Contraceptives

Medication	Present in ... HC or hospital	Commentary/extra
Contraceptives	9 HC	Pill, depo-provera, condoms, female condoms, IUD, cycle beads, implanon.

3.1.5.5. Medication for the pregnant women

In table 17 all medications for the pregnant women are presented. Some medications used in pregnancy can also be used for the mother in general, such as antibiotics and diuretics. These medications are not noted again.

One health centre and the district hospital had medication for treating hypertension. They used methyldopa tablets of 250 mg. Neither the health centre nor the district hospital had magnesium sulphate. All health centres and the district hospital had iron tablets of 200 mg, folic acid tablets of 0,5 mg and a combination of iron sulphate 200 mg with folic acid 0,5 mg. Nine health centres and the district hospital used metoclopramide tablets of 10 mg and metoclopramide injectable solution of 2 ml for the treatment of nausea. Only one health centre and the district hospital had medication for diabetics. The health centre had actrapid 10 ml and the district hospital had both actrapid 10 ml and insulatid 10 ml. All health centres and the district hospital had a vaccine for tetanus.

Table 17 : Medication for the pregnant women

Medication	Present in ... HC or hospital	Commentary/extra
Antihypertensive	1 HC + Kabutare	Methyldopa 250mg
Irontablets	12 HC + Kabutare	Iron sulphate 200mg, combination iron sulphate 200mg + folic acid 0,5mg
Anti-emetic	9 HC + Kabutare	Metoclopramide tablets 10mg, injectable 2ml.
Anti-diabetic	1 HC + Kabutare	Actrapid 10ml, insulatid 10 ml
Folic acid	11 HC + Kabutare	Folic acid and combination iron sulphate 200mg + folic acid 0,5mg.
Tetanusvaccine	12 HC + Kabutare	/

3.1.5.6. Medication for the labouring women

In table 18 all medications for the labouring women are presented. Some medications that can be used during labour and delivery, but also for the mother in general or in pregnancy, such as antibiotics, infusion liquid and oxygen are not noted again.

Neither the health centres nor the district hospital had lidocaïne cream. Eleven health centres and the district hospital had lidocaïne injectable solutions. Three health centres used lidocaïne 1% of 50 ml, eight health centres used lidocaïne 2% of 50 ml and the district hospital used both. Nine health centres and the district hospital had oxytotics. Eight health

centres had methylergometrine injectable solution of 0,2 mg / 1 ml and one health centre and the district hospital used both methylergometrine injectable solution of 0,2 mg/1 ml and syntocinon 10U/ 10ml. Neither the health centres nor the district hospital had anti – coagulants. They only had acetyl salicylate acid that could be used as an anti – coagulant.

The health centre CUSP did not provide care in labour or postnatally, so they do not need lidocaine cream or injectable solutions or oxytocics.

Table 18 : Medication for the labouring women

Medication	Present in ... HC or hospital	Commentary/extra
Lidocaine cream	/	/
Lidocaine injectable	11 HC + Kabutare	Lidocaine 1% 50ml, lidocaine 2% 50ml
Oxytocics	9 HC + Kabutare	Methylergometrine injectable 0,2mg/ml, oxytocine 10U/10ml.
Anti - coagulant	/	All HC + Kabutare have acetyl salicylate acid

3.1.5.7. Medication for the mother postnatal

Most medications that can be used for the mother postnatally, such as antibiotics, oxytocics, oxygen and anti - coagulants are already presented in table 14, 15, 16, 17 and 18.

Painkillers, other than paracetamol and acetyl salicylate acid used by all health centres and the district hospital were ibuprofen tablets of 100 mg, 200 mg and 300 mg, ibuprofen syrup of 125 mg, butylhyoscine tablets of 10 mg, butylhyoscine injectable solution of 20 mg/ 1 ml and indomethacine tablets of 25 mg.

3.2. Transferring patients to the district hospital

The policy of transfer of a patient from a health centre to the district hospital is an important issue to address in trying to achieve the Millennium Development Goal 5 and to improve the mother and infant mortality and morbidity rates (Tinker et al., 2005; World Health Organization, 1994).

In this section all observations about how referral of the mother and their baby was organised in the district of Huye will be presented. Bottlenecks of this observations followed by recommendations will be presented in the discussion section, see point 4.

As noted before, none of the health centres had a local telephone to call in case of emergency. The nursing staff either used their own private telephone or used these from the patient.

As noted before the 12 health centres of the district of Huye were sharing three ambulances. At the time the researcher was there, only two ambulances were working. These ambulances were located at the district hospital Kabutare.

In table 19 the distance from each health centre to the district hospital Kabutare, the time to get there by car and the time needed to wait for an ambulance to arrive are presented. The researcher experienced the long wait for an ambulance in case of transfer. In regard to the location of the health centres to the district hospital Kabutare, time for waiting for the ambulance to arrive could vary between 10 minutes and 5 hours. After the arrival of the ambulance at the health centre, it could take between 5 minutes and 1,5 hours to be back at the district hospital.

When the ambulance was called, the driver was not always in a hurry to leave, even if there were medical conditions that needed immediate intervention. Also after arriving at the health centre, the ambulance was not always leaving immediately. In several cases neither a doctor nor a nurse joined the driver of the ambulance. He is left alone with the patient during referral.

Striking was also that the nurse considered the patients as no longer theirs and stopped caring for them, as soon as they have called the ambulance to come. This could be a result from the evaluation system for health centres in Rwanda. Hereby health centres are partly marked on their number of deaths.

When the condition of the mother or baby required treatment in the university hospital CHUB, which is also located in the city of Butare, the patient had to be referred first to the district hospital and could only thereafter be referred further to the university hospital.

Table 19: distance and time to get to the health centre by car and by ambulance

Health centres	Distance to hospital Kabutare	Time to Kabutare by car	Time needed for arriving of the ambulance
Busoro (public)	18 km	1 hour	3 hours
Karama (private)	16 km	1,5 hours	2 to 4 hours
Kinyamakara (public)	29 km	1 hours	3 hours
Matyazo (private)	5 km	15 minutes	30 minutes
Mbazi (public)	7 km	25 minutes	1 hour
Rango (public)	7 km	15 minutes	30 minutes
Rubona (public)	18 km	35 minutes	1 hour
Ruhashya (public)	21 km	1 hour	3 hours
Rusatira (public)	20 km	45 minutes	1 hour
Simbi (private)	17 km	45 minutes	3 to 5 hours
Sovu (private)	6 km	30 minutes	45 minutes
CUSP (public)	1 km	5 minutes	10 minutes

4. Discussion

This discussion section describes each bottleneck in the working environment of the future midwives, followed immediately by recommendations. This section ends with a general discussion.

4.1. Bottlenecks in the working environment of future midwives and recommendations

Quantifying basic needs is a complex but critical exercise. Systematic quantification of equipment, supplies and medication needs is important, because of the heavy dependence of many countries on imports. (World Health Organization, 1994).

In terms of infrastructure, equipment and medication there are major differences between the various health centres and the district hospital Kabutare. There are also differences between public health centres and health centres run by Catholic sisters. Some Catholic centres can rely on extra funds from their congregation and they can use them for extra material or nurses.

All health centres were structured in the same way. They all provided the same package of services, except the health centre CUSP which did not provide labour and postnatal services.

Based on the observational data, several aspects were considered as bottlenecks. This section first presents bottlenecks and recommendations concerning the infrastructure, vital medical equipment, hygiene, laboratory material and equipment and medication. In a second part the bottlenecks and recommendations in relation to the referral of patients to the district hospital will be presented.

4.1.1. Bottlenecks and recommendations concerning the infrastructure

In this section, several bottlenecks concerning the infrastructure will be discussed. First the bottlenecks about buildings and wards will be discussed, followed by bottlenecks concerning electricity, water, material for communication and referral and furniture and equipment of the wards and services.

4.1.1.1. Buildings and wards

When analysing the infrastructure of the health centres and the district hospital, a few comments can be made. Two health centres had very small delivery rooms, nine others had small delivery rooms. One health centre had large buildings but the space was not used efficiently. The district hospital had small buildings for the numbers of deliveries per month. If these health centres could have more space, their activities could be organised better. At the time of data collection the waiting room for pregnant women in four health centres was the same of the one for sick patients. In the other health centres and the district hospital pregnant women and patients had to wait outside. In some health centres, prenatal consultation occurred in the same consultation room as for sick patients. Neither the health centres nor the district hospital had a neonatal ward, newborn infants were always staying in bed with the mother.

An architect, specialized in architecture of tropical countries and of health centres, should revise all buildings and wards in the health centres and the district hospital, so that adequate use can be assured.

4.1.1.2. Electricity

Electricity was a deficit in several health centres. Without electricity several activities cannot function properly. How can a service run properly at night without light? Many women were delivered by candle light. One health centre had no electricity and in two health centres the electricity was not always working.

Electricity should be working properly in all health centres, so that quality of care can be assured. In a land such as Rwanda, investing in solar energy for all health centres could be profitable. Two health centres were already using solar energy for their electricity.

4.1.1.3. Water

A safe and permanent water supply is essential for any health centre or maternity service. According to the World Health Organization, only 62% of African population had access to safe water in 2000. The situation is much worse in rural areas, where coverage is only 47%, compared with 85% coverage in urban areas (World Health Organization, 2000).

At the time of data collection, only four health centres and the district hospital almost always had a water supply. Three health centres only had an occasional water supply and five health centres depended on water tanks for collecting rainwater. These water tanks were only useful during the rainy season. Some of these health centres brought in schoolchildren and the patients' family to go to the nearest water source to collect water with water bottles. Some water tanks were destroyed during the genocide and were leaking.

Beside having the possibility of running water, health centres need to be aware of how clean their water is. Lack of safe and clean water supply makes hand hygiene impossible. Transmission of infection by way of hands is one of the most important sources of infection for a large number of pathogens. Most morbidity in Africa is linked to unsafe water supplies and a lack of adequate sanitation facilities. Water is also an irreplaceable foodstuff and drinking of water from an unsafe source can lead to many illnesses. Further, water supply is essential in a health centre providing maternity services for the minimum of body hygiene.

Clean water is essential. Therefore, besides providing health centres with water pipes for running water, also a water filtering system should be installed in each health centre. In addition, community members need to have intensive education to convince them of the health benefits of clean water sources.

4.1.1.4. Communication and referral

Communication is essential for the working of a health centre and for referral of patients. Only three health centres had a fix telephone but these were not working. Only the district hospital had a telephone, but in their secretariat. For calling the ambulance, health workers needed to use their own mobile phone or the patients' mobile, if there is reception.

To communicate in emergency situations a telephone should be available immediately. Therefore it is recommended to have a telephone at each service of a health centre.

For referring patients from the village to the health centre, the patient's family and friends used stretchers, mostly from the village. Only four health centres had stretchers at the health centre. When referral to the district hospital is necessary, centres need to telephone the district hospital and wait for the ambulance to come. Only three ambulances were available to serve the 12 health centres. This means one ambulance for four health centres, so if more

than three urgencies occurs, patients in critical condition are forced to wait. Referral of patients is further discussed, see 3.2, 'Transferring patients to the district hospital'.

4.1.1.5. Furniture and equipment of the wards and services

The health centres had insufficiently delivery beds and hospitalisation beds. But what is the use of buying extra delivery beds or hospitalisation beds if there is no place where to put them? Three health centres only had one delivery bed and eight health centres had two delivery beds. In two health centres the delivery beds were in a bad state of repair, with rips in the mattress and with rust spots. All health centres had approximately between 30 and 40 deliveries a month, or an average of one or two a day. The district hospital Kabutare only had three delivery beds for approximately 140 deliveries a month. This means about five deliveries a day.

For the amount of deliveries that occurred in the health centres, two delivery beds is a minimum requirement. For the amount of deliveries that occurred in the district hospital, at least five or six delivery beds should be available. Before buying new delivery beds, the lack of space should be resolved both in the health centres and the district hospital.

All the health centres had between two and six hospitalisation beds for maternity care. In six of these centres the postnatal ward was also used as a prenatal and labour ward. The district hospital had 28 beds for prenatal and postnatal care. In one ward 19 beds were put next to each other with a minimum of space between them. When shortage of beds occurred, beds were used by more than one mother and baby at the same time.

For several health centres new wards will have to be built so that mother and child can be separated from pregnant women and women in labour. Also the district hospital needs a new building to enlarge their postnatal care facilities.

In tropical areas of Africa an estimation of 10.000 pregnant women and 200.000 of their infants die each year as a result of malaria infection during pregnancy (Roll Back Malaria, 2001). If properly used and maintained, mosquito nets can provide a physical barrier to mosquito bites. If treated with insecticide, the effectiveness of nets is greatly improved (Roll Back Malaria, 2001; World Health Organization, 2007). All health centres and the district hospital had mosquito nets hanging above almost all their beds. When looking closer a lot of these nets were ripped or contained holes. Mosquito nets are not very expensive in Rwanda,

so for the prevention of malaria these should be replaced. Health centres need to be sure that their mosquito nets are well maintenance. Also here, more attention need to be paid to broken windows or open doors (Roll Back Malaria, 2001; World Health Organization, 2007).

When neonatal pathology occurred, there were no heat sources available. Because all newborn infants or pregnant women with complications are transferred to the district hospital, facilities for neonatal care with incubators, heat sources and first aid neonatal equipment is recommended (World Health Organization, 2003).

4.1.2. Bottlenecks and recommendations in relation to vital medical equipment

In this section, several bottlenecks in relation to vital medical equipment will be presented and recommendations will be made. Hereby bottlenecks and recommendations about material for the care of women during pregnancy, labour, delivery and postpartum will be presented.

While checking equipment for general care, prenatal, labour and postnatal care several important points were noted.

Firstly, not all health centres had the same equipment or the same quantity of equipment. In Rwanda every health centre decides what they need and will buy within their budget, this leads to the differences between health centres. For example four health centres had only one fetal stethoscope. The World Health Organization recommends to record the fetal heart rate every 30 minutes in normal deliveries (World Health Organization, 2003). When a health centre only has one fetal stethoscope, it is very difficult to monitor fetal health properly with two women in labour and prenatal consultations running at the same time.

Secondly, not all equipment was stored appropriately or at the right place. Thermometers should be available in the clinic, in the delivery room and postnatal ward and not only in the stock room. In three health centres with prenatal, labour and postnatal activities, there was only one blood sphygmomanometer and stethoscope in the consultation room and none in the delivery room or postnatal ward.

Thirdly, not all equipment was used properly. All the health centres had partograms for using during labour, but they did not always use them. The World Health Organization partogram has been modified to make it simpler and easier to use (World Health Organization, 2003).

The nurses had been given wrong information, they did not really know how and why to use the partogram. A postnatal record system was not available, so no records were made. Education on care of mother and child is therefore important (World Health Organization, 2003).

Fourth, not all equipment was being cared for. Some equipment was not cleaned after using it. In some health centre beds are rusty and unstable.

An adequate selection of the basic material needed is essential for increasing the quality of care. Therefore lists with essential equipment and supplies can be consulted. Health centres should all use the same list of equipment and supplies. Next to the selection which material they need, also quantification is important. Health centres need to plan orders well in advance, with regard to the vital importance of making the best use of limited budgets. The use of a good storage, stock control and record keeping is important for controlling the needs of equipment.

4.1.3. Bottlenecks and recommendations in relation to hygiene

In this section, several bottlenecks in relation to hygiene will be presented and recommendations will be made. Hereby lack of equipment, detergents and disinfectants will be discussed and recommendations will be made.

4.1.3.1. Lack of equipment

In most health centres equipment for maintaining hygiene is poor and very little attention is paid to hygiene. As already noted above, having clean and safe water in a health centre or maternity service is essential for good care of the mother, baby and other patients.

Only six health centres and the district hospital had bins to collect waste at their maternity service or delivery room. The other health centres used washbasins or buckets which were also used for other things than collecting rubbish. Neither the health centres nor the district hospital used rubbish bags, so all rubbish was collected directly into the dustbins, washbasins or buckets.

For sterilising instruments only five health centres and the district hospital had a steriliser. The other health centres tried to sterilise their instruments by first washing them and

afterwards boiling them in water. One health centre boiled the instruments in water, afterwards they putted the instruments in chloorhexidine and then for more than 24 hours in formol. It is hardly recommended for all health centres to have a steriliser. In addition all staff require continuing education on the aspect of sterilisation.

Sterile gloves and compresses were scarce in most health centres. Nurses were more aware of the importance of hygiene, these health centres may well spend more money on these equipments.

4.1.3.2. Detergents and disinfectants

The soap they used for cleaning space, surfaces and equipment, for hand hygiene and for personal hygiene was the same. The soap was called “Omo” and was available in the form of liquid, powder or a block. This is a neutral soap, that can be effective when used properly.

The disinfectants used to disinfect surfaces and equipment, for hand hygiene and for medical and nursing procedures were the same. They used formol, chloorhexidine, chloramine, alcohol, povidone iodium, dettol and javel. Formol is generally toxic and can be used as disinfectant for surfaces, instruments and sterilisation (Schuermans, 2006: Van de Putte, 2000). In the health centres they used formol to clean equipment or to sterilise it. Chloorhexidine is only slightly toxic and can be used on skin, wounds and instruments (Schuermans, 2006: Van de Putte, 2000). Chloramine and javel are generally toxic and unstable and can be used for linen, surface, pans, wounds and mucous membranes (Schuermans, 2006: Van de Putte, 2000). Alcohols can be used for hand hygiene, surgical skin preparation and little surfaces. Povidone iodine (isobetadine iodine) can be used for chirurgical hand hygiene, on skin, wounds and mucous membranes (Schuermans, 2006: Van de Putte, 2000). Dettol is a phenol derivate and can be used to disinfect surfaces and instruments and sometimes for wounds and mucous membranes. This is not toxic but it is not very effective (Schuermans, 2006: Van de Putte, 2000).

All health centres had surely enough and the right disinfectants for space, surfaces, equipment, hand hygiene and medical and nursing procedures. The only problem here is the use of them. From the observations in the health centres it became clear that the staff members did not understood the importance of hygiene. While observing staff members, it became clear that they rarely washed and disinfected their hands, neither between the caring for women nor when they arrived or left the health centre. Also equipment and surfaces were

not washed or disinfected between two patients. While performing nursing and medical interventions, nurses did not follow sterile principles. The cleaning staff threw water on the floor and then collected it again, without scrubbing first.

Patient safety is a global issue that affects both developed and developing countries. In October 2004, the World Health Organization launched the World Alliance for Patient Safety to coordinate and accelerate improvements in patient safety internationally. The first topic chosen by the Alliance was health care associated infection (Pittet et al., 2006; Pittet et al., 2008). Pittet et al. (2006) also concludes that the time has come to shout from the roof tops that hand hygiene promotion should be a worldwide priority in health care, especially in developing countries. Successful promotion and implementation of hand hygiene will require system change, education and motivation of caregivers.

4.1.4. Bottlenecks and recommendations in relation to laboratory material and equipment

Most laboratories were functioning properly. Some laboratories were funded by 'Global Fund' and they did perform HIV tests. Other health centres only performed urine tests, tests for malaria etc..., all checked with a microscope. If other, more difficult, tests were necessary, patients were referred to the district hospital. Three health centres did not have urine sticks, which is a simple test for checking proteins and glucose in the urine of pregnant women. These health centres should be recommended to buy these.

4.1.5. Bottlenecks and recommendations in relation to medication

Provision of an adequate supply of medication is critical to the successful implementation of activities (World Health Organization, 1994).

In this section, several bottlenecks in relation to medication will be presented. First the bottlenecks about medication for the treatment of HIV will be discussed. Next bottlenecks about contraceptives and medication for general use, for prenatal care, labour care and postnatal will be presented. Recommendations will be made.

4.1.5.1. Medication for the treatment of HIV

Only one health centre and the district hospital had several medication for HIV. These services are funded by 'Global Fund' for their drugs supply and HIV tests. Other health centres did gave health education to the population and encouraged them to have a HIV test. After knowing the result, support was given at the health centres and at the district hospital.

4.1.5.2. Contraceptives

Promotion of family planning in countries with high birth rates has the potential to reduce poverty and hunger and to avert 32% of all maternal deaths and nearly 10% of childhood deaths (Cleland et al., 2006). In 2000, about 90% of global abortion related mortality and morbidity and 20% of obstetric related mortality and morbidity could have been averted by the use of effective contraception (Cleland et al., 2006). As noted before the mean total fertility rate per woman in Rwanda is 5,5 and the prevalence of using contraception is only 13,2 % according to the World Health Organization (2007).

Three out of four health centres run by Catholic sisters did not allow the distribution of nor the prescription of artificial contraception devices. One health centre run by sisters did have male condoms and female condoms, but I am not sure if they were distributed, as they were lying in the stock room. The other health centres did also have oral contraception, cycle beads, contraception by injection, implanon and one health centre had intra uterine contraceptive devices, which were inserted at the district hospital. In some health centres health education about contraception was already organized, but in most centres this was still taboo.

Another issue on the use of contraception are the men. In Rwanda men want as many children as possible and as a result women need to use contraceptives without informing their husband. Some health centres already require the men to come with their wives on consultation. Also this is a problem, because in general these men are not motivated to do this. The World Health Organization emphasizes the need to involve men in family planning (World Health Organization, 2004). It is estimated that over 20% of the population has an unmet need for contraception (Cleland et al., 2006). The health centres gave more attention on the issue of HIV and protection with condoms than contraception.

Education of nurses on the use of contraception and the manner of giving health education is necessary. Further education of the populations on the use of contraception is necessary.

4.1.5.3. Medication for general use, during pregnancy, labour, delivery and postpartum

Neither the health centres nor the district hospital had oxygen. The use of oxygen for support of the respiration or to improve the level of gas in the blood is important in maternity services and health services in general (Sweet & Tiran, 2002).

Only one health centre and the district hospital had methyldopa tablets of 250 mg, a drug to treat hypertension and actrapid, a drug for treating diabetes. Neither the health centres nor the district hospital had magnesium sulphate for treating hypertensive disorders. In health centres where maternity services occurred these are necessary drugs (Sweet & Tiran, 2002).

Nine health centres and the district hospital had methylergometrine or syntocinon as oxytotics. These are also necessary drugs for health centres where labour and postnatal activities occurred (Sweet & Tiran, 2002).

Next to adequate selection of the needed material as noted before, also adequate selection of the needed drugs is essential for increasing the quality of care. Lists with essential drugs and quantity of drugs need to be consulted for choosing their necessary medications. Drugs need to be stored adequately and record keeping is important.

4.1.6. Bottlenecks and recommendations in relation to transfer of patients to the district hospital

As noted above, all health centres need to have a local telephone at their services, so that in case of emergency, a call to the district hospital can be made.

The lack of ambulances should be resolved in order to improve the transfer policy. Three ambulances for 12 health centres, means only one ambulance per four health centres. When more than three urgencies occurred at the same time in different health centres, the district hospital needed to decide where to go first. In most cases it was the driver who decided where to go first, so no medical aspects were considered.

For several health centres it took too long waiting for the ambulance, as these three ambulances are located at the district hospital. Urgent transfer cases could sometimes take hours and consequently the condition of the patient worsened and became harder to treat. It should be recommended to have at least one good equipped ambulance for three health

centres. These ambulances should be placed at a central point for the health centres, so that when emergency occurs, patients can be referred directly to the district hospital.

Next to the number of ambulances, also the assist of a well trained nurse or doctor in mother and child care is necessary for good patient care. In several cases only the driver was in the ambulance, so no patient follow up could be given during travel or at the arrival at the district hospital. In every health centre there should always be a permanence of at least two well trained nurses in mother and child care. These nurses can accompanied the patient during transfer.

After the ambulance was called, it could happen that nurses stop taking care of the patient. As it can take up to 5 hours to wait for the ambulance to arrive, patients are left alone, without appropriate care so that the condition of the patient worsened. Care should continue until the patient arrives at the district hospital and can then be transferred to the nurses working there.

4.2. General discussion

During the collection of the observational data in the 12 health centres and the district hospital the researcher was faced with several limitations.

Language was one of the obstacles while conducting the research. In Rwanda the mother tongue is Kinyarwanda, but all education in Rwanda is given in French. Nurses and educated people understood and spoke French very well. The researcher spoke too French fluently. Nevertheless some words and interpretations could differ between both the researcher and the nurses.

Another obstacle in collecting data was that nurses sometimes tended to disguise reality. The researcher experienced some contradicting information, while working or talking with different nurses at the same health centre. It was therefore difficult to depend on orally given information. In order to collect truthful data it became more important to conduct observations than asking about their way of working.

The validity of this research has all ready been described in point 2.6, 'Quality of the research'. Some items can be discussed further. To maintain the credibility multiple triangulation was used with a prolonged engagement for the data collection. Investigator

triangulation refers to the use of two or more researchers to analyze and interpret a data set (Polit & Beck, 2004). Because there was only one researcher, this could not be achieved. Also member checking could not have been done in order to establish credibility. In a member check, researchers provide feedback to the study participants regarding the emerging data and interpretations and obtain participants' reaction (Polit & Beck, 2004). The researcher will go back to the health centres and the district hospital in August 2008. Dependability refers to the stability of data over time and over conditions. Step-wise replication could have been used to assess the dependability, this involves a research team that will be divided into two groups to deal with data sources separately (Polit & Beck, 2004). Because there was only one researcher this could not have been achieved. The biggest criticism of a case study is the concern of generalizability, if researchers discover important relationships, it is difficult to know whether the same relationships would occur in other areas (Polit & Beck, 2004). The researcher tried to provide sufficient descriptive data in the research report so that readers can evaluate the applicability of the data to other areas.

5. Conclusion

While conducting the observational study, during the seven week study period, the researcher was able to collect the needed information to answer the two research questions which had been developed at the start of this study. These two questions were:

1. What are the recommendations about basic maternal infrastructure, equipment and medication and what is the situation in the district of Huye, Rwanda, anno summer 2007?
2. What are the recommendations about the procedure of referral of mother and newborn infant and what is the situation in the district of Huye, Rwanda, anno summer 2007?

Before making some conclusions in relation to these research questions, some general remarks can be made. In terms of the kind of programmes of care provided, there were no large differences between the health centres and the district hospital. They all provided the same package of services, except the health centre CUSP which did not provide labour and postnatal activities and for the district hospital which conducted caesarean sections but did not provide prenatal consultations.

During the observations it became clear that the health centres and the district hospital did not have the same infrastructure and equipment. For example, the geographic location of the health centres determined the extent to which they had access to water and electricity. The researcher also noticed some difference between the Catholic and public health centres.

The researcher tried to find out what elements of the Rwandan health centres and the district hospital might influence the achievement of the fifth Millennium Development Goal. Several bottlenecks could be distinguished, and appropriate action to alleviate them identified.

First of all, health centres and the district hospital need to ensure that all bottlenecks of the characteristics of the infrastructure are taken care of. Hereby all buildings and wards should be revised by an architect, so that adequate use can be assured. The possibility that sick patients and pregnant or delivered women and their babies are together in the same room should be avoided. If necessary new buildings should be built. The presence of continuous electricity supply is important. Solar energy may be worthy of investment, in a tropical country as Rwanda. Also a safe and permanent water supply is essential for any health centre or hospital. This is in order to maintain hygiene and as drinking water. Investing in water pipes for running water and in a water filtering system to assure clean and safe water is essential.

Secondly, education of the health care providers and giving knowledge of necessary equipment and drugs is essential. These two aspects cannot be separated from each other. Without knowledge of maternity care, good equipment is useless. Without the access to adequate equipment, education on maternity care has no use.

For the amount of deliveries that occurred in the health centres and the district hospital, more delivery and hospitalisation beds are necessary. Equipment, such as blood sphygmomanometers, stethoscopes, thermometers, etc. should be stored at the right place, so that nurses have immediate access when an emergency occurs. Here knowledge of the use of them and interpretation of the results is essential. Education on the use of a partogram is important.

To maintain hygiene it is recommended that all health centres and the district hospital have safe running water, a steriliser and knowledge of the aspects of hygiene. Promotion of hand hygiene should be a priority in every health care system.

For referring patients to the district hospital every service in the health centre needs to be equipped with a fixed telephone, so that transfer can be arranged immediately. The availability of ambulance services for emergency obstetrical and neonatal care has to be improved. The ambulance driver should be accompanied by a well-trained nurse or doctor in mother and child care.

Contraceptives, oxytocics, oxygen, medication for the treatment of HIV, hypertensive disorders and diabetes are necessary drugs for a health centre or hospital where maternity services are provided.

It is clear that with good education on maternity care and knowledge of necessary materials and drugs, health centres and hospitals would be able to better choose their equipment, supplies and drugs depending on their needs. Knowledge of the existence of equipment and drugs lists set up by the World Health Organization can help these centres to choose their supplies (World Health Organization, 1994).

Furthermore, the procurement of the equipment, supplies and drugs needed, should involve selecting suppliers, placing and monitoring orders, checking delivery quantities and quality, and paying suppliers. The distribution of equipment, supplies and drugs includes reception, storage, stock control, transport and delivery and record-keeping for monitoring and control (World Health Organization, 1994). If this can be done centrally it is possible that bulk buying

would result in lower costs and central government could be sure that stocks were appropriate and adequate.

Last but not least, it is worth noting that the local health care providers acknowledge their own lack of clinical knowledge and competences. It is encouraging that these providers are quite motivated to receive extra training and education to improve the quality of maternal and neonatal care in these, mostly rural settings. Even if it cannot be possible to immediately employ at least one midwife for each health centre and the district hospital, these nurses can already be brought into action to reduce maternal and neonatal morbidity and mortality. They should receive any opportunity to obtain knowledge on maternity and child care and to improve their skills and competences. This would also facilitate future midwives to do their job properly and to communicate and pass on their knowledge and skills.

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8. Appendix

In this section all original checklists, which were used to conduct the study are presented. First the checklist in relation to infrastructure is presented, followed by the checklists for vital medical equipment, in relation to equipment needed to maintain hygiene, in relation to laboratory material and equipment and in relation to medication.

8.1. Checklist in relation to infrastructure

→ Characteristics of the infrastructure

Material	Present (+quantity)	Commentary/extra
Building		
Waiting room		
Ex/consultation room		
Delivery room		
Maternity		
Baby room		
Electricity		
Electric socket		
Light source		
Running water		
Washbassin		
clock		

→ Material for communication and referral

Material	Present (+quantity)	Commentary/extra
Electricity		
Telephone		
Fax		
Computer		
Internet		
Stretcher		
Ambulance		

→ *Furniture and equipment of the wards and services*

Material	Present (+quantity)	Commentary/extra
Examination bed		
Delivery bed		
Beds		
Plastic mattress		
Baby bed		
First-aid charroit		
Perfusionstandard		
Night table		
closet/rack		
Cheet		
Pillow		
Pillow-cover		
Baby sheet		
Partition		
Curtain		
Washbassin		
Mosquito net		
Electric point		
Dustbin		
Rubbish bag		
Heat source		
Refrigerator		

8.2. Checklist for vital medical equipment

→ Equipment for general use

Material	Present (+quantity)	Commentary/extra
Blood sphygmomanometres meter		
Stethoscope		
Clinical Thermometer		
Weighing scale		
Renal form (steel)		
Non-steril gloves		
Non-steril compresses		
Steril compressen		
Syringe		
Needle SC		
Needle IM		
Infusioncanulle		
Infusionline		
Pinchband		
Washbassin		
Bandage scissors		
Pan		
Reanimationset		

→ Equipment for the women prenatally

Material	Present (+quantity)	Commentary/extra
Prenatal record		
Pregnancy disc		
Tape measure		
Fetal stethoscope		
Doptone		
Contactgel		
Fingerstall		
Steril gloves		
Speculae		
Steril forceps		
Cervical smear spatulae		

→ **Equipment for the labouring women**

Material	Present (+quantity)	Commentary/extra
Partogram		
Fetal stethoscope		
Doptone		
Contactgel		
Fingerstall		
Steril gloves		
Steril compresses		
Amnihooks		
Bladder catheter (unique use)		
Episiotomy scissors		
Umbilical cord clamp		
Kocher's forceps		
Suture		
Suture clamp		
Suture scissors		
Maternity sanitary towel		
Oxygen glasses		
Oxygen mask		

→ **Equipment for the mother postnatal**

Material	Present (+quantity)	Commentary/extra
Postnatal record		
Non-steril gloves		
Maternity sanitary towel		
Oxygen glasses		
Oxygen mask		
Bladder catheter (unique use)		
pan		
Steril compresses		

8.3. Checklist in relation to equipment needed to maintain hygiene

→ Hygiene of space and surfaces

Material	Present (+quantity)	Commentary/extra
Brush		
Water		
Soap		
Water scraper		
Floor cloth		
Disinfectant for space		
Disinfectant for surface		
Dustbin		
Rubbish bag		

→ Hygiene of equipment

Material	Present (+quantity)	Commentary/extra
Sterilisator		
Disinfectant for material		
Detergent for material		
Rack for material		

→ Personal hygiene of staff members

Material	Present (+quantity)	Commentary/extra
Scrub room		
Running water		
Soap		
Scrub spones		
Towels		
Disinfectant for hands		
Protective glasses		
Protective clothes		
Protective masks		
Gloves		

→ *Hygiene of medical and nursing procedures*

Material	Present (+quantity)	Commentary/extra
Non-steril gloves		
Steril gloves		
Non-steril compresses		
Steril gloves		
Soap		
Disinfectant for skin		

8.4. Checklist in relation to laboratory material and equipment

Material	Present (+quantity)	Commentary/extra
Microscope		
Slide		
Fixative spray		
Immersion oil		
Urinerecipient		
Urinstix		
Bloodtube		
excrementrecipient		
Hemoglobine meter		
Needle container		

8.5. Checklist in relation to medication

→ Medication for general use and diseases

Medicament	Present (+quantity)	Commentary/extra
Physiological serum		
Oxygen		
Paracetamol		
Salicylate		
Vaseline		
Nacl 0.9% infusion		
Glucose 5% infusion		
Antimalaria preventive		
Antimalaria treatment		
Treatment for HIV		
Contraception		
Laxative		
Anti-diuretic		
Antibiotics		

→ Medication for the pregnant women

Medicament	Present (+quantity)	Commentary/extra
Antibiotics		
Antihypertensive		
Diuretic		
Iron tablets		
Anti-emetic		
Anti-diabetic		
Folic acid		
Tetanus vaccine		

→ Medication for the labouring women

Medicament	Present (+quantity)	Commentary/extra
Lidocaine cream		
Lidocaine 2% inj		
Oxytocic		
Antibiotics		
Infusion liquid		
Oxygen		
Anticoagulantia		

→ *Medication for the mother postnatal*

Medicament	Present (+quantity)	Commentary/extra
Antibiotics		
Oxytocic		
Oxygen		
Anticoagulantia		
Painkillers		