Cost-Effectiveness Analysis of Emergency Obstetric Services in a Crisis Environment

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ABSTRACT

The study investigated the cost-effectiveness of caesarean section (CS) as the major component of Emergency Obstetric Care (EMOC) in a humanitarian context. Research was conducted from December 2007 until June 2008 in Bunia, in the north-east of the Democratic Republic of Congo.

Methods

A case-control study explored the factors determining whether a woman had a CS or a vaginal delivery. Cases (n=178) were randomly selected from women who had delivered by CS. Controls (n=180) were women who had delivered vaginally within two weeks of a case and were matched by place of residency. Face-to face interviews in the local language used a structured questionnaire about obstetric and socio-economic factors.

Obstetric care was assessed during repeat visits to health structures using checklists. Provider cost of CS was calculated for four hospitals, of which one provided free emergency healthcare. Information about cost allocation to CS was collected from hospital managers, maternity staff, and administrators. Costs were verified with local entrepreneurs, international organisations and UN agencies. The social cost of maternal death was discussed in focus groups, which also obtained user cost information additional to the data from the case-control study.

Results

CS constituted 9.7% of expected deliveries in the Bunia Health Zone. During the study period, the humanitarian hospital performed 75% of all CS. There were no elective CSs in the study sample. The study found no evidence of obstetric surgery for non-medical reasons. Previous CS and prolonged labour during this delivery were the strongest predictive factors for CS. The risk increased with age of the mother and decreased with the number of children alive.

Fifteen obstetric deaths were reported to the research team, three among them were women who had a CS. After adjusting the observed number for missed pregnancy-related and late post-partum deaths, the estimated number of maternal deaths avoided by humanitarian EMOC, compared to expected mortality without additional services, ranged from 20 to 228. Compared to recent estimates for the DRC, perinatal deaths avoided ranged from 237 to 453. Cost-effectiveness was expressed as cost per year of healthy life expectancy (HALE) gained. The estimated cost of adding one year of HALE by providing CSs in a humanitarian context ranged from 3.77 USD to 9.17 USD.

Comparison of the cost of EMOC and the social cost of maternal death was complicated by the existence of local customs such as "*sororate*". The user capacity to pay for health insurance was found to be low.

Conclusion

Caesarean sections as part of humanitarian assistance were cost-effective. To keep EMOC accessible during and following the transition from emergency relief to development, a change in the national financing policy for health services is advisable.

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In memory of my mother

LIST OF ACRONYMS

ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
ANC	Antenatal Care
BM	Bon Marché (hospital)
CEA	Cost-effectiveness analysis
CME	Evangelical Medical Centre (Centre Médical Evangélique)
CONADER	National Commission for disarmament, demobilisation and reintegration
CS	Caesarean section
CSs	Caesarean sections
DAC	Development Assistance Committee
DRC	Democratic Republic of the Congo
DDR	Disarmament, demobilization, and reintegration
DDRRR	Disarmament, Demobilisation, Repatriation, Rehabilitation & Reintegration
DFID	Department for International Development (UK bilateral assistance)
EC	European Commission
ECHO	European Commission Humanitarian Office
EDF	European Development Fund
EMOC	Emergency Obstetric Care
EMOCS	Emergency Obstetric Care Services
ERD	Evaluative Reports Database
FARDC	Forces Armées de la République Démocrtatique du Congo (Congolese national army)
FED	European Development Fund (French acronym)
FNI	Front for National Integration
FRPI	Patriotic Front of Resistance in Ituri
GDP	Gross Domestic Product
GHD	Good Humanitarian Donorship
HeRAMS	Health Resources Availability Mapping System
HGR	General Referral Hospital (Hôpital Général de Référnce)
HIV	Human Immuno-deficiency Virus
HNTS	Health and Nutrition Tracking System
IASC	Inter-Agency Standing Committee
ICD	Inter-Congolese Dialogue
IDP	Internally Displaced Person
IEC	Information Education Communication
INS	National Institute for Statistics (Institut National de Statistiques)
IPC	Ituri Pacification Commission
IRIN	Integrated Regional Information Network
ISPASC	Institut Supérieur Pan-Africain de Santé Communautaire
MISP	Minimum Initial Service Package
MLC	Movement for the Liberation of Congo
MONUC	French acronym for the United Nations Mission in Congo
MONUSCO	United Nations Stabilisation Mission in Congo
MRC	Congolese Revolutionary Movement
NGO	non-Governmental Organization
OCHA	Office of the Coordinator for Humanitarian Affairs

ODI	Overseas Development Institute
OECD	Organization for Economic Cooperation and Development
OFDA	Office of US Foreign Disaster Assistance (USAID)
PHC	Primary Healthcare
RCD	Rally for Congolese Democracy (Rassemblement Congolais pour la Démocratie)
RCD-ML	Rassemblement Congolais pour la Démocratie- Mouvement de Libération
RCD-N	Rassemblement Congolais pour la Démocratie- Nationale
RPF	Rwanda Patriotic Front
RTE	Real-time Evaluation
RW	Rwankole hospital
SMART	Standardized Monitoring and Assessment of Relief and Transitions
TEC	Tsunami Evaluation Coalition
UN	United Nations
UNDP	United Nations Development Programme
UNEG	United Nations Evaluation Group
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children’s Fund
UPDF	Uganda People’s Defence Force
USAID	United Stated Agency for International Development
USB	Shalom University Bunia (Université Shalom de Bunia)
WHO	World Health Organization

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PREFACE

This dissertation describes a study conducted in Bunia, Democratic Republic of Congo, in 2008. The aim was to estimate, in a humanitarian crisis environment, the cost-effectiveness of Emergency Obstetric Care, with a focus on caesarean sections as the major component.

To provide a full geographical and political context, and to situate the humanitarian effort in relation to the Congolese health system, the first chapter opens with a brief narrative of local and national political and military events since 1994. This is followed by a short overview of humanitarian assistance in healthcare, describing the rationale for evaluating humanitarian action with reference to health service evaluation. This chapter further outlines the most important features of the Congolese health system.

Chapter 2 details the methodology and sources used for the study. Apart from information obtained through individual interviews with women in Bunia who had recently delivered a child, the study design included focus group discussions and periodic compilation of data from routine reporting at health structures. The local health authorities and representatives of relevant technical UN agencies provided inputs on demographics and health service utilisation. Figures concerning the cost of emergency obstetric care, and more specifically of caesarean sections, were obtained from hospital staff and managers working in Bunia with the Ministry of Health, international NGOs and faith-based organisations. Business people were consulted about the cost of buildings and non-medical inputs. Documents from international sources such as the UN Population Fund were used to estimate the cost of medicine and recurrent medical supplies. This chapter also highlights some of the constraints encountered.

Chapter 3 reports the study findings in four distinct sections:

- A statistical analysis of interviews of cases (women who had a caesarean section) and controls (women who had a vaginal delivery);
- A range of estimates of the effectiveness of caesarean sections using different assumptions and baseline figures;
- Estimates of the provider and user cost of caesarean section in Bunia; and
- An analysis of the findings of the focus groups.

The results reported in Chapter 3 are discussed in detail in Chapter 4. Since the objective of the cost-effectiveness analysis was to identify unmet needs and define priorities for future investment, the discussion includes a review of alternative options, and looks into the comparative advantages and disadvantages of different possible sources of funding.

Chapter 5 concludes the dissertation with conclusions and recommendations drawn from the study findings.

CHAPTER 1

BACKGROUND

1.1. HISTORY

Ituri district (Fig 1.1) is part of the Oriental Province in the Democratic Republic of Congo (DRC). Covering an area of 65,775 km^2 in the north-east of the country, its population of about 4.5 million (1) is a mixture of ethnically distinct communities. Several sources, including the United Nations (UN), (2) indicate that the armed conflict in recent years was partly related to land disputes[i] between Lendu agricultural farmers and cattle raising Hema, (3) together accounting for some 40 percent of the Ituri population. Violence reportedly spread in 1999 after ancestral Lendu land near Bunia was purchased for cattle grazing by a Hema group with political backing of the ruling party, which had the support of Ugandan army troops occupying the area. This incident was followed by ethnic reprisal attacks on surrounding villages and towns. (4)

Ituri is a mineral-rich district, with gold mining as an important source of revenue since the beginning of the 20th century, (5) and more recently the exploitation of columbite-tantalite or coltan, a mineral used in the computing and mobile phone industry. The region also has diamonds, oil and timber. International economic interests and the local struggle for political power exposed Ituri to the rivalry of armed groups, with varying support from governments in neighbouring countries. (6) During five years of hostilities (1998-2003), tens of thousands of people died and many more were displaced as a direct result of the fighting. (7)

The history of the conflict in Ituri is tied with national events and those in the African Great Lakes region (see Annex 1: timeline). In 1994, the arrival of more than a million Rwandan refugees fomented unrest in the eastern part of former Zaire, now the Democratic Republic of the Congo (DRC).

[i] The "Bakajika law" of 1973 enforced and broadened the concept that vacant land could be appropriated

Fig 1.1 Administrative map of the DR Congo (source: GIS MONUC)

- **Bunia**

Infiltrated among the civilian refugee population were armed members of the "Interahamwe" militia. These were radical Hutus intent on returning to their country and overthrowing the new government of Paul Kagame.(8) With massive international support, the political situation in Rwanda soon stabilized, but many refugees remained in camps around Goma, in North Kivu, and further south in Bukavu and Uvira.

In 1996 the Rwanda army invaded the camps in North Kivu and forcibly dispersed the refugees. Meanwhile Mobutu Sese Seko, the president of former Zaire was losing his grip on power due to personal ill health and discontent among the army and the public sector. With active support from Uganda, Rwanda and Angola, Laurent Kabila led a rebel force from the east of the country to the capital, and gained control of Kinshasa in May 1997. A rebel offensive against the Kabila government started soon after with the backing of Rwanda and Uganda. Kabila sought support from other African nations and the advancing rebels were kept out of Kinshasa by Zimbabwean and Angolan forces. Namibia, Chad and Libya also lent support to Kabila. (9)

The Security Council set up MONUC (French acronym for the United Nations Mission in Congo) on November 30th 1999, "to maintain liaison with the parties and carry out other tasks, incorporating UN personnel authorized in earlier resolutions." By the year 2000, Ugandan military authorities (Uganda People's Defence Force, UPDF) controlled much of the Oriental Province, including the town of Bunia. (10)

In January 2001, Laurent Kabila was assassinated by a bodyguard and was replaced by his son Joseph. The "Inter-Congolese Dialogue," a series of negotiations between the warring factions started in October 2001and was concluded with a final agreement in April 2003.

A National Commission for disarmament, demobilisation and reintegration (DDR), CONADER was created in 2003. With UN support, the Ituri Pacification Commission (IPC) was inaugurated in April 2003 and the IPC delegations elected a civilian interim administration. However, shortly after the withdrawal of the Ugandan army, the battle resumed. In May 2003, after heavy fighting broke out for the control of Bunia town, the European Commission (EC), on a request by the UN, sent 1,400 troops on a three-month mission to stabilise Bunia and secure the airport. The operation code-named Artemis was successful in restoring relative stability in the town itself, but atrocities in the surrounding areas continued. (11) By September of the same year (2003) the "Ituri Brigade" was deployed to the district: 3,800 UN peacekeepers led by Bangladesh. (12)

In 2004, the interim administration was replaced by a district administration, with members nominated by the central government in Kinshasa. (13, 14) In February 2005, the Congolese government deployed 3000 additional national army troops in Ituri. They were assisted by MONUC in their efforts at forcibly implementing the ceasefire agreement.

Two rounds of national elections were held in 2006, leading to the establishment of a national government with Joseph Kabila as president. However, three areas of unrest remained: the Kivu Provinces along the Rwandan border, northern Katanga, and Ituri.

A gradual withdrawal of UN troops from Congolese territory was envisaged by 2010.

The number of UN military personnel in Ituri was reduced from 5000 to 4,500 by mid-2008. Renewed fighting started late 2008 in the areas south of Bunia, trapping civilians between battle fronts and causing further displacement. The town of Bunia and its immediate surroundings remained relatively quiet. In May 2010 the Security Council approved a reduction in the number of UN troops in Congo by 2000 people, (15) leaving 17,112 military personnel in place on 31st October 2010. (16) The name of the mission changed from MONUC to "MONUSCO", acronym for the UN Stabilization Mission in the DR Congo.

With security improving in Ituri after the national elections, international donors and their operational partners decided to return to development assistance after a period of transition from humanitarian aid. This changing mode of support had important implications for the provision and management of health care services, as described below.

1.2. HUMANITARIAN ASSISTANCE AND HEALTHCARE

United Nations Resolution 46/182 of December 1991 specified that humanitarian assistance must be linked to the humanitarian principles of humanity, neutrality and impartiality. A fourth principle, independence, is part of the Code of Conduct for the International Red Cross and Red Crescent Movement and NGOs in Disaster Response. The principle implies that "agencies endeavour not to act as instruments of government foreign policy." (17)

After declaring a disaster or emergency, the United Nations make an appeal for international humanitarian assistance through the Consolidated Appeals Process (CAP).(18) The definition of an event as a disaster is related to the number of casualties, while the need for external assistance with emergency response also takes account of available resources. A disaster can be classified by its causal mechanism, extent and duration, by the number of casualties and type of injuries, and by the level of response required. (19) The term "emergency" in a humanitarian context denotes the urgency of the response required to save lives subject to an imminent threat. (20)

The International Committee of the Red Cross (ICRC) first met in 1863 in Geneva, Switzerland. Its mission is to ensure protection and assistance for victims of armed conflict and other situations of violence. (21) International medical humanitarian aid organisations were created relatively recently. A group of French doctors, working with the International Committee of the Red Cross in Biafra in 1969, founded Médecins sans Frontières (MSF) in

1970. Médecins du Monde (MDM), another medical NGO first established in France, was set up in 1980 by some of the initial founders of MSF. The International Medical Corps (IMC), (22) which has its headquarters in California, USA, dates its foundation to 1984 with a programme in Afghanistan during the Soviet occupation. MERLIN (Medical Emergency Relief International) (23) was officially set up in London, UK, in 1993 to respond to the crisis in former Yugoslavia.

The mandate of humanitarian organizations, and variations in its interpretation, influence their decisions to intervene or to leave. For example, MSF intends to "deliver emergency aid to people affected by armed conflict, epidemics, healthcare exclusion and natural or manmade disasters." (24) OXFAM[ii], a non-medical charity founded in England in 1942, (25) aims to "find lasting solutions to poverty and injustice."

The debate around the boundaries of humanitarian assistance in healthcare has also been linked to the fluency in factors causing emergency situations to occur and re-occur. The geopolitical notion of "fragile States" has been used to advocate the need for emergency (humanitarian) and development aid to overlap. (26) It has further been argued that the transition from humanitarian aid to development assistance following complex emergencies may be complicated by a host of factors, including a lack of collaboration between humanitarian and development organisations, partly related to competition for funding. Humanitarian aid is said to be well funded and usually effective, carried out by external aid providers. Rehabilitation is considered to be politically dubious, inadequately funded, carried out by recipients and more difficult. From this point of view, "rehabilitation assistance aimed at effecting a transition from fierce crisis to a viable future remains politically un-salient." Donors and multilateral agencies would therefore be the main culprits when transition fails. (27)

The interaction between the international politics of "stabilisation" and humanitarian activities was the subject of "States of fragility: stabilisation and its implications for humanitarian action", the October 2010 supplement to the journal "Disasters". The lead article (28) defined stabilisation as "military, political, economic and humanitarian activities to control, contain and manage areas affected by armed conflict and complex emergencies". The authors highlighted the dilemma of a trend in the political-humanitarian interface simultaneously claiming soft and hard goals, such as peace-building and security.

[ii] Acronym for : Oxford Committee for Famine Relief

In countries recovering from armed conflict, such as the DRC, international decisions regarding humanitarian assistance can have a direct effect on the amount of resources available for public health services. The next section outlines the evolution of the Congolese health system before, during and in the aftermath of the humanitarian crisis.

1.3. THE HEALTH SYSTEM IN THE DRC

In 1980, the national government adopted the primary health care strategy as the basis of its health policy. Implementation relied on "Health Zones," typically including a population of 150,000 people, 200 villages, and 20 health centres structured around a referral hospital (29) which simultaneously functioned as a managerial hub. A "Zone Management Team" was tasked with assuring complementary services between the different health facilities. Three hundred and six Health Zones had been defined by 1985. Funding was obtained from the national budget, bilateral and multilateral donors, and user fees. As the country's economy went into decline from the late eighties onwards, less funding for the health sector was available from government resources, and user charges became the main source of income for health structures. The coordinating role of the Ministry of Health faded. Public sector salaries stagnated, hospital and Health Zone management became dissociated, and managers largely depended on the revenue generated by hospitals and health centres from user payments. Decentralization was hampered by a lack of resources for the intermediate (provincial) level, which added to a growing discrepancy between centrally-administered funding for vertical programmes and operational means for integrated health care in the Health Zone. (30)

Following the demise of Mobutu in 1997, international financial support was stepped up to aid transition in the Congo, including improvements in the public sector. A National Health Policy, signed by Joseph Kabila, was published in 2001. (31) As a result, the number of Health Zones increased from 306 to 515, but resources were insufficient to match the comprehensive, development-oriented vision expressed in the policy. In 2003, a Minimum Package of Activities was formulated for implementation in emergency settings. (32) The health strategy adopted in 2006 envisaged a strengthening of the system. (30)

Investment by major development donors, such as the World Bank, DFID, USAID and the EC after the national elections was delayed by violence in parts of the country. Although the State budget for health was expected to increase to an estimated 5 USD per capita, (33) no additional funds became available in the short term, while the new government was established and the budget decided. Humanitarian programme funding on the principle of free access to basic services was gradually discontinued from 2005 onwards and user fees were re-introduced as part of the national health policy. Bunia was selected among the Health Zones in the Oriental Province to receive support from the 9th European Development Fund (EDF).[iii]

Faith-based organisations have been providing medical services in the Congo since colonial times. At the local level, mission hospitals and dispensaries (health centres) function on a cost-recovery basis, with international charity back-up from churches in the western world. Before the start of the conflict, development-oriented international NGOs distributed renewable supplies and other inputs to the national health system, with the dual aim of improving performance and reducing the user cost. While the type of aid (medicine, equipment, rehabilitation of structures, training) remained the same, the NGOs already working in the area obtained international funding under a humanitarian mandate during the war. This allowed them to offer additional financial incentives to healthcare providers to compensate for the loss of income from service users who were destitute and unable to pay because of the destruction of livelihoods, due to the fighting. After the end of the war, the national government awarded salaries to a limited number of senior health workers. A large proportion of the direct revenue from user payments was spent on staff remunerations (68.5% according to a hospital administrator in Bunia).

The first regional association for the supply and distribution of essential drugs (Association Régionale d'Approvisionnement en Médicaments Essentiels, ASRAMES) was set up in North Kivu in 1992 as a joint initiative between a group of international and national NGOs and the local offices of the Ministry of Health. Working on a non-profit basis, the association supplied humanitarian organizations operating in the health sector in the north-eastern region of the DRC, including some NGOs in Ituri. Using the model of ASRAMES, a nationwide supply and distribution system was envisaged under the 2001 health policy, the "Fédération des Centrales d'Achat des Médicaments Essentiels" (FEDECAME). By 2008, four regional distribution centres were functioning with technical assistance from the European Commission under the 9th EDF and the Belgian Technical Cooperation. (34, 35)

[iii] Information received during meeting with Servais Capo-Chichi, Provincial Coordinator for 9th EDF in Oriental Province

1.4. HEALTH SERVICES IN BUNIA, ITURI

In 2005 Ituri counted 36 Health Zones spread over five administrative areas: Irumu, Djugu, Mahagi, Mambasa and Aru. (Fig 1.2) In newly designated Health Zones with no existing hospital, larger health centres had been upgraded to function as referral centres. However, the centres were often ill-equipped and unable to attract suitably qualified skilled personnel. (33, 36)

Displacement and insecurity caused by the conflict in Ituri resulted in high morbidity, limited access to healthcare and excess mortality. A retrospective mortality survey carried out in 2005 by epidemiologists from the French organisation Epicentre found mortality in Ituri among children aged less than 5 years to be three times above the emergency threshold. (37) According to the same researchers, the age pyramid of the population observed at one health facility in 2007 (Laudjo, n=1990) revealed that the number of children aged 0-4 years was one-third less than expected. (38)

Bunia, the capital of Ituri, is located in Irumu. The Bunia Health Zone covers the neighbourhoods in the urban area, as well as four nearby rural villages. For planning purposes, humanitarian organisations continued to use population figures based on the 1984 census to provide a common denominator for activities in the public sector. Over the years, information from mass campaigns such as polio vaccination and registration for the 2006 national elections, have confirmed the validity of these estimates. A Demographic and Health Survey was carried out in 2007.

Figure 1.2 Administrative map of Ituri district

The Expanded Programme on Immunization estimated the 2008 mid-year population of Bunia Health Zone at 209,604 of which 33,413 were living in rural areas. There are several hospitals, as well as a network of health centres, each of which covers a "Health Area" (Aire de Santé). The Hôpital Général de Référence[iv] (HGR) of Bunia was built in 1953 north of the town centre with a bed-capacity of 350. In 2007 only 161 beds were in use. The mission hospital in the suburb of Rwankole (RW) to the southeast had 55 beds, not including a temporary 20 bed section used for the repair of vesico-vaginal fistulas by a specialist surgeon who made short visits to the area two-to three times each year since 2007. The operating theatre was only used between 8 am and 6 pm.

The referral health centre of Bunia Cité provided services at first line referral level, including emergency surgery until the end of 2007. "Revitalization", the strategy for strengthening the health system (30) promoted a rigorous division of services between health centres and hospitals, with a reduction of the number of structures performing major surgical interventions in each Health Zone. As a result, the referral role of Bunia Cité was officially

[iv] The English translation is "General Referral Hospital." The French acronym HGR is locally used and maintained in the text for ease of reference

terminated. The “Centre Médical Evangélique Nyankunde” (CME) had been offering out-patient and hospital services from rented premises in the Bunia town centre since 2003, after the mission hospital in Nyankunde was destroyed in the fighting. In 2008, the CME hospital moved to a new building with 46 beds in Yambi, an area south of the Bunia town centre. Other private health facilities continued to work with international support, while some were set up on a for-profit basis. An additional temporary hospital structure had been opened in 2003 to the north-west of the town by an emergency-oriented international NGO. The facilities were close to the existing HGR and in the vicinity of the UN base at the Bunia airstrip. The organisation provided free health care for emergency consultations and admissions, using a screening procedure for non-referred out-patients to avoid being swamped by minor cases. Semi-permanent buildings were constructed in 2005, with a total of 253 beds including six beds in the isolation ward, mainly used during cholera outbreaks.

Humanitarian organisations provided basic services, including primary healthcare to the rural population, many of whom were displaced. Government health centres and rural hospitals in Ituri received equipment, medical supplies and financial incentives. However, because of security concerns and transport problems, aid was often restricted to the intermittent provision of essential supplies. In 2007, humanitarian assistance to Ituri from the Pooled Fund and the Common Emergency Reserve Fund (CERF) amounted to 14,933,366USD.(39) The Italian NGO COOPI received some of this funding to set up a project on reproductive health in Djugu territory, assisting 17 health structures in 13 Health Zones.[v] As recently as April 2010, USAID/OFDA reported humanitarian funding of 300,000USD to the NGO MEDAIR for a health programme in Ituri district designed to increase access to healthcare, train clinical staff, facilitate a vaccination programme and provide mosquito nets, intending to benefit 63,000 people. (40)

Humanitarian assistance to government health structures in the Bunia Health Zone was phased out by the end of 2007 when the 9th EDF became operational. The emergency hospital continued to offer healthcare free of charge, keeping to strict admission criteria and providing a limited range of services. In other hospitals, and in all health centres, users were charged for health services. The price of healthcare varied between providers and was performance-related. Insurance schemes had been established by international NGOs and some other employers, but only a small proportion of the population was covered by health insurance.

[v] Interview with Diego Moroso, COOPI administrator in Bunia, 26/11/2007

Nine health facilities in Bunia were selected to receive development assistance from the European Commission (9^{th} EDF). This included structural rehabilitation, drugs and medical supplies, as well as salary support for senior health staff and managers. Initial programme implementation was slow.

1.5. STANDARDS AND EVALUATION OF HUMANITARIAN PRACTICE

The humanitarian crisis in the Horn of Africa during the 1980s led to an increased understanding of priorities in humanitarian intervention for reducing mortality in refugee settings. (41) During the early 1990s, it was thought that with timely action, sufficient resources and a systematic approach, humanitarian crises caused by large population displacements could be controlled, if not avoided. The human cost of the Rwandan refugee crisis in 1994 (42) put a damper on the optimism of aid workers and led to calls for scrutiny of the effectiveness of humanitarian assistance.

The failure to prevent the Rwanda genocide and the excessive mortality during the ensuing refugee crisis raised awareness that humanitarian assistance required accountability. In order to be accountable, humanitarian actors needed to be able to refer to measurable standards of good practice.

The SPHERE project, (43) an inter-agency initiative to set minimum standards for service provision, provided a framework for project implementation in a range of sectors including health. The SPHERE standards are grounded in the Humanitarian Charter with the right to life in dignity as the first principle. The standards were developed to guide aid workers assisting populations affected by disaster who are dependent on humanitarian assistance for survival, such as refugees or displaced people living in camps. The first edition of the SPHERE manual did not include reproductive health, an area which had been covered in the Interagency Field Manual on reproductive health in refugee situations. (44) A complementary guide for programme managers was published by the World Health Organization (WHO) in 2000. (45) Both manuals emphasized the need for a Minimum Initial Service Package (MISP), assuming that existing referral structures would be available and able to take care of the additional emergency obstetric needs.

In 1996 the European Commission Humanitarian Office (ECHO) issued its first “Manual for the Evaluation of Humanitarian Aid” which was revised in 1999. (46) The guidelines stipulated that evaluation of humanitarian aid operations should establish whether they had achieved their objectives, and produce recommendations to improve the effectiveness of subsequent operations. An evaluation should be "an independent and objective survey of the relevance, effectiveness, efficiency, impact and viability of humanitarian intervention."(46) Indicators of impact-analysis included the contribution of humanitarian aid to the reduction of human suffering. (46)

In 1999, the Organization for Economic Cooperation and Development (OECD) published its "Guidance for evaluating humanitarian assistance in complex emergencies."(47) The document included the need to assess the humanitarian "space" with regard to human rights, security and protection needs of the affected population. The authors also suggested the use of key indicators, such as the SPHERE minimum technical standards. The proposed criteria for evaluation were efficiency, effectiveness, impact, relevance and connectedness, the latter a modification of sustainability, which was usually included in the evaluation of development programmes. Coverage, coherence and coordination were also to be addressed.

The OECD guidelines were adopted and promoted by the Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP), a sector-wide network [vi] hosted by the Overseas Development Institute (ODI), a London-based, independent think tank on humanitarian and development policy. ALNAP has an online evaluative reports database (ERD). Like the SPHERE project, ALNAP was created in 1997 following the Joint Evaluation of Emergency Assistance to Rwanda.

The "Good Humanitarian Donorship (GHD) Initiative" was set up by donor governments, and its principles endorsed in Stockholm in 2003.[vii] According to the document, good practice revolves around needs-based assistance and refers to the standards of international humanitarian law and the coordinating role of the United Nations and of the Inter-Agency Standing Committee (IASC). Evaluation of international responses, including assessment of donor performance is encouraged (article 22). The GHD, as a joint donor initiative, has links with the Financing Group of the IASC, (48) itself a mechanism for inter-agency coordination of humanitarian assistance involving UN and non-UN humanitarian partners. The Stockholm principles declared that the objectives of humanitarian action are to save lives, alleviate

[vi] ALNAP membership is composed of donor organizations, the Red Cross/Red Crescent Movement, UN agencies, NGOs and NGO networks, research organizations, academics and independent experts.

[vii] Signatories to the principles of good donorship represented Germany, Australia, Belgium, Canada, the European Commission, Denmark, the United States, Finland, France, Ireland, Japan, Luxemburg, Norway, the Netherlands, the United Kingdom, Sweden and Switzerland.

suffering and maintain human dignity. Though financing, management and accountability are at the core of the GHD initiative, the group declared that an assessment of achievements should also evaluate the appropriateness of the intervention in light of the beneficiaries' needs and priorities, and ultimately answer the question whether or not humanitarian action had contributed to its stated objectives. (49)

In France, a project entitled "Groupe URD" (Urgence, Réhabilitation, Développement, i.e. Emergency, Rehabilitation, Development) brought together experienced aid-workers in an initiative aimed at training and evaluation with a focus on quality.[viii] The group opposed the SPHERE benchmarks as too rigid and has developed 12 criteria, including the beneficiary perspective, to assess the quality of humanitarian assistance.

Real-time evaluation (RTE) is a relatively recent development in the evaluation of humanitarian action. An RTE is an evaluation in which the primary objective is to provide feedback in a participatory way in real time (i.e. during the evaluation fieldwork) to those executing and managing the humanitarian response. (50) Without being prescriptive in its methodology, RTE primary data are mainly qualitative and obtained from observation, semi-structured interviews of key informants, and focus groups. Quantitative data on mortality and nutritional status are usually taken from secondary sources. In any case, triangulation of methods is recommended. Aiming to provide operational feedback, RTE values the beneficiary viewpoint as a guiding force for decision making.

Evaluation tools and limitations

One of the key lessons of the Joint Evaluation of Emergency Assistance to Rwanda in 1994 was that "humanitarian action cannot serve as a substitute for political, diplomatic, and where necessary, military action."(51) An evaluation of humanitarian assistance should therefore provide an estimate of its impact on survival.

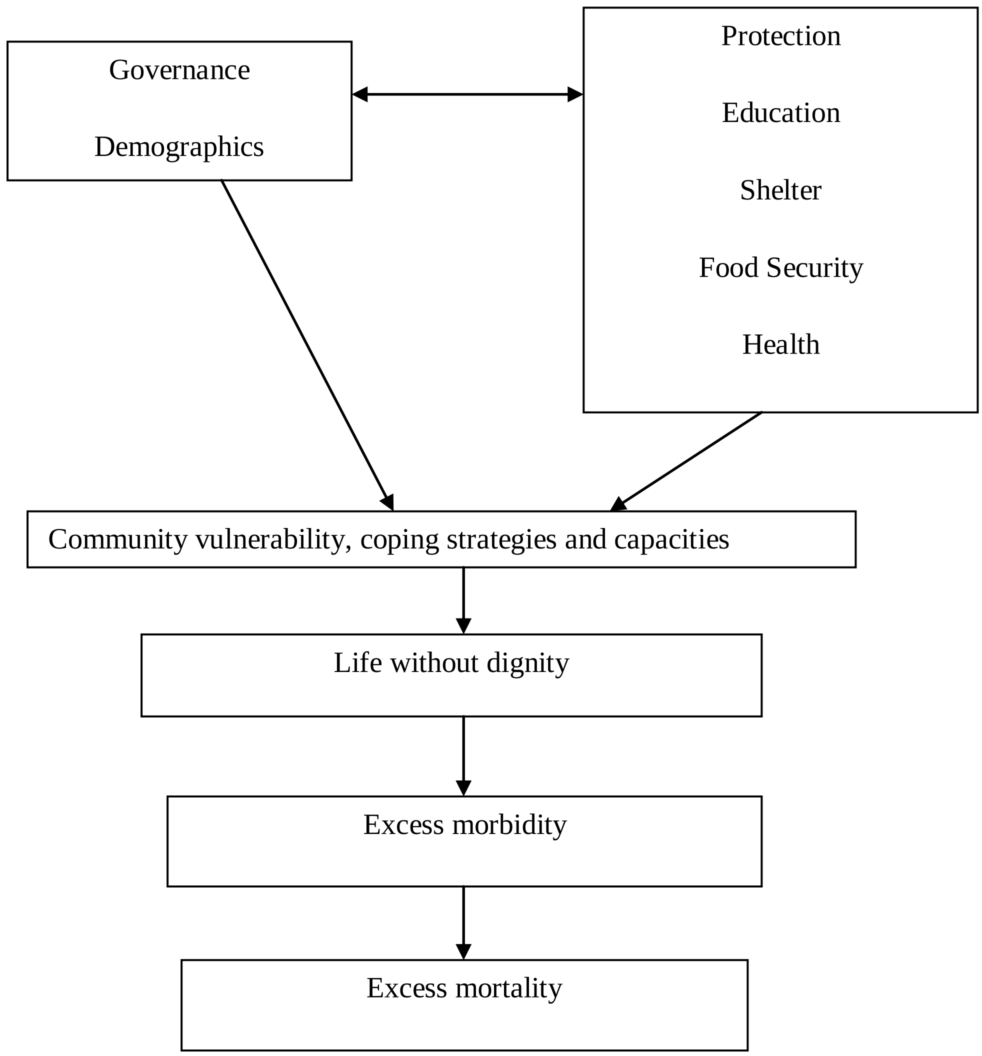
There is operational agreement on the minimum standards for emergency response in the immediate aftermath of a disaster. Standards exist for minimum daily requirements of water and food. The SPHERE manual includes minimum standards for shelter and medical care. (43) The health chapter comprises examples of check lists and surveillance forms.

[viii] www.urd.org (official website of Groupe URD)

Decisions about the type, scope and methods of service provision over a longer period of time (the post-emergency and transition phase) require periodic needs assessment. (52) Various methods and inter-agency tools have been developed, such as the Standardized Monitoring and Assessment of Relief and Transitions (SMART) and the Health and Nutrition Tracking System (HNTS), and new techniques, such as the Health Resources Availability Mapping System (HeRAMS) are being tested. (53)

Improvements in survival may be attributable to concomitant changes in sectors other than health, such as security and nutrition. Civil protection may influence healthcare seeking behaviour, while the interaction between nutritional status, health and survival is well documented.

Fig 1.3: Needs Assessment Framework (NAF) (Source: Strengthening the Analysis and presentation of humanitarian needs in the CAP, IASC CAP Sub-working group July 2007)



The multiple linkages between sectors, the fact that beneficiary populations usually require assistance in more than one area, and the interest of donors in operational results at the population level have led to joint initiatives aiming to assess the global impact of the international response to particular crises. The Tsunami Evaluation Coalition (TEC) was set up in February 2005 to evaluate the emergency response to the 2004 tsunami in Asia. Following the 2009 Haiti earthquake, the Development Assistance Committee (DAC) of the OECD, ALNAP and the United Nations Evaluation Group (UNEG) convened a meeting in London (18-19 May 2010) intending to foster a more strategic, user-focused and system-wide approach to evaluation in Haiti. Lesson learning and accountability being the organisational objectives of evaluations, (54) it is thought that the importance of the overall context in determining the effect of interventions requires a broad evaluative scope, beyond the immediate narrow parameters of single projects. (55)

Measurement of impact, defined as "the changes in people's lives attributable to an intervention" is dependent on methods acknowledging the context as well as the problems addressed. Methodological challenges include the choice of indicators, attribution of effects, baselines, monitoring, time and timing. For practical reasons and to facilitate attribution of causality, impact measurement tends to focus on the project level. (56) Comprehensive evaluations combine an assessment of achievements against technical standards within sectors with an overall situation assessment. Indicators of overall impact require value judgements regarding general objectives which are often unclear. Establishing links between the changes in a complex humanitarian environment, with multiple actors, and assistance is equally challenging. (57, 58)

The impact of interventions not only relates to the specific context and goals, but also to the amount and type of emergency assistance available. Factors determining the level of assistance include media coverage, donor interests (including geo-political considerations) and the level of engagement of operational agencies and organisations. (59) Impact assessment of humanitarian assistance at the population level is therefore at risk of being confined within the limits of aid providers' aspirations and shaped by momentous and fragmented expert perceptions. As an example, an evaluation of the DRC health system in 2004 concluded that the impact of humanitarian assistance was that public PHC services were available, since health centres would not have been functioning without external aid. (60) Another evaluation of ECHO projects (54 health zones) during the same period described the health, nutrition and food security in the DR Congo as "an example of a chronic post-conflict situation," in the title of the article. (61) The health system was said to be disintegrating and running on a full cost-recovery basis. The reasons given for high maternal mortality were high fertility and a low percentage of professionally attended deliveries. Project effectiveness was measured as user rate of health facilities with and without donor support. User rates varied between less than 0.05 and 1.5 consultations/person/year. While humanitarian assistance had a demonstrable positive effect on the user rate of services, the impact of primary healthcare on people's lives was not measured.

Beneficiary perspectives, when considered, are equally subject to the constraints of local circumstances and available resources. In many cases, the definition of beneficiaries itself is artificial, especially when refugees or internally displaced people (IDPs) are hard to distinguish from the host population among which they are living. (62)

Cost-effectiveness analysis as a tool for evaluating humanitarian action

While evidence of the overall impact of humanitarian action may be difficult to substantiate, evaluating changes on a narrower scale can provide insight into the effectiveness of a specific action at "changing people's lives" and facilitate decisions about future action.

Although economic evaluation has been used as a tool for decision making in various different contexts, cost-effectiveness analysis (CEA) of humanitarian assistance poses particular challenges. Emergencies and crisis situations are by nature unpredictable. Comparing the effectiveness of interventions may be difficult when multiple actions coincide in a fast-changing environment. Reliable baseline or comparative data are often unavailable. Nonetheless, efficiency and cost-effectiveness of humanitarian assistance are often included among criteria for evaluation. Arguments opposing economic thinking as conflicting with human rights have been defused by Amartya Sen and other proponents. (63)

In health economics, CEA is "a method used to evaluate the outcomes and costs of interventions designed to improve health". The purpose of CEA is "to compare the relative value of different interventions in creating better health and a longer life. CEA evaluation results are usually summarized in a CE ratio, where the denominator reflects the gain in health from a candidate intervention and the numerator reflects the cost of obtaining that health gained."(64)

CEA has been used in the health sector for several decades. Since CEA uses the concept of opportunity cost (the benefit that could be obtained by the next best use of resources, “efficiency” is reached when opportunity costs are minimized and benefits are maximized. It then follows that, to achieve efficiency, information is needed about resource use (costs) and benefits (health gains) that would result from alternative approaches. (65) For CEA to be useful in emergencies and crisis situations, the results of an analysis should be non-context specific, unless the CEA is carried out during a long-term crisis and findings can be used to inform aid workers on the cost-effectiveness of ongoing activities, providing a rational basis for operational changes. (66)

Evaluation of healthcare services

Monitoring and evaluation of healthcare services, including information on morbidity and mortality, together with data on service performance, can help to answer some of the broader questions regarding the need for and the effectiveness of humanitarian assistance in and beyond the health sector. While health services alone are not sufficient to ensure survival with dignity, it may be useful to explore epidemiological data in order to obtain a picture of the human rights status of a crisis-affected population. (67)

Quantitative monitoring with a narrow focus on output and outcome measurement at the project level (68) is based on assumed links between project activities and results. If the underlying assumptions are flawed, population impact can no longer be deduced without evidence. Measuring the relationship between a life-saving procedure such as caesarean section (CS) and survival of the target population at a certain level of service provision can help to resolve questions about the impact of humanitarian assistance.

1.6. EVALUATION OF EMERGENCY OBSTETRIC CARE

Improvements in maternal and neonatal health are part of the Millennium Development Goals (MDG), especially goals 4 and 5. MDG 5 aims to improve maternal health, targeting a reduction in maternal mortality by three quarters between 1990 and 2015, with universal access to reproductive health services. Progress is measured by the proportion of deliveries attended by skilled health workers, as well as by the reduction in maternal mortality. MDG 4 aims at reducing child mortality, with the specific intention of reducing under-five mortality by two thirds between 1990 and 2015. Achievement of these targets is thought to represent a major challenge, especially in countries with high and very high child and maternal mortality rates.

UNICEF statistics (69) for 2008 estimated under-five mortality in the DRC of 199/1000, among the highest in the world (fifth after Afghanistan, Angola, Chad and Somalia). The same source quoted infant mortality of 126/1000 (2008 estimate) and neonatal mortality of 47/1000 (2004 estimate). The reported maternal mortality ratio (MMR) for the period 2003-2008 was 550 per 100,000 live births. UNICEF estimated an adjusted MMR for 2005 of 1,100 per 100,000 live births with a woman's lifetime risk of maternal death of one in 13 (see Annex 2 for information on measuring maternal mortality).

Emergency obstetric care services (EMOCS) have long been recognised as an essential component of the basic package of health care services to be provided in crisis environments. (70) In refugee settings, availability of one functional hospital with operating theatre is recommended for a population of 150,000 to 200,000, with an established referral system to ensure adequate access. UN guidelines specify that there should be at least four facilities providing basic EMOCS and one health structure offering access to comprehensive EMOCS for a population of 500,000. (71)

A global review published in 1991 pointed out seven *direct* causes responsible for the majority of maternal deaths: haemorrhage (25%), obstructed labour (8%), post-partum sepsis (15%), abortion complications (13%), pre-eclampsia and eclampsia (12%), ectopic pregnancy and ruptured uterus. The global review provided no estimates of mortality due to the last two causes mentioned. Pre-existing conditions exacerbated by pregnancy or its management, collectively known as *indirect* causes, accounted for about 20% of maternal deaths. (72) A more recent systematic review also looked at regional differences. Including 4509 deaths in Africa, this analysis found haemorrhage (33.9%), hypertensive disorder (9.1%) and sepsis/infection (9.7%) to be the main causes of maternal mortality in the African region. Other causes listed were obstructed labour (4.1%), abortion (3.9%), anaemia (3.7%), embolism (2%), and ectopic pregnancy (0.5%). The importance of HIV/AIDS (6.2%) was said to be a possible underestimate, since a large proportion of pregnant women in Africa are unaware of their HIV status. (73)

A team of health economists at the World Health Organization established a list of 21 interventions for primary and referral level health care, ranking them according to cost-effectiveness. Implementing these interventions at 95% coverage would halve maternal and neonatal deaths. (74) The most cost-effective was the newborn care package, followed by antenatal care (tetanus toxoid, screening for pre-eclampsia, screening and treatment of asymptomatic bacteriuria and syphilis), skilled attendance at birth, offering first level maternal and neonatal care around childbirth and emergency obstetric and neonatal care around and after birth. The prevention and treatment of malaria, and supplementation with macro-and micro-nutrients, including iron and folate, were not investigated in this study, as their effectiveness has been established in the past.

Investments in maternal health services are likely to achieve wider health benefits and to improve health service delivery in general. (75) From 1998 onwards, the International Rescue Committee carried out several mortality surveys in the DRC, confirming persistent elevated mortality rates in the country with a Crude Mortality Rate (CMR) of 2.2/1000/month, 40% higher than in surrounding countries. Noting that the situation in the east of the country had improved since 2004, the 2007 report quoted a CMR of 2.6/1000/month in the eastern provinces, 85% higher than the average for sub-Saharan Africa. The authors attributed the improvement over time to “robust peacekeeping” with a reduction in the number of violent deaths recorded. (76)

This study focussed on emergency obstetric care (EMOC), an essential component of primary healthcare (PHC). The signal functions of EMOC are listed in table 3.2.1. Comprehensive EMOC includes obstetric surgery and blood transfusion, as well as the other, basic EMOC functions. The relationship between CS as a process indicator and maternal and neonatal survival as a measure of effectiveness allows an estimate of impact which is at once intervention-specific and relevant to the stated goal of humanitarian action.

Recommendations for a basic package of services to improve maternal health, when implemented through the health system, need to take the system’s properties into account, including its limitations. Findings from evaluating maternal health services could help to estimate the overall effectiveness of healthcare provision, especially with regard to access and affordability.

The study intended to analyse the cost-effectiveness of EMOC as part of humanitarian assistance in a crisis environment. The objectives were to determine the effectiveness and cost of EMOC in the study environment, to identify unmet needs, and to define priorities for investment. (65) (66)

After this outline of the study context, the next Chapter explains in detail the rationale for the study, along with a description of the procedures used to carry out the field work.

CHAPTER 2

METHODOLOGY

2.1. RESEARCH SETTING

The study was conducted in Bunia, Ituri, in the Oriental Province of the DR Congo. Easy access by air from Uganda (Entebbe international airport) and an acceptable level of security (presence of a large UN peacekeeping force) made it possible to conduct field research in this otherwise politically unstable region. The mainly urban environment with high population density facilitated data collection. At the time of the study, the healthcare system was in transition from humanitarian action to development assistance.

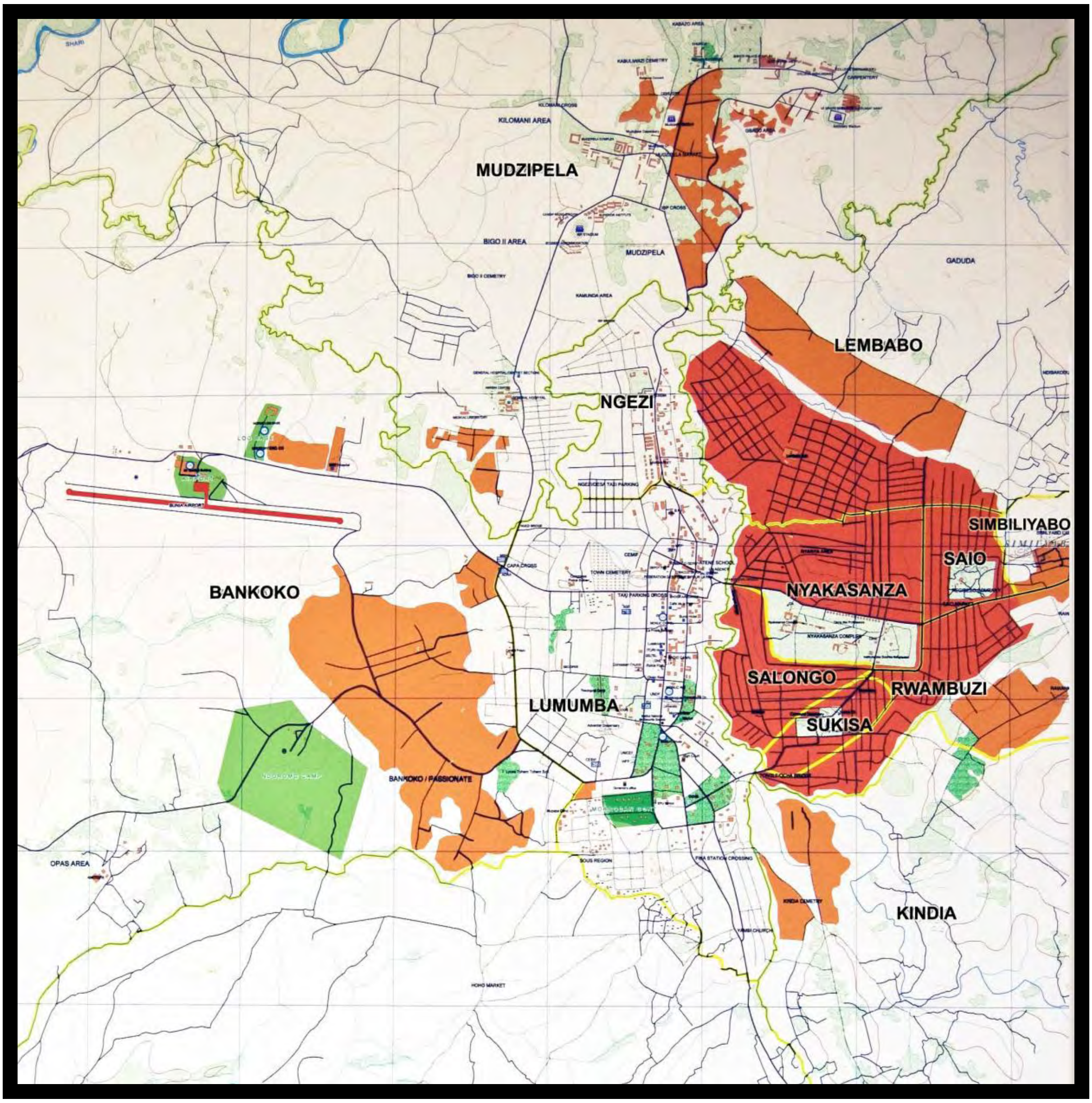
Preliminary information indicated that only two health structures in the Bunia Health Zone performed caesarean sections (CSs): the public hospital, Hôpital Général de Référence (HGR) and an emergency hospital, Bon Marché (BM) set up by an international humanitarian organisation in 2003. During the pilot study in May 2007, local informants listed at least seven places performing CSs on a regular basis, including private structures. Inclusion and exclusion criteria for health facilities are summarised in table 2.1.

Table 2.1 Criteria for inclusion or exclusion of health structures from sampling frame

Inclusion criteria **(to be simultaneously fulfilled)**	**Exclusion criteria**
Facility within Bunia Health Zone	Private for profit
More than one CS monthly	

Because the study aimed to evaluate the contribution of humanitarian assistance to EMOC, private-for-profit structures were excluded from the sampling frame. After assessment of the EMOC workload, it was decided to retain five health structures for recruiting cases to be interviewed. Bunia Cité, a referral health centre, was initially included. In January 2008, when health centres officially ceased to perform major surgery, this structure was removed from the sampling frame. Of the four remaining hospitals, only three performed EMOC round the clock: BM, HGR and the Centre Médical Evangélique (CME). Although Rwankole (RW) only provided daytime surgery, the number of CSs was similar to CME.

Fig 2.1: Bunia Town (source: GIS Unit, MONUC)



Administratively, the town area of Bunia (Fig 2.1) is divided in 12 neighbourhoods, each of which has a government health centre. HGR is in the northern part of the town, called Mudzi Pela. To the west, nearer to the airport, is BM, which was entirely managed by an international humanitarian organisation. The area is called Bankoko. The central part of the town has two neighbourhoods: Ngezi , the main market area, and Lumumba , where the wealthier part of the population tends to live. The MONUC headquarters are situated here. The eastern part of the town is the most densely populated. From north to south, the neighbourhoods are: Lembabo, Simbiliyabo, Nyakasanza, Saio, Salongo, Rwambuzi and

Sukisa. The most remote area to the south-east is Kindia. RW hospital is situated to the far end of the eastern part (in Rwambuzi), and the new building of the CME hospital is to the south of the town centre towards Kindia (the area is called "Yambi"). At least 17 health structures were equipped to perform deliveries in the town area.

The rural part of the Bunia health Zone contains four health centres: Nzere, Mwito, Centrale and Betokomba (no map available). The health centre in Betokomba had only recently been opened and did not have a maternity service. The nearest hospital outside the town area was in Rwampara, 10 km to the west of Bunia. The medical doctor assigned to the hospital was living in Bunia and services were restricted to daytime hours.

Ethical approval

The study proposal was approved by the Research Ethics Committee of LSTM in June 2006. Approval for the field study was granted for a period of three years. Before setting up the pilot study, the lead researcher contacted Professor Ahuka (University of Kisangani), Director of the Higher Institute of Medical Techniques (ISTM) in Bunia, who agreed to be a local partner in the study and to facilitate access to the local offices of the Ministry of Health.

Approval from the MSF Ethics Board in Geneva was obtained before the start of data collection at BM. A copy of the study proposal was handed to all other healthcare providers in Bunia.

2.2. RESEARCH QUESTION

Field research was composed of five elements:

A. A case-control study of CSs and non-surgical deliveries by interview
B. A review of reported maternal deaths in health structures and community
C. Collection of service information on obstetric care from health centres and hospitals
D. Collection of information on cost to service providers and proportional cost allocation
E. Focus group discussions

The aim was to determine the effectiveness of CSs (A&B), the user cost (A&E) and provider cost (C&D) of the procedure, and the social cost of maternal death (E).

The effectiveness of EMOC in the study environment was measured by estimating the reduction in maternal and perinatal deaths attributable to an increase in access to EMOC, which was a component of the emergency healthcare provided as part of humanitarian assistance. Evaluating the effectiveness of all types of emergency obstetric care would have required comparison groups for each EMOC intervention. This would have made the study very expensive. Therefore, it was decided to use CS as the most common and easily identifiable procedure. CS has been promoted for more than a decade by UN agencies as an important indicator for monitoring obstetric care. (77) The study aimed to find out to what extent changes in process indicators of EMOCS reflected changes in maternal and perinatal mortality in the research environment. To do this, the study focussed on identifying the factors influencing delivery by CS in Bunia. Acknowledging the fact that hospital records are difficult to verify retrospectively, information was also collected directly from women who had recently delivered a child.

Epidemiological research was designed as a case-control study. Cases were a random sample of women who delivered by CS in Bunia (excluding private-for-profit health structures). Controls were selected among women who had a vaginal delivery, within a period of two weeks before or after the delivery date of the corresponding case, and matched by place of residence.

Table 2.2 Criteria for selection of cases and controls

CASE	**CONTROL**
1. CS delivery in one of selected health structures	1. Vaginal delivery
2. Delivery during active period of randomisation *	2. Delivered maximum two weeks before or after matching case
	3. Matched by residency to selected case

*Explained below in “selection of cases and controls”

2.2.1. CALCULATION OF SAMPLE SIZE

The study was powered to detect risk factors that doubled (or more) the odds of a woman delivering by CS (i.e. the odds of being a case). To achieve 90% power for risk factors with prevalences in the control (non-CS delivery) group of 20% or greater required a sample of 120 cases and 120 controls. To allow for drop-outs and losses to follow-up, 150 cases and 150 controls were sought.

With a crude annual birth rate of 48/1000 and a population size of 100,000, the expected number of live births per month in the study area would be 400. The initial project design assumed a population of 100,000 and a 3% CS rate, which equated to an expected 12 CS deliveries per month. However, information collected in Bunia during the pilot study indicated that both the total population and the CS rate were considerably higher than previously assumed. According to local health authorities, the 2006 population estimate for the Bunia health zone, used by the polio eradication programme, was 198,086. (78) The CS rate was estimated to be around 5% (information received from WHO focal point for Emergency and Humanitarian Action in Bunia, Dr Eustace Kyroussis).[ix] The expected number of CS deliveries was thus actually likely to be close to 40 per month. Taking the mid-point of these two estimates (26 CSs per month), a period of six months was allocated to recruit the required 150 cases and 150 matched controls.

2.2.2. DATA COLLECTION INSTRUMENT

A structured questionnaire was developed for use with the EPI-info statistical software package. Questions were grouped under six headings: general information, this pregnancy, previous pregnancies, delivery, post-delivery and economic information. The format of most questions was closed, offering a limited range of possible responses or requiring a numerical answer. The total length of the questionnaire aimed for an interview duration of 30 to 45 minutes. Interviews conducted during the pilot phase confirmed this to be a reasonable assumption.

The lead researcher, who is fluent in English and French, was responsible for the English original of the questionnaire and for its translation into French. The French version was

[ix] The 2007 Demographic and Health Survey (EDS-DHS DRC) reported an average caesarean section rate of 4% nationwide, and a 2.7 % CS rate for the Oriental Province. (Reference 87)

translated to Swahili by volunteer local collaborators attached to the Institut Supérieur Technique Médical (ISTM). Pilot testing of the Swahili version took place in Bunia during the second half of May 2007.

Selection and training of research team

The choice of the research team was guided by ethical considerations. Preference was given to female interviewers with a nursing and/or midwifery background. Academic staff from the ISTM made a first selection among female candidates to be trained. Four selected nurses received three days of training before the start of the pilot phase. A fifth person (team leader) was charged with the overall field management of project activities. Pilot interviews of ten cases and five controls were conducted over the next week. The questions were reviewed and modified daily according to the feedback received until there were no more problems. The final version of the Swahili questionnaire was subsequently handed to a staff member of the Institut Supérieur Pan-Africain de Santé Communautaire (ISPASC) for back-translation into French and English and found to be accurate. The final, amended questionnaire was written in a slightly modified colloquial version of Swahili, as it is used in Bunia. Interviews were conducted from December 2007 until June 2008.

Selection of cases and controls

A list of cases was compiled twice weekly. Every Monday and Thursday, the team leader went to the participating hospitals to collect the names of all the women who had delivered by CS since the previous visit, and entered the names into a computerised randomisation programme. Cases were allocated to each of the interviewers by randomly selecting names from the "active" list. Only the latest (active) list of names was used to select new cases to be interviewed.

To identify a matching control, an interviewer went to the cases' place of residency. Information about deliveries in the area was obtained from staff at local health structures, from observation of the surroundings (e.g. baby clothes on washing line), and from members of the community. In each neighbourhood there was a government registered health centre. There were no formal networks of community workers or village health committees in Bunia. If there was no delivery in the area within the specified time period of two weeks before or after the delivery date of the case, the interviewers moved to the nearest adjacent neighbourhood to find a control.

As the study progressed, the team observed that the vast majority of CSs took place at the BM hospital. As a result, most case interviews were initially conducted in this structure. Because of the large number of surgical deliveries at BM, randomisation of cases at this hospital was necessary. At the time of the lead researcher's first follow-up visit in January 2008, it was decided to limit randomisation to the CSs taking place in the predominant structure, and to exclude from randomisation all the women who had a CS in any of the three other hospitals. From then on, randomisation was used to select cases among women who had a CS at BM, while those who had a CS in any of the other selected structures were all recruited to be interviewed. The ethics committee of the Liverpool School of Tropical Medicine (LSTM) was informed in writing about this change in methodology. CS deliveries in private practices were counted, but patients were not considered for inclusion in the study. It was assumed that people using private healthcare were able to afford the cost and did not need humanitarian assistance.

The study was conducted from December 2007 until June 2008. This period was long enough to recruit the number of participants required. It also ensured that seasonal variations potentially affecting the number of deliveries, access to, and use of health facilities were taken into account. The Bunia area has two rainy seasons, one of which was covered by the study period. North of the Equator the rainy season is during the period November to April; to the south, it is from June to September. (79) In Bunia, it rains most of the year, although December-January is considered to be relatively dry. (80) Malaria is endemic.

2.2.3. FOCUS GROUPS

The social cost of maternal death was investigated in focus group discussions. The purpose was to estimate the social cost of maternal death and subsequent re-marriage, as opposed to the user cost of EMOC. Making a comparison between these costs could help to raise awareness about the consequences of delaying life-saving interventions during childbirth. The organisers of the groups explained to participants that the final objective was to make a rational estimate of the amount of money that people would be prepared to pay as a voluntary contribution into a health insurance scheme offering free access to emergency obstetric care when needed.

It would have been impractical and costly to attempt an exhaustive study of the entire range of ethnic, socio-economic and cultural determinants potentially influencing the behaviour of populations living in Bunia. Religious affiliation in Congo is an important aspect of daily life, and may have influenced custom over time. Around 50% of the population belongs to the Catholic Church, 20% are Protestant and 10% are Kimbanguist (an independent African church rooted in Christianity and founded by Simon Kibangu in 1921 in colonial Belgian Congo). The proportion of Muslims in the DR Congo is estimated at 10%. A few Congolese people are Jewish, while the remainder belong to a wide range of less known evangelical religious groups, or are animist.(81) The responses of the focus groups did not capture the specific customs, if any, of religious minorities.

The composition of the groups was intended to reflect the widest possible range of opinions in the local community. The lead researcher, accompanied by one of the interviewers approached religious leaders and heads of higher education institutions to ask for assistance in calling upon volunteers. Using their influence in the local community, these prominent individuals assisted the team with bringing together eight groups of adult volunteers. With many people practising their faith, an appeal for volunteers in places of worship was a convenient method to reach a large number of people. To ensure the voice of the young and of low-income groups, unemployed men and women, and students at the ISPASC[x] and at the Université Shalom de Bunia,[xi] were recruited on a voluntary basis. An already existing group of widows, known to hold regular meetings at a specific location, was contacted directly, and agreed to be the ninth focus group. In this way it became possible to probe the opinion of large segments of the adult population. The combined findings provided a wide spectrum of customs and beliefs, suggesting that most of the variations in thought and behaviour in connection with marriage, maternal death and re-marriage were covered by the participants.

Each of the nine focus groups brought together 12 to 20 volunteers to discuss ten open questions for two hours. One of the trained interviewers acted as a moderator and took notes. The discussions took place in Swahili; the notes were in French. Afterwards, the lead researcher made a summarized transcription in English of the moderator's notes.

2.2.4. SERVICE INFORMATION

Information relevant to pregnancy and obstetric care was collected from 20 health structures, covering the urban and rural neighbourhoods of Bunia Health Zone. The functionality of

[x] Institut Supérieur Panafricain de Santé Communautaire, Pan-African Higher Institute of Community Health, based in Bunia ISPASC offers a 3-year graduate course in community medicine.

[xi] Shalom University of Bunia, (French acronym USB) a higher institute of theological studies

emergency obstetric care services was assessed monthly, using a check list of signal functions to monitor the availability of skilled staff, essential equipment, medicine and supplies. Maternity-related activities were compiled monthly from the service registers in each structure. Another check list was used to assess the capacity of primary healthcare structures to provide ante- and postnatal care and to measure their obstetric workload, including referrals. The primary healthcare structures were visited every two months.

Maternal and perinatal deaths

During their visits to the community, the interviewers asked if any maternal or perinatal deaths had occurred in the area and made a short report of each event. Where possible, a team member visited the family of the deceased to try and establish the circumstances of death by way of an unstructured interview. The team considered the use of a post-mortem questionnaire to investigate recent deaths culturally inappropriate and training in verbal autopsy methods was omitted. Reporting of maternal deaths covered a period of seven months from December 2007 to the end of June 2008, when the lead researcher made her final visit to Bunia. Maternal and perinatal deaths in health structures were also recorded in the activity reports.

2.2.5. PROVIDER COST

The provider cost of CS was calculated for the four hospitals in the Bunia Health Zone from which cases were recruited: BM, CME, HGR and RW. Because Bunia Cité, a referral health centre, ceased to perform EMOC at an early stage of the study, it was not included in the costing analyses.

The choice of methods reflected feasibility and the importance of precision within time and financial constraints. (82) The preferred method was bottom-up micro-costing. Because the study aimed to demonstrate the feasibility of cost-effectiveness analysis in a crisis environment, some estimates were based on gross costs (e.g. the staff salaries in HGR), or were obtained using a top-down approach (e.g. medicine).

Capital costs were itemized under the headings: buildings, vehicles, communications, furniture, equipment and linen. Recurrent costs were listed as: medicine and medical supplies, salaries, maintenance and land rent. Stationery, water, electricity and fuel were part of maintenance. To estimate the annual cost of performing CSs, a proportion of each listed cost was allocated to EMOC. For laundry use, the figure was doubled, to account for surgical procedures as well as bed linen.

Research team members made repeat visits to the participating referral structures to collect information from hospital administrators, logistics staff and managers. The number of deliveries was recorded from the maternity registers. The total numbers of CSs and major surgical interventions were taken monthly from theatre records. Figures for in-patient admissions were estimated by comparing data from various sources, including monthly internal reports and previous annual reports. It was assumed that the workload in each structure during the second half of 2008 would be similar to that recorded during the study period.

At CME, ultrasound was performed on all pregnant women attending antenatal care (ANC). The proportion of ultrasound cost for CSs was taken as the proportion of CSs among the maternity cases. At BM, an emergency hospital, there was no ANC consultation. CSs accounted for 5% of the inpatient beds occupancy (about 15 beds out of 300 available), but constituted 67% of major surgical cases, including complications of abortion. Most cases at BM did not necessitate ultrasound examination to establish the need for CS at the time of admission. Assuming some women receiving EMOC had been admitted to BM with pregnancy complications, the proportional CS-related use of ultrasound equipment was estimated at 10% of its total use.

BM had been constructed in 2005 to replace a field hospital mainly housed in tents since 2003. The surface of each ward was 178 m^2 and contained 28 beds, leaving some additional “overflow space” for occasions when all beds were occupied. The ward space for one maternity bed, including corridors and a reception area was estimated to be 6 m^2. The recommended bed space in Britain for acute patient wards was 104 square feet (=9.66 m^2) in 1935. (83) A recent study found cubicle floor space ranging between 6.84m^2 and 9.29 m^2. (84) Since only basic sanitary facilities were available, no additional cost was added for toilets (pit latrines) and bathrooms (water taps). The cost of water was included under maintenance.

For the other hospitals, ward dimensions were either not known or difficult to apply. The spacious buildings of HGR were in disrepair and under-used, while the new CME hospital was still under construction. At RW, the building designated to be used as a maternity ward had been occupied by international peacekeeping forces for several years. The newly built

BM hospital was used as a reference for the dimensions in the cost calculations of all four hospitals. Information on building cost was obtained from local construction companies. The replacement cost per square metre was set at 250 USD for a space with walls, a roof and a cement floor. For spaces with a tiled floor, the cost was set at 300 USD per square metre.

Amortization factors used for capital expenditure were those proposed in the WHO manual "Cost Analysis in Primary Health Care: A Training Manual for Programme Managers." (85) The amortization period for buildings was 20 years. To keep costs comparable, this period was applied to all building cost calculations, although BM was built to be used as a hospital for a limited period of time, and HGR had been constructed more than 50 years ago. Amortization time for vehicles was seven years and for communications equipment two years. For electricity generators, a period of five years was used, the same as for cooling equipment. Medical equipment was given a period of five years, and furniture a period of seven years. All other items were valued with an amortization period of two years.

Vehicles and communications equipment were imported. The replacement cost included freight and import taxes. The price of locally manufactured wooden furniture was obtained from MEDAIR, an international NGO involved in the rehabilitation of hospitals and health centres. Bed sheets and linen for the operating theatre were locally made from imported fabric. Imported blankets and stationery were available on the local market. The items procured locally were valued in USD, the preferred currency for transactions among traders in Bunia. Only BM provided separate costs for sheets and blankets. For the other hospitals, the cost estimated by CME for "bed covers" was used.

Since medicine, medical supplies and equipment were imported, international prices applied. The cost of equipment was taken from recent orders by international NGOs working in the area. Donated items were valued at replacement cost. To calculate the proportion of each cost attributable to CS, the workload of EMOC as a proportion of inpatients, maternity cases and major theatre procedures was assessed for each structure. Except for ultrasound scanning, the out-patient department was not included as a cost factor.

The cost of medicine and recurrent medical supplies was calculated from the 2006 UNFPA price list for reproductive health kit 11b of the Interagency Reproductive Health kits. (86) The supplies in the kit were intended to cover the needs of 105 patients, including 75 CSs. Because other emergency procedures, such as hysterectomy, were likely to require more inputs, the proportion of cost for CS-related inputs was estimated to be 60%. The cost of a full kit was 2905 USD. The approximate cost of renewable supplies for one CS, including 25% overheads and transport, was estimated to be 28.5 USD. The interagency RH kit does not include supplies for blood transfusion. The price charged for a transfusion at CME was 10 USD. Since CME had a cost-recovery policy, this amount was taken as a reasonable cost estimate. The proportion of women receiving a blood transfusion related to CS was derived from the proportion of cases in the study reporting transfusion, and from the laboratory records in the four hospitals. BM hospital had its own blood bank for transfusion, while other hospitals relied on relatives to donate blood in case of emergency. The blood bank in the central laboratory, adjacent to the HGR had been rehabilitated by the World Health Organization.

Except at BM, where in-patients received three meals daily, relatives were expected to provide food for patients. The cost of catering for patients was therefore only calculated for BM. A proportion of the capital cost of the kitchen building was added. The cost of feeding each CS patient three meals daily for five days was based on the amount provided and the cost of the staple food for each meal on the local market: maize flour for breakfast gruel, beans and rice for lunch and dinner. The cost of food items was verified by the manager of the UN restaurant in Bunia. The cost of vegetables as an accompaniment was considered negligible. The cost of fuel was included in the total maintenance cost of the hospital.

All salary figures were gross estimates. The costs of international travel and local living expenses such as housing for expatriate workers were not included. It was thought that such costs should be allocated to the organization, rather than to the health structure providing the service. The calculated cost of providing emergency obstetric care does not reflect the actual cost to international humanitarian organisations of setting up and running health services with personnel on short contracts and recruited overseas.

Salary scales were only available for BM and CME. Scales were based on professional grade and years of service. Individual monthly payments varied according to the time spent on duty, with supplementary amounts for night duty and emergency call-outs for maternity and theatre staff. Since the number of service years varied, average salaries in the cost analysis were based on an estimate of the number of years of experience. For maternity staff, the proportion of the salary allocated to EMOCS was the same as the proportion of maternity building space.

For administrative staff, the proportion of admissions was used. The proportion was doubled for hygienists (cleaners) and general medical doctors, to reflect the additional time spent in the operating theatre.

As no individual salaries were available for HGR, an arbitrary proportion had to be allocated. The total amount of salaries paid was taken from the 2007 annual report and the same figure applied to 2008. Salaries at HGR were similar to those paid at CME. A higher proportion of maternity admissions received EMOC at CME, but fewer CSs took place in total, and CSs at CME constituted a lower proportion of major surgical interventions than at HGR. Attributing an overall proportion of 11% of salaries at HGR to EMOC resulted in a figure very similar to the estimated amount at CME.

The administrator at RW explained that staff members were paid in accordance with the monthly hospital income from patient charges. Average monthly salaries were based on the estimated monthly receipts of the hospital, using the quota applied to re-distribute this income among different grades of personnel.

2.2.6. USER COST

Direct user costs were taken from the interview questionnaire of cases and controls. Respondents were asked to estimate how much they would be paying for hospitalization, including anticipated costs. Information on indirect costs was limited. Interviewees were asked about the cost of transport to and from the hospital. An additional question on disposable income provided a level of comparison for healthcare related expenditure. All user costs were expressed in local currency. The official local exchange rate of the Congolese Franc (Franc Congolais, FC) against the US dollar at the start of the study was 500 FC for one USD. This value was used for conversion of results into dollars, allowing comparison between costs. By the end of the study, the exchange value of the FC had decreased by 10 percent.

Other indirect costs, such as the compensation of a caregiver (“*garde-malade”*), were taken from the focus group responses. Information related to the social cost of maternal death was used as an approximation of intangible cost. The focus groups also explored assumptions of potential EMOC users and their families regarding the direct cost of CS, and their willingness to pay considering the possibility of a loan.

Population data and reference values for morbidity and mortality

Demographic information was obtained from the Directorate of Public Health and from the local office of the World Health Organization. Population estimates used the figures from the National Institute for Statistics, with the 1984 census as a baseline. The results from the National Demographic and Health Survey, conducted in 2007, were published in August 2008. (87) The DHS presented results of the direct sisterhood survey on maternal mortality by age group for the country. Neonatal and infant mortality figures were available by province.

Bunia was a sentinel site for the 2006 annual survey by the National Action Programme against AIDS (Programme National Multi-sectoriel de Lutte contre le SIDA, PNMLS). The estimated prevalence of HIV and syphilis among pregnant women was taken from a local report based on data from selected health structures in Bunia. (88)

2.3. ANALYSIS

2.3.1. STATISTICAL METHODS

The results obtained from the items in the survey questionnaire are summarised for the cases and controls separately. Categorical items are shown as frequency counts and percentages, continuous items are shown as means and standard deviations if the item was considered to follow a statistically Normal (Gaussian) distribution, or as medians and appropriate percentile values if the item was non-Normally distributed. Differences between the cases and controls were estimated using odds ratios (with their 95% confidence intervals and p-values computed using the Fisher exact test) for categorical items; Student unpaired t-tests or Mann-Whitney U-tests were used as appropriate for the comparisons when the items were continuous.

To determine which of the questionnaire items were most predictive of the risk of a woman delivering by CS, unconditional multiple binary logistic regression analyses were performed, using case/control as the outcome variable. Matching of cases and controls was by location of the residence of the mother; this was not considered to be a sufficiently rigorous level of matching to justify the use of conditional logistic regression methods.

2.3.2. EFFECTIVENESS OF EMOC

Data collection related to effectiveness was based on the indicators proposed in the 1997 guidelines for monitoring the availability and use of obstetric services. (89) The indicators proposed in Monitoring Emergency Obstetric Care, a Handbook, (77) a 2009 edition by WHO, UNFPA, UNICEF, and Columbia University, were taken into account for the analysis of results. For ease of reference, the proposed indicators are listed in "Ch 3.2 Effectiveness" in the results section of this study.

The estimates of effectiveness relied on the indications for CS among cases in the study. Interviewers copied the indication for CS from the theatre register on the questionnaire, which also included questions about the duration of labour, and about the mother's opinion regarding the reason for surgery. The indications from theatre records were re-coded (see Annex 6) to allow grouping into the categories proposed by the international guidelines for monitoring obstetric services. (77) (89) To avoid over-estimation, CSs performed for "narrow pelvis" were excluded from the definition of prolonged/obstructed labour. For the results using findings from the case-control study, a confidence interval is reported in brackets.

Mother-baby package

Since the concept of opportunity cost implies comparative analysis of alternative courses of action, good practice in cost-effectiveness analysis demands that the cost of alternative "next-best" options is estimated. (90)In 1999, the World Health Organization published the Mother-Baby Package Costing Spreadsheet (91) to estimate the cost of implementing a set of maternal and newborn health interventions at the district level. The default settings represent a hypothetical low-income rural population at the district level. At the time of designing this study, the intention was to use the costing spreadsheet to estimate the cost of providing a full package of maternal and newborn healthcare in the Bunia Health Zone.

The type and number of health structures providing antenatal and obstetric care was assessed during the first field visit. Health posts were no longer recognised by the Ministry of Health, and not involved in maternal and neonatal healthcare. Due to time and resource constraints, it was not possible to collect cost data in all the health structures providing antenatal and obstetric care.

Because of the differences in the health system and the uncertainties regarding service costs, adapting the WHO spreadsheet to the Bunia situation would have required extensive changes to the proposed model. The total cost of implementing a full package of maternal and neonatal healthcare in Bunia was estimated by taking the proportional cost of applying the standard package without modifications to the Bunia population. The incremental cost of upgrading the current package of care to the full standard could not be calculated.

2.4. REPORTING

All study findings are reported in Chapter 3, the results section. Except in the statistical analysis, an effort was made to adhere to the convention of writing whole numbers up to ten in words. References are numbered consecutively as they appear in the text. When a reference is quoted more than once, the same reference number was used, except for chapters by different authors published in the same book. The reference system follows the Uniform Requirements for Manuscripts submitted to Biomedical Journals. Reference numbers are given in brackets in the text. Whole numbers in brackets, other than references, are in italics.

2.5. CONSTRAINTS

It is essential to interpret the results of these analyses in the light of the difficulties encountered in collecting information in a dangerous and remote part of DRC. In these circumstances, quality of data is difficult to achieve. While there was no question as to the veracity of the information collected, nevertheless the data needs to be evaluated cautiously. So, while accepting that technically there are other analyses that could be applied to these data, it is considered that those presented in this dissertation represent the maximum that can reasonably be done with the data available.

The beginning of the data collection period coincided with the phasing out of humanitarian assistance to the health system. Only one emergency hospital continued to provide healthcare free of charge. Since the same hospital was able to offer a higher standard of care than others, many providers had a preference for referring complicated obstetric cases to this hospital. Many service users preferred going there, for financial reasons as well as because of its good reputation. As the hospital had strict admission criteria and only accepted emergencies, local women were known to arrive at the hospital during the second stage of labour in order to gain access for delivery.

The Ministry of Health decreed that its new guidelines (92) for the “revitalization of Health Zones” were to be implemented as from January 2008. With regard to maternal health, strict separation of duties between different levels of care was the norm. Health centres were responsible for antenatal care, normal deliveries and postnatal consultations, while hospitals were in charge of emergencies. Doctors could only work in hospitals and the concept of “referral health centres” was abandoned. As a result, Bunia Cité, which was originally included in the study, was no longer allowed to perform surgery. Another private, not-for-profit structure (the Davenport clinic in Saio neighbourhood) was also affected by the new measures. The latter opted for a gradual reduction of surgical deliveries with increased referrals to the hospital. When the team made its first visit to Saio health centre (Davenport clinic) in late 2007, the nurse on duty insisted that, in anticipation of the new guidelines, CSs were only performed in case of extreme emergency.

Several private health structures in Bunia had an operating theatre and performed CSs during the study period, some on a regular basis. Although these structures were not included in the costing exercise, they were visited every two months to assess their activities, and the number of CSs recorded. There were also a large number of private clinics, some of which performed deliveries. The lead researcher was unable to locate all the private clinics before the start of the data collection period and deliveries that took place in these clinics were not recorded. During ad-hoc visits to some of these health centres, it was found that the number of deliveries was small, reportedly around five per month.

For practical reasons, and considering the larger than expected number of CSs performed in the study area, the data collection period was reduced to six months. Possible bias due to seasonal variations in access to services was thought to be minimal.

Bunia is situated close to the Equator at 1.57 degrees latitude, and has two rainy seasons, one of which was covered by the study period.

Due to financial constraints, the lead researcher was unable to stay in the study area during the entire data collection period. In February 2008 an email account was opened for the team leader, who was taught how to use it. There were few internet cafés in Bunia, and connections were slow and frequently interrupted by power failures. Between field visits, contact of the lead researcher with the team was limited.

Although the security situation in and around Bunia was relatively stable during the data collection period, violence perpetrated by uniformed men was reported throughout the district. The roads were unsafe after dark, and entry points to Bunia were barricaded by armed FARDC and UN troops during the night. The theatre at RW, a referral centre on the outskirts of urban Bunia operated during daytime hours only, referring night-time emergencies to other hospitals. All possible precautions were taken to reduce the risk of harassment of the interviewers, all adult women, especially during their field trips by motorbike taxi out of the town area. After meeting the liaison officer of the Congolese armed forces (FARDC) at MONUC, the principal investigator received a laissez-passer for each member of the team, covering the research period. Interviewers were allowed to make arrangements among themselves and to postpone out-of-town trips until convenient. Few deliveries of non-resident women were recorded and only 15 field trips were made for interviews out of town.

According to the study protocol, when a maternal death occurred, the intention was to interview relatives of the deceased using the same questionnaire as was used for a “case” in the study. Among the randomly selected cases, there were no maternal deaths. Information about maternal deaths was obtained from hospital records, health personnel, and from the community. Apart from the maternal deaths reported by hospitals, the team was informed of other deaths by health centre staff and community members. The interviewers insisted that it was culturally unacceptable to formally question a bereaved family. They opted for compassionate visits, taking a small gift (a bag of sugar, a piece of soap) as was customary. During an unstructured conversation, they asked about the events surrounding the maternal death. The information thus collected turned out to be incomplete and difficult to analyse. Except for hospital reported deaths, the causes of maternal death remain vague.

The maternal and perinatal deaths reported by the health structures included in the study are likely to reflect differences in case-mix and in accuracy of reporting. The quality of care can therefore not be deduced from mortality rates reported by individual health structures. Only BM employed a specialist obstetrician during most of the study period, except in late December 2007 and early January 2008. BM also had the most elaborate facilities, provided its services free of charge, and received the majority of referrals. The check list of signal functions gives an indication of quality of care.

Data proposed in 2009 for process indicators to monitor EMOC were not collected, since the field study was conducted before the handbook was published. (77) In the absence of information regarding intrapartum and very early neonatal death, estimated perinatal deaths were based on reported stillbirths and neonatal deaths from the health structures participating in this study.

No accurate information was available on the number of home deliveries during the study period. According to local health workers, home deliveries were exceptional in Bunia. Each neighbourhood had at least one government health centre. Privacy was limited in areas with high population density, which may have encouraged women to deliver in a health structure.

Taking outdoor photographs in the town of Bunia was discouraged for security reasons. At some health structures photography was allowed, while other healthcare providers strongly opposed the use of cameras. To avoid misunderstandings, no photos were taken to illustrate the study.

After this overview of methodology and constraints, the next chapter provides a detailed analysis of the study results, divided in four sections: statistical analysis of the case-control interviews, effectiveness of CS in the study environment, cost of CS,and results of the focus group discussions.

CHAPTER 3

RESULTS

3.1. CASE-CONTROL QUESTIONNAIRES

3.1.1. STUDY SAMPLE

Interviews for the case-control study were carried out between December 2007 and June 2008. Cases were a random sample of women who delivered by caesarean section (CS) in Bunia (excluding private-for-profit health structures). Controls were selected among women who had a vaginal delivery, within a period of two weeks before or after the delivery date of the corresponding case, and matched by place of residency.

The total sample consisted of 359 files, 180 controls and 179 cases. Although there was an additional control, it would have been difficult to decide which control was not matched with any of the cases. Controls were only matched to cases as a design element to ensure that these two groups would be balanced by residency. While most cases lived in one of the neighbourhoods of Bunia or in nearby villages, an imbalance on this factor would have made the study results difficult to interpret. In the absence of matching on any other factor, the study was considered to be unmatched (unconditional). Thus, and as removal of files from the sample would have reduced the amount of information available, all the data files were entered in EPI-info for analysis. After the data had been checked, it was decided to delete one "case" record; the discarded record appeared to be a repeat case interview, as the interviewee's name, date of delivery and area of residency were the same on two different records.

Statistical analysis was performed on 358 questionnaires, 178 cases (49.7%) and 180 controls (50.3%). On some of the questionnaires retained for analysis, data were missing or inconsistent for certain variables, as indicated below. For example, interviews dated as being conducted before the date of delivery were excluded from analysis of the time between delivery and interview.

There were no maternal deaths among the study subjects selected to be interviewed and no "proxy interviews" (interview of a relative of the deceased) were conducted. Maternal deaths that occurred in the area during the study period were recorded and investigated separately.

3.1.2. GENERAL INFORMATION

Civil Status

Among cases, 156 (87.6%) were living with a partner or husband at the time of delivery. For controls, the figure was 152 (84.4%). The odds ratio (OR) was 1.31 (95% CI 0.72-2.38; Fisher exact test p=0.447). There was no statistically significant difference between cases and controls.

Forty-nine respondents (13.7%) were living without a partner at the time of delivery, four of these (all controls) said they lived alone; the others (22 cases, 12.3% and 23 controls, 12.8%) were staying with their family. Of the women who said they lived alone, only one was a primipara. The questionnaire did not elaborate on the reason(s) for women to live without a partner.

Place of origin

Bunia was named as the place of origin by 61 respondents; six of them mentioned that they had lived in Bunia for several years, without further precision on where they had lived before. Another respondent mentioned Kindia (a neighbourhood in Bunia) as her place of origin. If the response "Bunia for several years" is included as the place of origin, the proportion of women in the study sample originating from Bunia was 17.3%; excluding these responses lowered the proportion to 15.6%.

A number of respondents said they came from nearby villages and towns in Ituri: Chari *(6)*, Nizi *(5)*, Iga Barriere*(4)*, Drodro *(7)*, Mongwalu and Blukwa *(11)* to the north, Nyankunde *(24)* and Gethy *(8)* to the south. Places further away such as Mahagi *(13)*, Fataki *(9)*, and Tchomia *(3)* were also mentioned. Others originated from Kisangani *(11)*, the capital of the Oriental Province and from various places in neighbouring North Kivu: (Butembo *(9)*, Goma *(3)*, Beni *(3)*, Ouicha*(2)*. A few came from as far away as Kindu *(2)* (Maniema Province) and Kinshasa *(2)*. (Fig 1.1 and 1.2)

Ethnicity

As it was thought that ethnicity could influence access to healthcare, the original questionnaire included "ethnic group" as part of the general information. During the pilot phase, this question was changed to "groupement" (the smallest administrative unit after “territoire” and “commune”)[xii] at the request of a service provider, because the question about ethnicity was considered too sensitive. According to the local authorities (interview with Mr Rwambona, deputy District Commissioner in May 2008) 18 different communities live in Ituri. Fourteen of these are considered to be of a defined ethnicity, the other four are described as large “groups” (for more information on ethnicity, see focus group discussions Ch 3.4. and Annex 4).

The responses of the 227 interviewees answering the question about “groupement” provided very little information on ethnicity. Twelve women identified themselves as (Ba) Hema, six said they were Ang(h)al, five Risasi, four Andisoma, two replied Aru and another two Nyankunde. As it was not possible to restructure the data into meaningful larger groups, analysis of ethnic origin was omitted.

Age

Age information was missing on two records, one case and one control. The youngest (three subjects aged 14) and the oldest subjects (one woman of 46) were all controls.

The mean age was 24.7 (s.d. 6.5) years, ranging between 14 and 46. Separate analysis of age by group showed that the mean age for both was just under 25 years [cases 24.6 (s.d. 6.8), controls 24.8 (s.d. 6.3) years]. The difference between the mean ages of the cases and controls was not statistically significant (Student unpaired t-test; $p=0.786$).

Time of Interview

Four control interviews were excluded from this part of the analysis, because the dates of interview and delivery were inconsistent. The median time between date of delivery and date of interview was three days for cases and seven days for controls, with a minimum of one day for both cases and controls, and a maximum of 11 days for cases and 33 days for controls. This difference was highly significant ($p<0.001$, Mann-Whitney test).

[xii] French for “grouping”, “territory” and “municipality”

3.1.3. OBSTETRIC HISTORY

The total study *sample* reported 1193 pregnancies and 1137 deliveries, including this pregnancy and delivery. On the day of the interview 930 children (81.8% of total delivered) were reported to be alive.

Number of pregnancies

The median number of pregnancies was 2 for cases (25^{th} percentile = 1 and 75^{th} percentile = 4) and 3 for controls (25^{th} percentile = 2 and 75^{th} percentile = 4.5). The number of pregnancies by subject ranged from 1 to 11 for cases, and 1 to 12 for controls. There was no significant difference in the median number of pregnancies between cases and controls (p=0.201, Mann-Whitney U-test).

A total of 101 subjects reported this to be the first pregnancy, 57 cases (32.0%) and 44 controls (24.4%) (Fisher exact test; p=0.127, not significant). Eighty-six women, 41 cases (23.0%) and 45 controls (25.0%) reported five or more pregnancies, and could be defined as "grand multiparous" (Fisher exact test; p=0.711, not significant).

Number of deliveries

The number of deliveries individually reported ranged between 1 and 12 (median = 3). The number of women reporting to have delivered only one child was 105 (29.3%): 59 cases (33.1%) and 46 controls (25.6%). This difference between the proportions of cases and controls reporting that they had just delivered their first baby was not statistically significant (Fisher exact test; p=0.131, not significant).

In the study sample 78.8% had delivered a total of 1 to 4 children (81.4% cases, 76.1% controls). The median total number of children delivered was 2 for cases and 3 for controls, with a maximum of 11 for cases and 12 for controls (Mann Whitney U-test, p=0.127). The total number of deliveries was not significantly different between cases and controls.

Number of children alive

The number of children alive at the time of interview ranged from 0 to 10; the median was 2 for cases and 2.5 for controls (Mann-Whitney U-test: p = 0.005). Six (3.4%) of the cases and 11 (6.1%) controls reported having 7 or more children alive; 70 cases (58.3%) and 50 controls (41.7%) reported to have one child alive; 4 cases (2.2%) and 3 controls (1.7%) had no children alive.

Table 3.1.1: number of children alive on day of interview

Q. 36. How many of your children are alive today?						
Alive on day of interview	**Cases**	**Proportion**	**Controls**	**Proportion**	**Total**	**Proportion**
0	4	2.2%	3	2.0%	7	2.0%
1	70	39.3%	50	27.8%	120	33.5%
2	42	23.6%	37	20.6%	79	22.1%
3	26	14.6%	40	22.2%	66	18.4%
4	16	9.0%	20	11.1%	36	10.1%
5	11	6.2%	11	6.1%	22	6.1%
6	3	1.7%	8	4.4%	11	3.1%
7	2	1.1%	6	3.3%	8	2.2%
8	1	0.6%	3	1.7%	4	1.1%
9	2	1.1%	2	1.1%	4	1.1%
10	1	0.6%	0	0.0%	1	0.3%
Total	**178**	**100%**	**180**	**100%**	**358**	**100%**

Cases reported 22.6% (123/542) of children *not* having survived against 14.1% (84/595) among controls (OR=1.79; 95% CI: 1.30-2.45; Fisher exact test $p<0.001$). Cases were more likely than controls to have ever lost a child.

Previous Stillbirths

Fifty women (13.2% of sample) reported one or more previous stillbirths (not including this pregnancy), 35 of whom were cases. Three cases reported delivering 2 stillbirths and 1 case reported 3 previous stillbirths. Of the 179 controls responding to the question (1 response missing), 15 (8.4%) reported 1 or more previous stillbirths (Fisher exact test p=0.002). The odds ratio of cases versus controls for having had a previous stillbirth was 2.68 (95% CI: 1.40-5.10). The result is statistically significant, indicating that women with previous stillbirths were more likely to deliver by CS.

Cause of previous stillbirth

Review of the reasons for previous stillbirth found one case response reported as "they were paediatric deaths"[xiii] and one control reportedly saying "they were abortions." Of those remaining, 12 did not know the cause. Further analysis of the 36 remaining files showed that "foetal distress" was the cause of ten previous stillbirths. An additional report "swallowed amniotic fluid" could be added to the same category. Bleeding was the reported cause of five foetal deaths (includes one placenta abruption and one placenta praevia). Other causes were disease during pregnancy (2) and infection (3), breech presentation (2) and twins (1). Other reasons mentioned were "bad management," "car accident," "war" and "worries."

Prolonged Labour for Previous Deliveries

There was a significant difference in prolonged labour during previous deliveries (n=258), with the proportion of cases reporting prolonged labour (47/123; 38.2%) more than double the proportion of controls (23/135; 17.0%). The odds of women with a previous history of prolonged labour having a CS for this delivery were three times higher than for those not reporting prolonged labour in the past. (OR=3.01; CI: 1.69-5.37; Fisher exact p<0.001). The question was left blank for first deliveries.

Previous Caesarean Sections

There were 337 replies to the question "did you have any CSs before, excluding this delivery," 167 from cases and 170 from controls. Among the women who had a previous CS, 11 said they had a CS after the second pregnancy and 3 after the third; 3 cases reported 3 previous CSs not including the most recent delivery and 1 case reported 4 previous CSs.

[xiii] The interviews were conducted in Swahili. Interviewers wrote the answers translated into French onto the questionnaire sheet. The data were entered in English in Epi-Info. Although the exact wording of the interviewee's response was not available, it appears that the meaning of the word "stillbirth" in the previous question was initially misunderstood by the person interviewed.

Excluding those who replied to this question, although they reported this to be their first child, left 253 records; 6 of these (controls) had no reply to the question about previous CS, and so 247 records remained for analysis, 119 cases and 128 controls. Among women with at least one previous delivery who replied to the question, 5 controls (3.9 % of respondent controls) and 52 cases (43.7% of respondent cases) had a previous CS. The odds ratio was 19.09 (95% CI: 7.28-50.10; Fisher exact test $p<0.001$). Women with a previous CS were thus 19 times more likely to have had a CS for this delivery.

Table 3.1.2: Previous caesarean section: cases compared to controls

CS before this delivery? (excluding first deliveries)	**Cases**	**Controls**	**Odds ratio**	**95% CI**	**p-value**
	52/119 (43.7%)	5/128 (3.9%)	18.87	7.62-55.69	0.001

3.1.4 MORBIDITY DURING THIS PREGNANCY

Fever, bleeding, hypertension during pregnancy

1. Fever

Fever during pregnancy was reported by 126 subjects: 65 cases (36.5%) and 61 controls (33.9%) (OR=1.12; CI: 0.73-1.73; Fisher exact; p=0.658). Positive respondents were asked to specify if the fever occurred during early, mid- or late pregnancy, or more than once. Multiple answers were possible.

Thirty cases (16.9%) and 20 controls (11.1%) reported fever in early pregnancy. The OR was 1.62 for cases compared to controls (95% CI: 0.88-2.98). The difference was not significant (Fisher exact; p=0.129).

Nineteen cases (10.7%) and 26 controls (14.4%) reported fever in mid-pregnancy. The OR was 0.71 (95% CI: 0.38-1.33), and the difference was not significant (Fisher exact; p=0.339).

Twelve cases (6.7%) and 13 controls (7.2%) reported fever late in pregnancy. The difference between cases and controls reporting fever late in pregnancy was also not significant (OR=0.93; 95% CI 0.41-2.10) (Fisher exact; p=1.000).

Twelve cases (6.7%) and five controls (2.8%) said they had fever more than once. The OR was 2.53 (95% CI: 0.87-7.34) and the difference not quite significant (Fisher exact; p=0.087).

Cases and controls did not show any statistical difference with regard to fever during the last pregnancy.

2. Bleeding

The reported occurrence of bleeding before onset of labour was 22/178 among cases (12.4%) and 20/180 among controls (11.1%). The difference was not significant (OR=1.13; 95%: CI 0.59-2.15; Fisher exact test p=0.745).

Six cases (3.4%) and 9 controls (5.0%) reported bleeding early in pregnancy. The OR was 0.66 (95% CI=0.23-1.90) showing no significant difference between cases and controls (Fisher exact test p=0.599).

Bleeding in mid-pregnancy was reported by 6 cases (3.4%) and 6 controls (3.3%). The difference was not significant (OR=1.01; CI=0.30-3.37; Fisher exact test p=1.000).

Eleven cases (6.2%) and 4 controls (2.2%) reported bleeding late in pregnancy. The difference remained just below the conventional statistically significant level (OR=2.90; 95% CI 0.91-9.28; Fisher exact test p=0.070). Only one case said she had bleeding more than once.

There was no statistically significant difference between reported bleeding in pregnancy between cases and controls.

3. Hypertension

The reported incidence of hypertension during pregnancy was 15 for cases (8.4%) and 11 for controls (6.1%). The difference was not significant (OR= 1.41; 95% CI: 0.63-3.17; Fisher exact test p=0.423).

Respondents who replied positively to the question about hypertension in pregnancy were asked when the problem started. In the analysis below, the total number of replies among cases was higher than the number of women responding positively to the previous question, suggesting that some of the cases gave more than one answer.

Two cases and 2 controls reported having hypertension before this pregnancy.

Eight cases (4.5%) and 1 control (0.6%) reported hypertension in early pregnancy. The OR was 8.42 for cases compared to controls (95% CI: 1.04-68.06) and the difference was statistically significant (Fisher exact test p=0.019). Given the small numbers of early pregnancy hypertension, however, this result should be interpreted cautiously.

Seven cases (3.9%) and 3 controls (1.7%) reported hypertension in the middle of pregnancy. The OR was 2.42 (95%CI: 0.61-9.49) and the difference was not significant (Fisher exact test p= 0.218).

Six cases (3.4%) and 5 controls (2.8%) said they had hypertension late in pregnancy. There was no significant difference between cases and controls reporting hypertension late in pregnancy (OR=1.22; 95% CI: 0.37-4.08) (Fisher exact test p=0.770).

One of the cases reporting hypertension at the end of pregnancy had a CS for "toxicosis of pregnancy." Another case had a CS for pre-eclampsia, together with abnormal presentation. Both delivered a child that was alive and in good condition. Among the other cases who reported hypertension at any time during pregnancy, there were four perinatal deaths and five babies alive but not in good condition (one of which died later at home). All the controls reporting hypertension during pregnancy had a normal delivery (including one episiotomy) of a live child in good condition.

Although there was no significant difference in reported hypertension during pregnancy between cases and controls, the effect of hypertension appeared to have been worse for cases.

Table 3.1.3 (Q11.): morbidity in pregnancy: cases compared to controls

Morbidity during this pregnancy					
Condition	**Cases**	**Controls**	**OR**	**95% CI**	**P value**
Fever	65 (36.5%)	61 (33.9%)	1.12	0.73-1.73	0.658
Bleeding	22 (12.3%)	20 (11.1%)	1.13	0.59-2.15	0.745
Hypertension	15 (8.4%)	11 (6.1%)	1.41	0.63-3.17	0.423
Total	**102**	**92**			

4. More than one problem in pregnancy

Among the women reporting fever, 12/65 cases (18.5% of cases with fever) and 12/61controls (19.7%) also reported bleeding. Four cases (6.2%) and 7 controls (11.5%) reported hypertension as well as fever.

Action taken for fever, bleeding or hypertension during pregnancy

Overall, 43 (42.1%) cases and 28 (30.4%) controls reporting fever, bleeding or hypertension during pregnancy said they had received treatment at a health centre or hospital.

1. Fever

Among women reporting fever, 3 cases (4.6% of those reporting fever) and 4 controls (6.5% of controls reporting fever) said they “did nothing.” None of the respondents said they went to see a traditional healer. Thirty-one cases (47.7% of those reporting fever) and 23 controls (37.7% of those reporting fever) said they *went to the health centre*. The OR for going to a health centre was 1.51 for cases compared to controls (95% CI=0.74-3.07). The difference between cases and controls was statistically not significant (Fisher exact test p=0.284).

Only 28 cases (43.1%) and 20 controls (32.8%) said they had received medicine at a health centre. The OR of being treated for fever at a health structure was 1.55 for cases against controls, statistically not significant (95% CI 0.75-3.21; Fisher exact test p=0.273).

Thirteen cases (20.0% of those reporting fever) and 17 controls (27.9% of those reporting fever) said they bought medicine at a shop or pharmacy. The OR was 0.65 (95% CI: 0.28-1.48), a non-significant difference (Fisher exact p=0.403).

Of the interviewees who reported fever during pregnancy, 2 cases and 3 controls said that they got worse after taking action. 46 cases (70.8%) and 52 controls (85.2%) said they improved; this difference almost reached statistical significance (OR=0.42; CI: 0.17-1.02; Fisher exact test p=0.057), suggesting that cases were significantly more likely to have had first treatment failure.

2. Bleeding

Among women reporting bleeding, 2 cases (9.1% of cases reporting bleeding) and 3 controls (15.0% of controls reporting bleeding) said they did nothing.

Five cases (22.7% of cases with bleeding) and 3 controls (15.0% of controls with bleeding) said they *went to the health centre*, while 11 cases (50.0% of cases with bleeding) and 8 controls (40.0% of controls with bleeding) said they *went to the hospital.* The odds ratio of going to a health centre was 1.67 for cases against controls (95% CI: 0.34-8.10; Fisher exact test p=0.700). The odds ratio of going to a hospital was 1.50 (95% CI: 0.44-5.10; Fisher exact test p=0.551). There was thus no significant difference between cases and controls in going to a health structure when bleeding was experienced during the pregnancy.

Eight cases (36.4% of cases with bleeding) and 5 controls (25.0%) said they received treatment at a health centre or hospital. The OR for bleeding being treated at a health structure was 1.71 for cases compared to controls (95% CI 0.45-6.51; Fisher exact test p=0.514), not significant. Two controls said they took medicine which they bought at a shop.

Two cases said the bleeding got worse after treatment. 17 cases (77.3%) and 19 controls (95.0%) said the bleeding stopped after treatment, not a significant difference (OR=0.18; CI: 0.02-1.69; Fisher exact test p=0.187).

3. Hypertension

Among women reporting hypertension, 2 cases (13.3% of those reporting hypertension) and 1 control (9.1%) said they took no action. 4 cases (26.7% of those reporting hypertension) and 2 controls (18.2%) reported going *to a health* centre, while 3 cases (20.0%) and 2 controls (18.2%) said they went *to a hospital.*

Six cases (40.0% of those reporting hypertension) and 3 controls (27.3% of those reporting hypertension) said they had been given treatment at the health centre or hospital. The OR for cases being treated for hypertension at a health structure was 1.78 compared to controls (95% CI 0.33-9.55; Fisher exact test p=0.683).

One case and 1 control reporting hypertension said they took medicine they bought at a shop or on the market. None of the respondents said that they asked the advice of a friend or relative, were treated by a traditional healer, or saw a community worker. Those who did "something else" included 2 cases and 3 controls. One case said she had been immediately taken to the operation theatre. The second case replied she "only rested." The responses of the controls were: "strict rest", "salt free diet and glucose water" and "I drank sugar water."

Ten cases (66.7%) and 10 controls (90.9%) said they improved as a result of the action taken. The difference was not significant, but numbers were small (OR=0.20; CI: 0.02-2.03; Fisher exact test p=0.197).

Table 3.1.4: Odds of treatment at a health centre or hospital, cases v controls.

Treatment at hospital or health centre					
Condition↓	**Cases**	**Controls**	**OR (cases v controls)**	**95% CI**	**p-value**
Fever	28/65 (43.1%)	20/61(32.8%)	1.55	0.75-3.21	0.273
Bleeding	8/22 (36.4%)	5/20 (25.0%)	1.71	0.45-6.51	0.514
Hypertension	6/15 (40.0%)	3/11 (27.3%)	1.78	0.33-9.55	0.683
Total	42/102(41.2%)	28/92(30.4%)	1.60	0.88-2.90	0.160

There was no significant difference in positive response to the variable "I did not have any problem" (89 cases (50.0%), 98 controls (54.4%); (OR 0.84; 95% CI: 0.55-1.27; p=0.459).

Other health problems during this pregnancy

Convulsions

Convulsions during pregnancy were reported by 2 controls, but not confirmed by antenatal records, which were rarely available post-delivery.[xiv]

Other conditions

Fifty-nine women, 34 cases (19.1%) and 25 controls (13.9%) reported abnormal vaginal discharge during pregnancy (OR=1.46; CI: 0.83-2.57, Fisher exact test p=0.202). Pain when passing urine was a complaint of 47 cases (26.4%) and 36 controls (20.0%) (OR 1.44; CI: 0.88-2.35, Fisher exact test p=0.169).

Weight loss in excess of 5 kg was reported by 7 cases (3.9%) and by 5 controls (2.8%); cough for more than two weeks by 8 cases (4.5%) and 9 controls (5.0%). The OR for weight loss

[xiv]Antenatal records must be handed in at delivery to obtain a birth record

was 1.43 (95% CI: 0.45-4.60; p=0.573) for cases compared to controls. The OR for cough was 0.89 (95% CI: 0.34-2.37, p=1.000). For both variables there was no significant difference between cases and controls.

Of the 148 women reporting one or more “other” problems during pregnancy, 57 cases (68.7% of those responding) and 43 controls (66.2% of those responding) said they had taken any treatment. The OR of cases versus controls was 1.12 (95% CI: 0.56-2.24; Fisher exact 0.860).

None of the women interviewed reported having sought or received traditional treatment for any condition. There were no positive replies to the question if they had asked the advice of a community health worker, or of a relative or friend. While the veracity of these statements could not be checked, it may be worth noting that there were no community health workers in the urban area of Bunia at the time of the study. 6 interviewees (1.7%) said they had bought medicine at a shop or in the market, and 9 (2.5%) had followed the advice of someone else.

3.1.5. LABORATORY TESTS

Out of 352 responses (6 replies missing, 3 cases and 3 controls), 214 subjects (113 cases, 64.6%, and 101 controls, 57.1%) said they had one or more laboratory tests during pregnancy (OR=1.37; 95% CI: 0.89-2.11; Fisher exact test p=0.157). The reported tests performed were 199 blood tests (105 cases, 94 controls), 192 urinalyses (106 cases, 86 controls) and 115 stool analysis (65 cases, 50 controls).

Table 3.1.5 (Q23-24): laboratory tests during this pregnancy

Laboratory test	Cases	Controls	OR	p-value
Blood	105/175 (60.0%)	94/177(53.1%)	1.32 (0.87-2.02)	0.199
Urinalysis	106/175 (60.6%)	86/177(48.6%)	1.63 (1.07-2.48)	0.025*
Stool	65/175(37.1%)	50/177(28.2%)	1.50 (0.96-2.35)	0.088
Any test	113/175 (64.6%)	101/177(57.1%)	1.37 (0.89-2.11)	0.157

*Significantly more cases than controls had a urinalysis during this pregnancy

The question “do you know the results of these tests” was answered positively by 90/214 respondents (42.0%), 50 cases (44.2%) and 40 controls (39.6%).

There were 120 answers to the question: if you had a urine test, did you have proteinuria. Forty-one subjects, 25/65 cases (38.5%) and 16/55 controls (29.1%), said they had been told by a health worker there was proteinuria during pregnancy (OR=1.52; CI: 0.71-3.28; Fisher exact test p=0.336). Laboratory confirmation of these results could not be found, since pregnancy records were usually handed in to obtain a birth certificate.

3.1.6. TETANUS VACCINATION

A large proportion of interviewees (310/358= 86.6%) said they had been vaccinated against tetanus during pregnancy. Of these, 45 (15.5%) had received only one injection and 220 (71.2%) had two injections; 37 (12%) said they had been vaccinated three times and 3 (0.9 %) responded four times. The negative responses (48) were equal among cases (24/178=13.5%) and controls (24/180=13.3%). The OR for tetanus vaccination was 1.01 for cases against controls (CI: 0.55-1.86 Fisher exact test p=1.000).

3.1.7. DURATION OF LABOUR FOR THIS DELIVERY

Prolonged labour during this delivery

The reported duration of labour in hours for the most recent delivery (n=258) ranged from 0 to 96 hours for cases and from one to 72 hours for controls. The median duration for cases was ten hours (25thpercentile 4h and 75th percentile 24h). For controls, the median was six hours (25thpercentile 3h and 75th percentile 10h). The difference in median duration of labour between cases and controls was highly significant (Mann-Whitney U-test p=0.003).

Forty-four cases and 16 controls reported that labour took more than the time between sunrise and sunset (12 hours); this difference between cases and controls was highly significant (OR= 3.37; CI: 1.82-6.23; Fisher exact p<0.001).

Table 3.1.6 (Q. 48-49): duration of labour in hours or days

How long was your labour?	Cases	Controls	OR	p-value
A. HOURS	*N= 117*	*N=141*		
Minimum (hours)	0h	1h		
Maximum (hours)	96h	72h		
Median (hours)	**10 h**	**6h**		**0.003**
B. DAYS	*N=178*	*N=180*		
Longer than time between sunrise sunset (=12h)	44 (24.7%)	16 (8.9%)	3.37 (CI= 1.82-6.23)	<0.001

Previous caesarean section and duration of labour in hours

Only 3 controls and 39 cases with a previous CS answered the question on the duration of labour in hours, including five cases whose answer was recorded as 0 (zero) hours. The median duration was 8.5 hours for cases, and seven hours for controls. In the presence of information from only 3 controls and as the duration times were non-Normally distributed, a formal statistical comparison of these median times was not sensible.

Previous caesarean section and duration of labour in days

All 57 subjects who had a previous CS gave an answer to the alternative question regarding duration of labour: “if you don't know the duration in hours, was it -not as long- or -longer- than the time between sunrise and sunset (12h).” 11 (21.2%) cases and only 1 (20.0%) control replied “longer” (more than 12 hours): OR = 1.07 (CI 0.11-10.60), not a statistically significant difference (p=1.000).

Duration of labour in first deliveries

Out of 105 first deliveries, 59 (56.2%) were cases and 46 (43.8%) were controls. Sixty-nine first deliveries answered the duration of labour in hours, 36 cases (61.0% of first deliveries in cases) and 33 controls (71.7% of first deliveries in controls). Overall, the median duration of labour was 10 hours; however, the median duration of labour was substantially greater for cases (24 hours) than for controls (8 hours) and this difference was statistically significant (Mann Whitney U-test p=0.034).

Duration of labour was grouped into “less than 12 hours”, “12-24 hours” and “more than 24 hours.” In the first group there were more controls (n=23, 69.7%) than cases (n=15, 41.6%); 11 cases (30.5%) and 9 controls (27.3%) reported between 12 and 24 hours; 10 cases (27.8%) and only 1 control (3.0%) reported duration of labour longer than 24 hours. These differences were statistically significant (Fisher exact test p=0.008).

Table 3.1.7: duration of labour (hours) in first deliveries grouped <12h, 12-24h, > 24h

Duration of labour	**Cases**	**Controls**
<12h	15 (41.6%)	23 (69.7%)
12-24h	11 (30.5%)	9 (27.3%)
>24h	10 (27.8%)	1 (3.0%)
Total	**36**	**33**

To the question about duration of labour in days (not as long-or longer- than the time between sunrise and sunset) 18 cases (30.5% of cases with first delivery) and 5 controls (10.9% of controls delivering for the first time) replied “longer.” The difference between cases and controls was statistically significant (OR 3.60; 95% CI: 1.22-10.61; Fisher exact 0.018). However, some of the respondents replied to both questions (time in hours and time between sunrise and sunset). To avoid double counting, the data were re-coded. A further conservative analysis was performed after re-coding “longer than the time between sunrise and sunset” as “12-24 hours” and adding the missing subjects in each category as shown in the table below. The differences remained statistically highly significant (Fisher exact test p=0.006).

Table 3.1.8: duration of labour including "longer" as "12-24h" (first deliveries)

Duration of labour	**Cases**	**Controls**
<12h	15 (25.4%)	23 (50.0%)
12-24h	34 (57.6%)	22 (47.8%)
>24h	10 (16.9%)	1 (2.2%)
Total	**59**	**46**

Delivery without labour

Ten cases reported they had not been in labour before delivery. The records were reviewed to determine whether any of these could be classified as elective CSs. The indications for CS among women not in labour were the following:

- placenta praevia with bleeding: 2 cases
- third trimester bleeding following removal of cerclage: 1 case
- ruptured membranes with bleeding: 2 cases
- early rupture of membranes with foetal distress at 7 ½ months pregnancy: 1 case
- two previous CSs: 1 case
- three previous CSs: 1 case
- foetal distress in a woman with fifth pregnancy and no other live children: 1 case
- post-term and failed induction: 1 case

3.1.8 CONSENT

Out of 151 cases (84.8%) who said they had needed consent from someone else before the operation, 135 (89.4%) replied that this procedure had delayed the intervention.

3.1.9. NON-SURGICAL DELIVERIES

Out of 180 controls who had a non-surgical delivery, 149 (82.8%) reported a normal vaginal delivery without any intervention. Five controls (2.8%) delivered with oxytocin infusion, 21 (11.7%) had an episiotomy and there was only 1 vacuum extraction (0.5%).

3.1.10. INDICATIONS FOR CAESAREAN SECTION

Indications for CS were copied from the theatre registers. The register was inaccessible in 1 case. Foetal distress was a major factor in the decision to perform a CS in 46 (25%) of cases. In 31 cases, (17.4%), foetal distress was the only reason given for section. Another 15 indications mentioned foetal distress first, though some could arguably be categorized differently, such as two cases with "foetal distress and abnormal presentation" and a trial of labour with previous CS for transverse lie.

Maternal indications were placenta praevia (4.4%; n=8, including one marginal placenta praevia and one transverse lie with placenta praevia), placenta abruption (1.7%; n=3), pre-eclampsia (1.1%; n=2) and malpresentation, including one multiple pregnancy (11.7%; n=21). The latter is exclusive of the previously mentioned cases with foetal distress and abnormal presentation. One CS was performed on a known stillbirth, with asymmetrical pelvis as the indication. There were 2 cases of imminent uterine rupture, and 2 with ruptured uterus, both treated with hysterectomies. Dystocia (dynamic, cervical, mechanical) was recorded in 20 cases (11.2%). Foeto-pelvic disproportion was the main reason for section on 15 records (8.3%) and "narrow pelvis" on 12 records (6.7%).

In the next section of this chapter (Ch 3.2) a further analysis of indications for CS will be reported to determine effectiveness, including absolute maternal indications. Since the indication for CS was not always clear-cut, the figures may differ slightly. A full transcript of indications for CS can be found in Annex 6.

Other indications not included in table 3.1.9 were bleeding *(3)*, imminent rupture of uterus *(2)*, hydramnios *(2)*, stationary dilatation with cord around neck *(2)* and asymmetrical pelvis *(1)*.

Table 3.1.9: indications for CS from theatre register

Maternal Indication		**Foetal Indication**		**Other**	
Prolonged labour	3 (1.6%)	Foetal distress	46 (25.8%)	Foeto-pelvic disproportion	15 (8.3%)
Abruptio placentae	3 (1.6%)			Narrow pelvis	10 (5.6%)
Eclampsia	2 (1.1%)			Dystocia	20 (11.2%)
Placenta praevia	8 (4.4%)				
malpresentation	21 (11.7%)				
Previous caesarean	39 (21.9%)				
Total	**76 (42.7%)**		**46 (25.8%)**		**45 (25.3%)**

Caesarean section for first delivery

The indication for surgery was reviewed for the 59 cases reporting this to be their first delivery. Foetal distress was the main indication for 19 interventions (32.2%). Other indications were foeto-pelvic disproportion (FPD) (n=15; 25.4%), dynamic dystocia (n=9; 15.2%), malpresentation (n=6; 10.2%) and narrow pelvis (n=5; 8.5%). Pre-eclampsia with FPD *(1)*, placenta abruption *(1)*, bleeding *(1)*, and pre-ruptured uterus *(1)* (1.7% each), were the reasons given for CS in the remaining cases. The indication FPD was only found in cases with a first delivery.

Caesarean section in multiparous women

The study sample included 86 women who had been pregnant 5 or more times, 41 cases (23.0% of cases) and 45 controls (25.0% of controls). Among the cases with 5 or more pregnancies, 4 (9.7%) had a placenta praevia, 1 placenta abruption (2.4%) and 1 severe bleeding (2.4%) with suspected rupture of uterus. Other indications were malpresentation (26.8%; n=11), including a twin pregnancy with shoulder presentation of the second twin and a breech stillbirth (See also Annex 6). Twelve of the cases (29.3%) and none of the controls with 5 pregnancies or more reported at least one previous CS.

Of the women who had a CS, 20 (11.2%) had been pregnant 7 times or more. Among controls, 23 (12.8%) had been pregnant 7 or more times. Sixteen cases (9.0%) and 21 controls (11.7%) reported having delivered 7 or more children.

Of the cases who had 7 or more pregnancies, the indications for CS were: foetal distress *(5)* including 1 with cervical oedema, 1 previous CS and 1 cord around neck, 2 dystocia of cervix of which 1 with oligo-amnios, 1 twins with shoulder presentation of second twin, 2 cord prolapses with hand presentation, 1 hand presentation, 1 intra uterine death with breech presentation, 1 post-term with transverse lie, 1 abruptio placentae, 2 placenta praevia, 1 prolonged labour with ruptured membranes, 1 ruptured uterus, 1 imminent rupture of uterus and 1 bleeding with suspected rupture of uterus.

3.1.11. CONDITION OF THE CHILD

Among cases, 125 (70.2%) replied the child was "alive and in good condition", while 164 (91.1%) controls gave the same response regarding the condition of the child. The overall odds ratio for the child being "alive and in good condition" was 0.23 (95% CI: 0.13-0.42; Fisher exact test $p<0.001$). Thus, controls had just over a four times better chance than cases of delivering a child that was alive and in good condition.

Forty cases (23.0%) and 13 controls (7.2%) said that the child was alive at birth but not in good condition; OR (relative to category "alive in good condition") = 4.04 (95% CI 2.07-7.87), a highly significant result ($p<0.001$).

Thirteen cases (7.3%) and 3 controls (1.7%) had delivered a child that was not alive at the time of interview; OR (relative to category "alive in good condition") = 5.69 (95% CI 1.59-20.38, $p=0.008$), again a statistically significant difference. Interviewers reported that one more baby died at home after discharge from hospital (case).

One case responded positively to "alive and in good condition" as well as "alive but not in good condition." The interview record showed that the woman delivered twins, one of which was in good condition, while the second twin had suffered foetal distress. For the purpose of this analysis, both babies were recorded as "alive but not in good condition".

Table 3.1.10: Q52 what was the condition of the child after birth

Condition of child	Cases	Controls	Odds ratio	95% CI	p-value
Alive in good condition	125/178 (70.2%)	164/180 (91.1%)	---		
Alive not in good condition	40/178 (22.5%)	13/180 (7.2%)	4.04	2.07- 7.87	<0.001
Not alive	13/178 (7.3%)	3/180 (1.7%)	5.69	1.59-20.38	0.017

3.1.12 CONDITION OF THE MOTHER AFTER DELIVERY

Fever after delivery

Out of 347 respondents, 56 (16.1%) said they had fever after delivery. There were significantly more cases (34/171; 19.9%) than controls (14/176; 8.0%) responding positively (OR=2.87; 95% CI: 1.48-5.57; Fisher exact test p=0.002).

Bleeding after delivery

More controls (60/177; 33.9%) than cases (43/177; 24.3%) reported severe bleeding post delivery, though the result was not quite statistically significant. (OR=0.63; CI: 0.39-1.00; p=0.061). Only 1 control (0.6%) received a blood transfusion, compared to 6 cases (3.5%). The odds ratio of having a transfusion post-delivery was 6.24 (CI 0.74-52.40) for cases against controls; this difference was just not quite statistically significant due to the small number of women who had a transfusion (Fisher exact test p= 0.067).

Other illness

Of the 37 women who said they were "ill" at the time of the interview, 28 were cases (15.7% of all cases) and 9 were controls (5.0% of all controls). The OR for cases to report being ill was 3.55 against controls (CI: 1.62-7.76; Fisher exact test p=0.001), a significant difference. The mean date of interview for cases was closer to delivery than for controls, which could have influenced the response.

Only 8 respondents (5 cases, 3 controls) provided details of their illness. Controls complained about headache and dizziness, backache and lower abdominal pains. The cases' complaints were: pain (not specified), pain over the wound, an infected wound, cough, and shortness of breath when standing up.

The questions about bleeding, fever and other illness after delivery were asked separately. Sixteen (43.2%) of the women who said they were ill also reported heavy bleeding post-delivery, and 10 of them (27.0%) also said they had fever. Five respondents (3 cases and two controls) said they had both fever and heavy bleeding post-delivery.

3.1.13. PLACE OF LABOUR AND DELIVERY

The majority of women (331: 87.4%) were at home at the start of labour (cases: 151= 84.8%; controls: 162= 90.0%; OR=0.62 95%CI: 0.33-1.17; Fisher exact; p=0.154, difference not significant). Fourteen (7.9%) cases and 12 (6.7%) controls were at the hospital when labour started (OR=1.20; CI 0.54-2.66; p=0.689). Two cases (1.1%) reported being at the health centre; 2 controls replied that they were at a waiting mothers' shelter; 13 cases and 4 controls said they were "somewhere else." Further clarification of the response "somewhere else" is provided in the table below.

Table 3.1.11 (Q 45) Where were you when labour started?

Place at start of labour	Cases	Controls	OR	p-value
Home	151(84.8%)	162 (90.0%)	0.62 (0.32-1.17)	0.187
Hospital	14 (7.9%)	12 (6.7%)	1.19 (0.53-2.71)	0.815
Health centre	2	0		
Waiting mother's shelter	0	2		
Private (practice?)	1			
Church/prayer house	1	1		
Market	1	2		
Friends/relatives	1	1		
Field/ spring	2			
Travelling	1			
No contractions	4			
Total	178*	180		

*Two case responses were omitted ("removal of cerclage with bleeding" and "maternal health problems, no labour"). Total could not be more than 178. Respondents are likely to be included in "at the hospital"

Regarding the place of delivery, 174 cases (97.8%) and 134 controls (74.4%) said they delivered at the hospital. The difference between cases and controls delivering in the hospital was statistically significant (OR=14.93; 95% CI: 5.25-42.51; Fisher exact test p<0.001). Three cases (1.7%) said they delivered at a health centre[xv] and 1 replied that the nurse at the health centre had referred her to the hospital. Among controls, 40 (22.2%) said they delivered "at the health centre," while 2 others gave the name of a health centre under "elsewhere." Four controls (2.2%) said they delivered at home.

It is notable that 75% of controls said they had a hospital delivery. Possible reasons are mentioned in the discussion.

Table 3.1.12: (Q 46) Where did you deliver?

Place of delivery	Cases	Controls	OR	P-value
Hospital	174 (97.8%)	134 (74.4%)	14.93 (5.25-42.51)	<0.001
Health centre	3(1.7%)**	40 (22.2%)		
Home		4 (2.2%)		
Elsewhere	1 (referral)	2*		
Total	178	180		

*One control saying "elsewhere" did not specify further. Eliminated from replies as total cannot be more than 180.

** At the beginning of the study, referral health centres were performing caesarean sections

As for the choice of the place to deliver, 59 controls (32.8%) and 24 cases (13.5%), responded that it was the nearest place. The odds ratio of cases choosing the nearest place to deliver was 0.32 (95% CI: 0.19-0.54) (Fisher exact test p<0.001).

The proportion of controls (33.9%; n=61) who said they preferred the place of delivery was significantly higher than the proportion of cases (23.0%; n=41). While the reason for preference was not explored further, respondents who said that it was the nearest place were recorded separately from those expressing a general preference. The odds ratio of cases against controls preferring the place of delivery was 0.58 (95% CI: 0.37-0.93; p=0.031).

[xv] During the first month of the study, in December 2007, caesarean sections were performed at Bunia Cité Referral Health Centre, which was included for recruitment of cases until January 2008.

Significantly more cases (17.4%; n=31) than controls (5.0%; n=9) said they had followed the advice of a health worker. The OR of cases having followed a health worker's advice was 4.01 relative to controls (95% CI=1.85-8.69), a highly significant difference (p<0.001).

Six cases (3.4%) and 3 controls (1.7%) replied that they had followed the advice of someone else (OR 2.06; CI 0.51-8.36, Fisher exact test p=0.335). The number of respondents to the question was small and the difference not significant. Only two women (both controls) said they had no other choice.

The question "another reason" was answered by 115 cases and 57 controls, indicating that many cases *(39)* had more than one reason for their choice of the place to deliver. The majority of "other" reasons fell into four categories: transfer *(30)*, quality of care *(22)*, place of antenatal consultation *(17)*, financial reasons *(7)*.

3.1.14. TRAVEL TO THE PLACE OF DELIVERY

The question "did you have to travel to the place where you delivered" was answered by 351 respondents; 155 (44.2%) replied positively, 103/177 cases (58.2%) and 52/174 controls (29.9%). The odds of a case mother having to travel to the place of delivery was 3.27 times greater than for a control mother (95% CI: 2.10-5.08, Fisher exact test p<0.001). While the difference is highly significant, these figures need to be interpreted with caution, as the distance travelled was very short for many mothers in both groups.

Table 3.1.13 (Q 58) Did you have to travel to the place where you delivered?

	Cases	Controls	OR	p-value
Yes	103 (58.2%)	52 (29.9%)	3.27 (2.10-5.08)	<0.001
No	74 (41.8%)	122 (70.1%)		
Not recorded	1	6		

The distance from the place where labour started to the place of delivery ranged from 0 to 90 km. The median distance travelled for cases was four km. For controls, the median distance was 1 km. The maximum distance travelled was 35 km for controls and 90 km for cases. The difference in the median distance travelled between cases and controls was highly significant (Mann-Whitney U-test Z=7.302, p<0.001). Nineteen cases (19.1%) and only 2 controls (1.1%) reported travelling 10 km or more.

Table 3.1.14 (Q60) How many kilometres did you travel?

Percentiles	Cases	Controls
Minimum	0	0
5^{th}	0.5	0
25^{th}	2	0.7
50^{th} (median)	**4**	**1**
75^{th}	6	3
95^{th}	29.5	8
Maximum	90	35
Not recorded	17	30

Mann-Whitney U-test Z=7.302, p<0.001

After excluding replies of less than 1 km, 247 responses remained: 147 cases (82.6% of all cases) and 100 controls (55.5% of all controls). The median distance travelled, excluding less than 1 km, was 4 km for cases and 2.2 km for controls, a significant difference (Mann-Whitney U-test, p=0.001).

Table3.1.15 Distance travelled excluding <1km

Percentiles	Cases (n=140)	Controls (n=100)	p-value(Mann-Whitney)
25^{th} percentile	2.5km	1km	
MEDIAN	**4 km**	**2.25km**	**0.001**
75^{th} percentile	6 km	4km	

Mode of transport

A significantly higher proportion of controls (123/180=68.3%) compared to cases (69/178=38.8%) said they walked to the place of delivery (OR=3.41; CI: 2.21-5.27; Fisher exact test p<0.001). Controls were three times more likely than cases to have walked to the place where they delivered.

Public transport was used by 16 cases (9.0%) and 1 control (0.5%). The control who replied "public transport" specified that "she had been helped by a neighbour." Five cases said they used an ambulance and 2 more replied "bus," with "ambulance?" added in brackets as a comment by the interviewer. 1 case specified "transfer" without more details. Another 5 cases said they came by bus. This would suggest they came from outside Bunia, as there is no public bus service in the town area. Private transport was used by 94 cases (52.8%) and 49 controls (27.2%). The most used means of private transport was a motorbike (126/143; 88.1% of replies).

Duration of travel

The question about the time to reach the place of delivery was answered by 239 respondents (66.7%), 134 cases (75.3%) and 105 controls (58.3%). Answers ranged from 0 to 6 hours. The reply of five respondents (two cases and three controls) was recorded as zero. An additional three cases and 12 controls said it took less than 10 minutes to reach the place where they delivered. The median time taken to reach the place of delivery was 30 minutes for cases and 20 minutes for controls, a significant difference (Mann Whitney test; $p<0.001$)

3.1.15. SUMMARY OF INTERVIEW FINDINGS OTHER THAN COST

Regarding general characteristics, no significant difference was found in age, marital status or parity between the two groups. The median time of interview was 3 days after the date of delivery for cases and 7 days for controls. This could have reduced the difference in reported neonatal deaths between the 2 groups. Some early neonatal deaths among cases could have occurred after the date of interview.

There was no significant difference in the occurrence of fever, hypertension or bleeding during the last pregnancy, except for reported hypertension in early pregnancy, which was significantly higher among cases. Although differences were statistically not significant, the OR for cases against controls was greater than 1 for all three diseases. The same pattern was observed with regard to treatment at the health centre or hospital. While more cases had received treatment for all three conditions, the difference was not statistically significant. The precise nature and seriousness of reported conditions could not be explored further, since interviewers had no access to antenatal records. More cases than controls reported vaginal discharge and dysuria, though the difference was statistically not significant.

Based on tetanus vaccination status, the proportion of women receiving antenatal care was similar in both groups. Cases reported having more laboratory tests done, with the difference in urinalysis reaching statistical significance.

Concerning previous pregnancies, cases had significantly more stillbirths, prolonged labour and caesarean sections. Cases reported a significantly higher number of children not surviving. While there was no difference between cases and controls in the reported number of pregnancies and deliveries, the median number of children alive was significantly higher among controls.

A significant difference was found in the duration of labour for the last delivery, with cases reporting a median of 10 hours and controls a median of 6 hours. There was no significant difference in duration of labour between cases and controls who reported a previous CS. This could have been due to the small number of controls *(5)* reporting a previous CS. The duration of labour for cases reporting this to be the first delivery was significantly longer than for controls.

The number of perinatal deaths among cases was more than 4 times higher than among controls. The difference between cases and controls reporting the child to be alive but not in good condition was also highly significant.

Fever after delivery was more frequently reported by cases, while controls reported more severe bleeding. The difference for fever was statistically significant. The difference for bleeding was close to significant (p=0.061). Cases reported significantly more other illness after delivery. It is possible that the responses were influenced by the time of interview, which was closer to delivery for cases than for controls.

Three times more controls than cases said they chose the nearest place to deliver. Significantly more controls said they preferred the place. Significantly more cases reported having followed the advice of a health worker.

Significantly more cases than controls said they travelled to the place of delivery, with the median distance travelled by cases significantly longer than for controls. Significantly more controls than cases walked to the place of delivery.

3.1.16. MULTIVARIATE ANALYSIS

In order to identify which of the factors identified in the univariate analysis reported above were, in mathematical terms, likely to be most important in terms of increasing the risk of a mother delivering by CS, a series of binary logistic regression analyses was performed. After a number of preliminary analyses to determine which potential predictors could be included in this analysis (particularly in the situation of variables for which the number of responses to one or more categories was small), a sub-set of the questionnaire items were selected as explanatory / risk variables for CS delivery. As the interview contained two questions about the duration of labour and as the total number of observations was higher when duration of labour was conservatively recoded into three groups, as described in the section “duration of labour” of this chapter, the variables included in the model used the categories “12-24 hours” and “more than 24 h”.

The variables listed below were selected as explanatory / risk variables for CS delivery:

- age of the woman on the day of interview
- total number of pregnancies
- number of children alive on the day of the interview
- fever during last pregnancy
- bleeding during last pregnancy
- hypertension during last pregnancy
- painful micturition during last pregnancy
- abnormal vaginal discharge during last pregnancy
- laboratory testing of blood during last pregnancy
- laboratory testing of urine during last pregnancy
- stillbirth at previous deliveries
- previous caesarean section
- duration of labour for this last delivery 12-24h
- duration of labour for this last delivery more than 24h.

As the matching of cases and controls was only by residency, this was considered inadequate to justify a conditional multivariate analysis, so all logistic regressions were unconditional. Initially, all the explanatory variables were entered into a full model, shown in Table 3.1.16.

Table 3.1.16 Unconditional Logistic Regression (full model)

Term	Odds Ratio	95%	C.I.	Coefficient	S. E.	Z-Statistic	P-Value
Blood test (yes/no)	1.2475	0.5638	2.7603	0.2211	0.4052	0.5458	0.5852
Fever (yes/no)	1.0324	0.5863	1.8179	0.0319	0.2887	0.1104	0.9121
Vaginal discharge (yes/no)	1.2643	0.6040	2.6462	0.2345	0.3769	0.6222	0.5338
Vaginal Bleeding (yes/no)	1.7109	0.7150	4.0938	0.5370	0.4451	1.2064	0.2277
Urinalysis (yes/no)	1.6621	0.7535	3.6666	0.5081	0.4037	1.2588	0.2081
Hypertension (yes/no)	1.4430	0.5359	3.8853	0.3667	0.5054	0.7257	0.4680
Dysuria (yes/no)	0.9688	0.4936	1.9013	-0.0317	0.3440	-0.0922	0.9265
Labour 12h - 24h	4.3244	2.3240	8.0467	1.4643	0.3168	4.6216	0.0000
Labour > 24 hours	6.9079	2.8202	16.9208	1.9327	0.4571	4.2282	0.0000
Age of mother	1.0851	1.0152	1.1597	0.0816	0.0340	2.4043	0.0162
Total pregnancies	1.1895	0.8986	1.5746	0.1736	0.1431	1.2129	0.2252
Number of children alive	0.5900	0.4163	0.8362	-0.5276	0.1779	-2.9656	0.0030
Previous stillbirth(s)	1.5085	0.6491	3.5056	0.4111	0.4302	0.9556	0.3393
Previous CS(s)	23.7481	8.4304	66.8970	3.1675	0.5284	5.9945	0.0000
CONSTANT	*	*	*	-2.8421	0.7107	-3.9992	0.0001

Final -2*Log-Likelihood:	343.3211
Cases included:	330

Likelihood Ratio	114.1440	14	0.0000

In this full model, five variables were independently significant predictors of a CS delivery: age of the mother ($p=0.016$), number of children alive on the day of interview ($p=0.003$), previous CS ($p<0.001$), duration of labour 12-24h ($p<0.001$) and duration of labour >24h ($p<0.001$).

The correlation between CS and number of children alive was negative, indicating that a CS delivery became less likely as the number of children the mother had delivered increased. The strongest predicting factors for having a CS were duration of labour for this last delivery and CS for a previous delivery. Although the number of pregnancies did not reach statistical significance in the full model, the number of children alive was a strong negative predictor of CS. Replacing question 34 "how many times have you been pregnant" by question 35 "how many children have you delivered" did not make a noticeable difference to the model. Since including both variables would have resulted in statistical colinearity, only question 34 was retained in the final model.

Prolonged labour at previous deliveries was significantly more frequent among cases than among controls in the univariate analysis. Since this variable did not quite reach the conventional 5% significance level in the development of the full model, it was not retained.

A reduced (parsimonious) model containing only statistically significant ($p<0.10$) terms was then obtained by systematically removing the non-significant variables, starting from the variable with the highest p-value (backwards stepwise elimination). The result was the model containing the following 7 independent variables (Table 3.1.17):

-urinalysis during pregnancy

-duration of labour 12-24h

-duration of labour > 24h

-age of woman on the day of interview

-total number of pregnancies

-children alive on the day of interview

-previous caesarean section.

In this parsimonious model, "number of previous pregnancies" did not reach conventional statistical significance ($p\leq0.05$) but was sufficiently close ($p=0.071$) to justify its retention in this (essentially exploratory) parsimonious model. The model indicated that the odds of having a CS increased with each pregnancy (OR = 1.28; 95% CI=0.98-1.68; p=0.07). The OR for women with a previous CS having a CS at the current delivery was 23.79 (95% CI=8.60-65.82; p<0.0001). The odds of having a CS increased with duration of labour, especially labour beyond 24h.

Table 3.1.17 Unconditional Logistic Regression (restricted model)

Term	Odds Ratio	95%	C.I.	Coefficient	S. E.	Z-Statistic	P-Value
Urinalysis (yes/no)	2.0338	1.1880	3.4818	0.7099	0.2743	2.5880	0.0097
Labour 12 h- 24h	3.9885	2.1843	7.2828	1.3834	0.3072	4.5033	0.0000
Labour > 24 hours	6.8317	2.8505	16.3733	1.9216	0.4460	4.3087	0.0000
Age of mother	1.0823	1.0135	1.1558	0.0791	0.0335	2.3602	0.0183
Total pregnancies	1.2681	0.9792	1.6423	0.2376	0.1319	1.8007	0.0718
Number of children alive	0.5561	0.4010	0.7713	-0.5867	0.1668	-3.5168	0.0004
Previous CS(s)	23.6492	8.5485	65.4250	3.1633	0.5192	6.0929	0.0000
CONSTANT	*	*	*	-2.6212	0.6742	-3.8879	0.0001

Convergence:	Converged
Iterations:	6
Final -2*Log-Likelihood:	348.1977
Cases included:	331

Test	Statistic	D.F.	P-Value
Score	92.3516	7	0.0000
Likelihood Ratio	110.6386	7	0.0000

3.1.17 USER COST

Cost of transport to the place of delivery

The question "how much did you pay to get to the place where you delivered" was answered by 306 respondents, 157 cases (88.2% of all cases) and 149 controls (82.7% of all controls). In both groups, a large number of respondents reported no cost (response 0): 82/157 cases (52.2%) and 115/149 controls (77.2%) [Fisher exact test $p<0.001$]. One case reported to have spent 70,000 Congolese francs (FC) [xvi], the equivalent of 140 USD on transport to the place of delivery. At the time of the data entry into EPI-info, the lead researcher verified the accuracy of this response with the interviewers. They insisted that the reply had been correctly recorded and that the woman had travelled a long distance at night. It was decided to include the value in the dataset for analysis, which had a minimal effect on the median value of expenditure. The maximum expenditure for controls was 8000 FC (16USD).

If all available data are included, the median expenditure for the sample was 0, with 75th percentile of 500 FC (1 USD). Exclusion of the 0 responses left 75 cases (42.1% of all cases) and 34 controls (18. 9% of all controls) having paid to reach the place where they delivered. After excluding those who reported 0 travel cost to reach the place of delivery, the median expenditure for transport to the place of delivery was 700 FC (1.4USD) for cases and 500 FC for controls. The 25th and 75th percentiles were 500 FC and 1,500 FC for cases; for controls the same values were 300 FC and 700 FC. The difference is statistically highly significant (Mann-Whitney $p<0.001$).

Cost of transport to go home

The cost of going back home (n=195) was estimated to be 0 by 86 (44.1%) respondents, 26/86 cases (30.2%) and 60/109 controls (55.0%) [Fisher exact test $p=0.001$]. The maximum

[xvi] The official exchange rate of the Congolese Franc against the US dollar was 500 at the start and 550 at the end of the study. Conversions were made using the value of 500.

value given for going home was 45,000 FC (n=1) with 78.5% paying less than 1000 FC and 97.9 % less than 10,000 FC.

Excluding those who said they paid nothing to go home leaves 109 respondents, 60 cases and 49 controls. The median payment for transport home was 850 FC (1.7 USD) for cases (25th percentile 600 and 75th percentile 45.000) and 600 FC (1.2USD) for controls (25th percentile 500 and 75th percentile 1000 FC). The difference is statistically significant (Mann-Whitney p=0.002).

Table 3.1.18: Cost of transport to and from health structure excluding 0 responses

To health structure ↓	Cases (n=75)	Controls (n=34)	P-value
Median	700 FC	500 FC	<0.001
25th percentile	500 FC	300 FC	
75th percentile	1,500 FC	700 FC	
From health structure ↓	**Cases (n=60)**	**Controls (49)**	**P-value**
Median	850 FC	600 FC	=0.002
25th percentile	600 FC	500 FC	
75th percentile	45,000 FC	1000 FC	

Cost of staying at the hospital

The cost of staying at the hospital (excluding transport) was between 0 and 85,500 FC with a median of 3,200 FC.

If all responses are included, the median amount paid for obstetric care by controls was 3,725FC (7.45USD), considerably higher than the amount paid by cases, which was 500 FC (1USD). Among the respondents, the proportion of cases (70/145) (48.3%) who reported 0 payment for hospitalization was higher than the proportion of controls (29/156) (18.6%). (Fisher exact test p<0.001).

When excluding the 0 responses from the analysis, there were 202 respondents, 75 cases (42.1% of all cases in sample) and 127 controls (70.5% of all controls). The difference in the amount paid becomes highly significant (p<0.001) with cases paying a median amount of 34,400 FC (68.8 USD) and controls paying a median amount of 5,300FC (10.6 USD).

Table 3.1.19 (Q63) How much did/will you pay for staying at the place where you delivered, including the cost of all treatment?

Payment for hospitalization	Cases	Controls	p-value
Median including all answers	500	3725	0.9
Median excluding 0	**34400**	**5300**	<0.001
25th percentile excluding 0	12000	2250	
75th percentile excluding 0	50000	8550	

3.1.18 DISPOSABLE INCOME

To estimate the financial burden of obstetric care, two questions were added: the family's disposable monthly income and the individual income. The question about individual income could not be analyzed, as the responses were not expressed in numerical values. The figures below relate to questionnaire item 65: "What is the monthly disposable income of your family or household?"

An estimated monthly income was provided by 260 respondents, 129 cases and 131 controls. The median monthly family income was 30,000 FC (60 USD). One case reported a monthly income of 500,000 (1000 USD), another case reported to have no income (answer = 0).

The median monthly income for cases was 30,000 FC (60 USD) and 26,000 FC (52 USD) for controls (p=0.085). Although the difference did not reach statistical significance at p=0.05, the median reported monthly disposable income was 4000 FC (8USD) lower for controls than for cases. Taking the median reported income of all respondents as the standard, it would take an average of four days work to gain 8 USD in Bunia.

3.1.19 SUMMARY OF ECONOMIC INFORMATION

The interviews included questions about the cost of transport, the cost of delivery and the disposable income of respondents.

More than 50% of respondent cases and more than 75% of respondent controls reported that they had not paid anything for transport. Although reported expenditure on travel was low when compared to the cost of delivery, the sum of the median travel cost to and from the place of delivery represented more than a day's work.

Among those who paid, the median cost of transport to and from the place of delivery was significantly higher for cases than for controls.

After excluding zero responses, a higher proportion of controls (70.5%) than cases (42.1%) reported hospitalization cost (including medical care). Among these respondents, the median cost for cases was more than six times the median cost for controls. The median cost of a CS was in excess of a month's average disposable income, while the median cost of a vaginal delivery represented less than a week's income.

Although the difference was statistically not significant, the median reported monthly income of controls was considerably higher (8 USD, around four days of work) than that of cases.

3.2 EFFECTIVENESS

The population data needed to estimate effectiveness were obtained from the Ministry of Health Department of Public Health for the Bunia Health Zone. The figures were projections from the National Institute for Statistics (INS), based on the population census of 1984, which were used for micro-planning in the ongoing polio eradication campaign. With a 4.7% birth rate and an estimated total population of 209,604 the predicted number of births in 2008 was 9851. (78)

Service information was collected over a period of six months, covering December 2007 to May 2008. Interviews for the case-control study took place between 4th December 2007 and 23rd June 2008. Calculations for the six-month period covered by the study used 4925 as denominator for expected births (9851/2= 4925.5, rounded down). Bunia is situated at 1.57 degrees latitude north of the Equator and seasonal variations over six months approximate the climate throughout the year.

The total number of deliveries recorded in 20 health structures in Bunia Health Zone during the same period was 4154. Of these, 1664 deliveries (40.0% of recorded and 33.8% of expected total) were recorded in 16 health centres. The other deliveries took place at health facilities providing EMOC, four hospitals and one referral health centre (Bunia Cité). Since the referral health centre stopped performing CSs in January 2008, the structure was considered as an EMOC facility for the first two months of the study, and as a health centre for the remainder of the observation period. During six months, 479 CSs were recorded in the Health Zone (see table 3.2.4 for distribution among health structures).

Maternal deaths were counted over a period of seven months, from December 2007 until the end of June 2008. As the lead researcher was present in Bunia in November-December 2007 and in June-July 2008, the team was asked to use the longest possible reporting period for maternal death, a relatively rare event.

The research team took note of every report of a maternal death in health structures and in the community. Of the 15 reported deaths, 11 occurred in a hospital. Three of these deaths were women who had a caesarean section.

3.2.1. MEASUREMENT OF PROCESS INDICATORS

Data collection was based on the indicators proposed in the 1997 guidelines for monitoring the availability and use of obstetric services. (89) The originally proposed indicators were:

1. The amount of EMOC services available
2. The geographical distribution of EMOC services
3. The percentage of expected births in the area served taking place in the EMOC facility
4. The proportion of women with complications delivering at the EMOC facility
5. The proportion of caesarean sections (of all expected deliveries in the area served)
6. The case-fatality rate, or the proportion of women with obstetric complications, admitted to a facility, who die (maximum 1%).[xvii]

In 2009, revised UN process indicators for monitoring EMOC were issued jointly by the UN agencies and the Averting Maternal Death and Disability Programme (AMDD) at Columbia University. (77) By that time, the field study had been completed. The original six indicators had been modified, and two new indicators added. Below is the revised list of indicators:

[xvii] Only deaths before discharge from the facility are counted for the direct obstetric case fatality rate (indicator 6 in: WHO, UNFPA, UNICEF, AMDD. (Monitoring Emergency Obstetric Care, A Handbook. WHO 2009. p31)

1. Availability of emergency obstetric care: basic and comprehensive care facilities
2. Geographical distribution of emergency obstetric care facilities
3. Proportion of all births in emergency obstetric care facilities
4. Meeting the need for emergency obstetric care: proportion of women with major direct obstetric complications who are treated in such facilities
5. Caesarean sections as a proportion of all births
6. Direct obstetric case fatality rate
7. Intrapartum and very early neonatal death rate
8. Proportion of maternal deaths due to indirect causes in emergency obstetric care facilities

To calculate the six original indicators a checklist of *signal functions* (Table 3.2.1.) was filled out monthly at four hospitals and every two months at 16 health centres.[xviii] Perinatal deaths in health structures were recorded, in the case of intra-uterine death indicating whether the stillbirth was macerated or not. Information about maternal deaths was obtained from hospital records and from relatives of the deceased.

Repeated assessment of the health centres (every two months) showed that none of these structures performed all the signal functions of Basic EMOC, though three large centres (Saio, Bunia Cité, and Bomoi) had the capacity to carry out some of these functions as well as performing CSs. At the time of the study the health system was being reformed, emphasizing the role of health centres as the first line providers of a minimum care package, with hospitals as referral structures. (30) As a result, former referral health centres such as Bunia Cité were no longer permitted to perform CSs. Bomoi and Saio (also called Clinique Davenport) are private structures, the former a private-for-profit structure in the town centre of Bunia, the latter supported by a faith-based international group. Rwankole (RW), one of the four hospitals included in the case-control study, did not admit patients during the night. In the context of this study three hospitals were considered potential round-the-clock providers of comprehensive EMOCS. Table 3.2.1 shows the assessment of signal functions in these hospitals.

[xviii] Clinique Freedom, one of the 16 health centres included in the list, was closed and relocated in February 2008. Deliveries at this centre were only recorded in December 2007 and January 2008.

Table 3.2.1: performance of signal functions by EMOC facility: Y=yes, N=no

SIGNAL FUNCTIONS	HGR	CME	BM
Administer parenteral antibiotics	Y	Y	Y
Administer uterotonic drugs (i.e. parenteral oxytocin)	Y	Y	Y
Administer parenteral anticonvulsants for pre-eclampsia and eclampsia (i.e. magnesium sulphate)	N	N	Y
Manually remove the placenta (-)= no elbow gloves	Y (-)	Y(-)	Y
Remove retained products (curettage)	Y	Y	Y
Perform assisted vaginal delivery (vacuum extraction)	Y	N	Y
Perform basic neonatal resuscitation (with bag and mask)	N	Y	Y
Perform surgery	Y	Y	Y
Perform blood transfusion (-) = no storage	Y(-)[xix]	Y(-)	Y

Only Bon Marché (BM) performed all of the signal functions. As in other Bunia health structures, the procedure to remove retained products of conception was curettage. Centre Médical Evangélique (CME) did no assisted deliveries (i.e. vacuum extraction) and had no elbow length gloves for manual removal of the placenta. At the Hôpital Général de Référence (HGR), no elbow length gloves were available and there was no ambu-bag for resuscitation of the newborn. Magnesium sulphate as an anti-convulsant was only used at BM (reportedly available at Saio). Other parenteral anticonvulsants, such as diazepam, were available at HGR and CME. While recognising the limitations of CME and HGR as EMOC providers, excluding these structures from the analysis would have distorted the findings and made it difficult to formulate recommendations.

According to the health authorities (Dr Assani Bubakari, EPI programme), the Bunia Health Zone covers an area of 450 km^2. The spatial distribution of the hospitals providing comprehensive EMOC was somewhat uneven, with BM and HGR at close proximity in the north-western part of urban Bunia near the airport. At the beginning of the study period, CME moved its hospital from the town centre to “Yambi,” a place near the south-eastern Kindia neighbourhood of Bunia. RW, where only daytime surgery was done, is located due east. Urban Bunia covers a more limited surface. For health service users living in the town

[xix] HGR is situated less than 1km from the central laboratory, which has a blood storage facility

area, the distance to travel was short: ninety percent of respondents to the case-control questionnaire said they had travelled 6 km or less to their place of delivery. However, the security situation may have been a deterrent for some women to travel at night.

The total number of births in the three hospitals providing emergency obstetric care services round the clock during the study period was 2171 or 44.1% of the expected number of deliveries during the same period *(4925)*. The three round-the-clock providers of EMOC performed 52.3% of all deliveries recorded in health structures during the study period (Table 3.2.2).

The 2009 monitoring guidelines (77) strongly recommended the use of a parallel indicator, the proportion of births (using the number of women giving birth as the numerator) in all health facilities in the Health Zone, or "institutional births." The recorded number of women giving birth during the study period of six months was 4154 which is 84.3% of the expected number of births. This was thought to be an underestimate, as deliveries in some private health centres were not included.[xx] The study did not collect quantitative data on home deliveries. Only four (2.2%) of the interviewed controls said they delivered at home. As women were encouraged to deliver in health facilities, this could also be an underestimate.

Table 3.2.2: deliveries by structure providing EMOC

EMOC PROVIDER	DELIVERIES	% OF TOTAL IN EMOC PROVIDING STRUCTURES		% OF TOTAL DELIVERIES (N=4154)	% OF EXPECTED DELIVERIES (N=4925)
HGR	445	(a) 20.5 %	(b) 17.9%	10.7%	9.0%
CME	153	(a) 7.0 %	(b) 6.1%	3.8%	3.1%
BM	1573	(a) 72.4%	(b) 63.2%	37.9%	31.9%
TOTAL (a)	**2171**			**52.3%**	**44.1%**
RW	208		(b) 8.3%	5.0%	4.2%
OTHER	111 *		(b) 4.4%	2.7%	2.2%
TOTAL(b)**	**2490**			**59.9%**	**50.6%**

Total (a): round-the-clock EMOC facilities. Total (b) all facilities performing CSs
* Deliveries recorded at Bunia Cité during December 2007 and January 2008. ** The sampling frame for the case-control study included Rwankole and Bunia Cité, the latter only for 2 months

[xx] The quality and workload of the private clinics not listed by the Ministry of Health could not be assessed

The fourth indicator, *the proportion of women with major direct complications treated in EMOC facilities (the met need)*, is calculated as the number of women treated with direct obstetric complications at emergency obstetric care facilities, divided by 15% of the expected number of deliveries in the area. Seven major direct obstetric complications are included in the numerator: haemorrhage (antepartum and postpartum), prolonged obstructed labour, postpartum sepsis, complications of abortion, severe pre-eclampsia and eclampsia, ectopic pregnancy and ruptured uterus. (77) To measure this indicator, complications treated in facilities not providing comprehensive round-the-clock EMOC (Rwankole, Bunia Cité and Bomoi) were also included.

Table 3.2.3: admissions with direct obstetric complications[xxi]

Health Structure→ ----------------- Complication↓	**HGR**	**CME**	**BM**	**RW**	**Other**	**TOTAL**
Haemorrhage	0	6	35	2	5	48
Postpartum sepsis	0	0	8	0	1	9
Complications of abortion	20	15	137	7	0	179
(pre)-Eclampsia	0	1	18	1	0	20
Ectopic pregnancy	0	0	17	0	0	17
Ruptured uterus	0	0	12	0	0	12
TOTAL*	20	22	227	10	6	*285*

* Prolonged obstructed labour is the 7th major direct complication. The number of women with prolonged labour was not counted by health facility. The proportion of caesareans for obstructed labour was extrapolated from the case-control study (see below for details)

Assuming that the expected number of deliveries during the six month study period was half the expected number of deliveries in 2008 (9851/2) = 4925.5 the figure 739 (4925.5x15/100 = 738.75) was used as the denominator for the expected number of women with direct obstetric complications to be treated. Concerning the numerator, information about the indication for caesarean section was only collected for cases recruited to be interviewed.

[xxi] The information presented in table 3.2.3 includes all admissions for abortion and not just those complicated with haemorrhage or sepsis.

Using the 2009 operational definition of prolonged/obstructed labour, (77) malpresentation, foeto-pelvic disproportion, scarred uterus, protracted labour and dystocia together comprised 60% of the indications from theatre registers for interviewed cases (107/177; register inaccessible for one case) (Annex 6). Assuming that cases were a representative sample of the total number of CSs, the number of women with prolonged obstructed labour during the study period was therefore estimated to be 60% (95% CI 52.5-67.4%) of the total number (479) of CSs (479x0.6) = 287 (95% CI: 252-323). The numerator becomes (287+285) = 572. Thus the proportion of women with major direct complications treated in all EMOC facilities in Bunia was (572/739) = 77.4% (CI 72.7%-82.3%). Using the same assumption (60% of CSs for obstructed labour) the three round-the-clock EMOC facilities (BM, HGR and CME) together treated (269+257/739) = 71.2% of the same complications and BM alone treated (227+215/739) = 59.8% of major direct complications, including complications of abortion.

Complications of abortion comprised 31.3% of all major direct obstetric complications included in this calculation. The major complications of abortion, haemorrhage and sepsis, are more likely to occur following an unsafe procedure. (93, 94) At the time of the study, abortion was illegal in the DRC. Detailed information about the indications for abortion-related admissions was not collected in this study. The observed gap in the met need could possibly be explained by a failure to adequately address complications requiring interventions other than caesarean section.

The fifth indicator, *caesarean sections as a proportion of all births*, can be calculated for all facilities as well as for the EMOC facilities. The total number of CSs in the study area was 479, out of which 429 were performed in the three comprehensive EMOC providing structures (HGR, BM,CME), and 29 in RW. CSs performed in Bunia Cité, a referral health centre, and in other health structures not included in the sampling frame, account for the remaining 21 procedures. BM alone performed 359 CSs. The proportion of all CSs was 9.7% of the expected number of live births in the area. For CSs performed in the three comprehensive EMOC facilities, the proportion was 8.7% of all expected live births in Bunia Health Zone, and for BM alone the proportion was 7.3%.

Table 3.2.4: Distribution of surgical deliveries among health structures in Bunia

Facility→	**BM**	**RW**	**CME**	**HGR**	**Bunia Cité** (2 months)	**Other**	**Total**
CSs recorded	359	28	29	41	4	17	479
% Total	74.9%	5.8%	6.0%	8.5%	0.1%	3.5%	100%

The 2009 “Handbook on Monitoring Emergency Obstetric Care” recommended estimating the unmet need by subtracting the observed number of major obstetric interventions performed for absolute maternal indications from the estimated number of absolute maternal indications. The estimated “absolute” need over the study period was (4925x1.4/100) =69. The factor 1.4 (CI: 1.27-1.52) used in the Handbook was based on findings from studies in five Sub-Saharan countries, and Haiti, Morocco and Pakistan. Absolute maternal indications are: antepartum haemorrhage due to placenta praevia or abruptio placentae, abnormal presentation, major foeto-pelvic disproportion and uncontrollable post-partum haemorrhage. (77)

The number of major obstetric interventions performed for absolute maternal indications was extrapolated from the proportion of CSs with an absolute indication among cases in the study. Indications for CS were copied from the register and re-coded into categories, such as previous CS, foetal distress, malpresentation, placenta praevia, bleeding, and foeto-pelvic disproportion. The full list of indications among cases, including transcripts of theatre records and re-coded indications, can be found in Annex 6. The indications retained as “absolute maternal” were: placenta abruption *(3)*, bleeding *(4)*, foeto-pelvic disproportion *(15)*, twins with shoulder presentation of second twin *(1)*, malpresentation *(19)*, malpresentation and placenta praevia *(1)*, placenta praevia *(7)*, ruptured uterus *(4)*, and prolonged labour *(3)*. The proportion of CSs with an absolute maternal indication in the study sample was therefore (57/178) = 32.0% (CI: 25.2-39.4). Assuming a representative study sample, the observed number of major obstetric interventions performed for absolute maternal indications was (479x32/100) = 153.3 (CI: 120.7-188.7). The difference between the observed and the expected number of obstetric interventions performed was (69-153) = -84 (CI: -52 to -120). According to this indicator, there was no unmet need for surgical interventions to treat absolute maternal indications. Possible reasons why the estimated absolute need was exceeded by 52 to 120 CSs are explored in the discussion chapter.

The sixth indicator, *the direct obstetric case fatality rate*, is the proportion of women admitted to an EMOC facility with major direct obstetric complications, or who develop such complications after admission, and die before discharge. The numerator for met need from the fourth indicator (572) is used as the denominator for this proportion. Fifteen maternal deaths were recorded over a seven-month period from 01 December 2007 to 30 June 2008 and eleven of these occurred in an EMOC facility. Another woman was taken to the hospital after delivery but was dead on arrival. One maternal death in the hospital was reportedly due to Kaposi's sarcoma in a HIV infected patient. Direct maternal deaths over six months were: [(11-1/7) x6] = 8.6 rounded up to nine.

The direct obstetric case fatality rate in the three EMOC facilities was (9/572) =1.6%. The 2009 Handbook suggested a maximum acceptable level of 1%. The benchmark is quoted as representing a "reasonable maximum acceptable level" based on monitoring data from hospitals in several low-income countries. (77) Since the observed level was higher than the maximum level, it would be useful to investigate the causes of the institutional maternal deaths to check whether some of them could have been avoided and if so, how this could be done.

The data collection for this research did not cover the two new process indicators, published in 2009. (77) The information below made use of the available collected information to estimate the perinatal death rate, and the proportion of maternal deaths due to indirect causes, in EMOC facilities.

The intrapartum and very early neonatal death rate (within 24 hours of delivery), the seventh indicator, uses the number of women who gave birth in the facility as a denominator. It is recommended to exclude low birth weight infants from the numerator. Information on birth weight was not recorded in this study. The 2001 Multiple Indicator Cluster Survey published in 2002 (95) found that only 50% of Congolese mothers interviewed reported their child to have been weighed at birth. Of these, one third was able to provide a written record. On the basis of this information, the overall proportion of LBW (<2,500gm) was estimated to be 11%, with mothers' recall at 10% and written records at 12%.

The denominator (2171) used for indicator seven, the intrapartum and very early neonatal death rate, is the same as the numerator for indicator three. The original indicator three measured the percentage of expected births in the area served taking place in the EMOC facility.

The revised indicator of the 2009 Handbook looked at the proportion of all births in emergency obstetric care facilities. Both indicators used the number of births in EMOC facilities as the numerator.

The number of fresh stillbirths in the three EMOC facilities was 44. The total number of stillbirths in the same facilities was 86. The number of very early neonatal deaths was not recorded separately. The number of early neonatal deaths (within seven days after delivery) in the same facilities was 25, bringing the total number of perinatal deaths, excluding macerated stillbirths, to 69. If macerated stillbirths are included, the number of perinatal deaths in the three comprehensive EMOC facilities was 101.

Including all the observed health structures in Bunia, the total number of stillbirths was 103, and the number of (early) neonatal deaths was 39, increasing the total number of perinatal deaths to 142. The guidelines do not provide a standard for comparison. The intrapartum and early neonatal death rate in the three EMOC facilities was (69/2171) = 32/1000. If all stillbirths are included, the perinatal death rate was 46/1000 for the three EMOC facilities and (142/2724) = 52/1000 for all health structures providing some EMOC (denominator includes deliveries in Bomoi, Saio, RW and 2 months for Bunia Cité). No adjustment was made for LBW. The UN estimated perinatal death rate in the DR Congo in 2006 was 76/1000. (96) Compared to the highest observed rate in Bunia of 52/1000, this constitutes a reduction of 31% in the perinatal death rate.

3.2.5: Stillbirths, early neonatal deaths, perinatal deaths

Table 3.2.5 (a): intrapartum and early neonatal deaths

	Fresh Stillbirths	**Early Neonatal Deaths**	**Total**
3 EMOC structures	44	25	69

Table 3.2.5 (b): perinatal deaths

	All Stillbirths	**Early Neonatal Deaths**	**Total**
3 EMOC structures	86	25	101
All structures	103	39	142

Sixteen perinatal deaths were reported by interviewees in the case-control study, 13 among cases and three among controls. The perinatal death rate was (13/178) = 73/1000 among cases and (3/180) = 17/1000 among controls.

The research team also collected information about perinatal deaths in the community during the study period. Out of 17 deaths, 16 were reported to have occurred in a health structure. For the one remaining event only the neighbourhood and date were provided without details about the place of birth or cause of death.

The eighth indicator is *the proportion of deaths due to indirect causes in EMOC facilities during the study period*, taking all maternal deaths in the same facilities during the same period as the denominator. Eleven maternal deaths occurred in the three comprehensive EMOC facilities during the study period. One maternal death related to HIV/AIDS (Kaposi sarcoma) was classified as due to indirect causes. The proportion of deaths due to indirect causes in EMOC facilities was (1/11) =0.09. The handbook does not provide a reference level.

3.2.2. ESTIMATED EFFECTIVENESS OF CAESAREAN SECTIONS

Unplanned CSs are emergency procedures aiming to save the life of a mother and/or the child. Ten of the interviewed cases reported not to have been in labour. Indications for CS among these cases were: bleeding *(5)*, pre-term rupture of membranes and foetal distress *(1)*, foetal distress in a fifth pregnancy with no surviving children *(1)*, more than one previous CS *(2)* and failed induction *(1)*. Cases with more than one previous CS are not considered "elective". No further details were given for the case with foetal distress and no surviving children. For the other cases, CS was unplanned and the indication justifiable.

Assuming that all CSs performed in the study area were intended to either save the life of mother and/or child, or to avoid serious disability, 32% (CI: 25.2-39.4) of CSs in the sample were performed for absolute maternal indications (i.e. to save the mother's life). As there were no elective CSs in the study sample, the remaining interventions would have primarily intended to save the life of the foetus.

Foetal distress was the *only* indication for CS in 31 cases (17.4%), with another 15 indications including foetal distress, suggesting that survival of the child was the main indication in 25% of surgical interventions. CSs for prolonged/obstructed labour are performed to save the life of the child and to avoid serious disability such as vesico-vaginal fistula and possibly death (e.g. ruptured uterus, sepsis) of the mother. (97) According to theatre records, 60% of CSs performed on cases in the study sample could be categorised as prolonged/obstructed labour.

Because morbidity due to CS is mostly temporary, the effectiveness of a CS can be expressed as the number of adult women's deaths and newborn deaths averted. Using the denominator from indicator six, the direct obstetric case fatality rate in Bunia during the study period was 1.6%. If all women with obstetric complications were admitted to an EMOC facility and treated appropriately, direct maternal mortality should be reduced by 99.0% in a standard setting. (77)

In this study, the observed reduction in maternal mortality would be 98.4%, since women with obstetric complications treated in a hospital in Bunia had a 98.4% chance of survival.

The denominator for indicator six included all admissions with "major direct complications." This denominator not only comprises CSs but all major direct complications of pregnancy, including complications of abortion and ectopic pregnancy. As mentioned before, complications of abortion comprised 31.3% of the denominator for indicator six. Direct obstetric deaths, including complications of abortion (13%), contribute to around 80% of all maternal deaths. (98) There were no reported hospital deaths due to complications of abortion or ectopic pregnancy.

All the maternal deaths reported during the study period were related to childbirth. Three of the hospital deaths occurred in women who had a caesarean section (0.6% of all CSs). Thus among CSs the chance of survival of the mother was 99.4%.

The effectiveness of EMOCS can be expressed as the number of maternal and infant deaths avoided in comparison to the situation before the services were set up, or to a (hypothetical) situation with no available services. It can also be compared to an optimal situation with all services available, accessible to all, and 100% efficient. The closest "optimal" scenario would be the situation in a high-income country with very low maternal and perinatal mortality.

The analysis below makes a comparison of the observed number of maternal deaths with numbers that would be expected if the national maternal mortality ratio applied. The figures at the national level are used as an approximation of the situation in Bunia without humanitarian assistance. A second comparison uses the reported MMR in Ituri for the period before the start of humanitarian action.

The third estimate of effectiveness is based on the proportion of CSs performed for absolute maternal indications. The fourth estimate compares the observed maternal mortality to the "absolute need," using 1.4% of expected deliveries as a minimum benchmark, (see indicator five above). Absolute maternal indications are exclusive of CSs for foetal indications. The UN minimum target for CS rates is 5%.

During a period of seven months, the research team was informed about 15 maternal deaths in health structures and in the community. Based on this observation, the projected annual number of maternal deaths for the year 2008 was (15/7x12) = 26, assuming there were no major fluctuations throughout the year. The reported figure only comprises obstetric deaths and maternal deaths occurring shortly after delivery. Some deaths in pregnancy and later on during the post-partum period may have gone unreported, and abortion-related deaths and some non-institutional deaths may have been missed. Adjusting the figure to allow for indirect causes and unreported deaths could increase the number by up to 30%. (99) This gives an estimated number of [26 + (26x0.3)] = 34 maternal deaths in 2008 and a MMR of (34/9851) = 345/100,000 live births.

Estimates of maternal deaths

<u>Estimate 1</u>

To estimate the effectiveness of EMOCS in Bunia, maternal deaths in the intervention zone were compared to figures reflecting the local situation before 2000 and to recent national survey data. The closest temporal baseline for maternal mortality in the DR Congo was the Demographic and Health Survey of 2007. (87) The estimated MMR obtained by the direct sisterhood method was 549/100,000 (CI not available) for the period 2002-2006. The previous estimate of 1289 for the period 1988-2000 had used the indirect sisterhood method as part of the 2001 Multiple Indicator Cluster Survey (MICS2). (95)

Applying the national estimate of 549/100,000 to the Bunia population, the expected number of maternal deaths in 2008 would have been 54.[xxii] The observed (adjusted) maternal mortality ratio of 345/100,000 was 37% less than would have been expected according to the figure of the 2007 DHS. Using this estimate, 20 maternal deaths would be avoided annually by EMOCS at the current level of service provision in Bunia. This figure does not take into

[xxii] According to WHO and the polio-eradication programme the estimated number of live births in the Bunia Health Zone was 9851 for a mid-year population of 209, 604

account other services that could have influenced maternal mortality, such as ANC. As an emergency hospital, BM did not offer ANC.

A recent multi-country study of maternal deaths (direct, indirect and HIV-related) using multiple data sources and improved methods, estimated the maternal mortality ratio in the DR Congo in 2000 at 607/100,000 (95% CI: 379-927) and in 2008 at 534 (95% CI: 311-856). (100) The "adjusted observed maternal mortality" during the study in Bunia in 2008 falls within the confidence interval, at the lower end.

<u>Estimate 2</u>

A country case study by Basics for USAID cites a Ministry of Health figure for maternal mortality in Ituri in 1999 of 905/100,000. (33) Applying this ratio to the Bunia population, the expected number of maternal deaths in 2008 would have been 89. The observed (adjusted) MMR of 345/100,000 was 62% less than would have been expected according to the 1999 estimates for Ituri. Using this estimate, 55 maternal deaths would be avoided annually by EMOCS at the current level of service provision in Bunia.

<u>Estimate 3</u>

Since 32% (CI: 25.2–39.4) of CSs were performed for absolute maternal reasons, the reduction in maternal deaths, assuming that 99.4% of obstetric surgery patients survived, would be (479x0.32x0.994) =152 (CI: 119-188) over six months. The annual number of maternal deaths avoided would be 304 (CI: 238-376). This figure refers to the estimated reduction in direct obstetric mortality.

<u>Estimate 4</u>

Setting the absolute maternal need at 1.4% of all deliveries, the expected number of maternal deaths without EMOCS would have been (9851x0.014) = 138. Comparing the observed adjusted figure to a situation without EMOCS, the number of maternal deaths averted would be (138 – 34) =104. The estimate of 34 includes indirect deaths.

Estimates of effectiveness of humanitarian assistance at reducing maternal deaths

The total number of CSs performed during the observation period of six months was 479 i.e. 9.7% of the total number of deliveries. Of these, 359 (75%) were performed at BM, a hospital managed by an international humanitarian organisation providing emergency healthcare free of charge. The average CS rate in the DR Congo during the same time period was 4%. (87) The 2007 Demographic and Health Survey also found that CS rates were higher in North Kivu (10%) and South Kivu (15%).

Both these provinces were recipients of humanitarian aid, including healthcare assistance. The assumption that humanitarian assistance and the provision of healthcare services free of charge result in an increase of the CS rate seems justified.

Estimate 1

Assuming that the proportion of CSs exceeding 4% can be attributed to the presence of BM, 561 caesareans (5.7% of 9851) would have been performed in 2008 in addition to the expected number, resulting in the avoidance of 20 maternal deaths in 2008. According to this estimate, at the current level of service provision, (561/20) = 28 CSs were required to avert one additional maternal death.

The estimated maternal mortality in Bunia in 2008 was based on a seven-month reporting period (December 2007-June2008) and increased by 30% to adjust for unreported and missed maternal deaths. The size of the adjustment factor is arbitrary, although similar to WHO applied adjustments to national direct sisterhood survey data.[xxiii] Since the 95% CI of the 2008 multi-country study estimate for the DRC is wide (311-856) and includes the adjusted 2008 estimate for Bunia (345), the number of deaths avoided cannot be calculated.

Estimate 2

Assuming that 55 maternal deaths were avoided by performing 561 additional caesareans, ten caesareans were required to avoid one additional maternal death at the current service provision level.

[xxiii] The WHO estimates use national data on MMRs derived from sisterhood survey as proportions of maternal deaths among women of reproductive age, adjusted for the general fertility rate, percentage of births assisted by a skilled attendant, GDP per capita (based on purchasing power parity) and whether or not the country has complete death registration. The model also takes into account HIV-related mortality. (DHS vs WHO maternal deaths, *Maternal Mortality in 2000: estimates developed by WHO, UNFPA, UNICEF*,p7

Estimate 3

With 359 caesareans taking place at BM, the potential number of maternal deaths avoided over six months by humanitarian intervention would be (359x0.32x0.994) =114 (CI: 89-141). In 2008, EMOC as a part of humanitarian action would have avoided 228 (CI: 178–282) maternal deaths. Avoiding one maternal death would require (359/114) = 3.15 CSs.

Estimate 4

The hospital managed by a humanitarian organisation performed 75% of all CSs. The potential number of maternal lives saved in the context of humanitarian assistance would then be (104x0.75) = 78.

Difference between estimates in the reduction in maternal deaths

The estimate based on the number of CSs performed for absolute maternal indications, results in a higher number of maternal deaths avoided than any of the other estimates.

The first calculation was based on the most recent national MMR estimate in the DRC. It is possible that the difference between the observed and expected number of deaths was greater than the calculated figure. The 2001 Multiple Indicator Cluster Survey (MICS2), (95) using the indirect sisterhood method reported a maternal mortality ratio of 1289/100,000. The estimates from the indirect method apply to a period of 10-12 years before the survey. (101) According to the pre-2000 estimate 127 maternal deaths would have been expected in Bunia. The number of deaths avoided would then be (127 - 34) = 93. However, estimates based on the indirect sisterhood method are considered inappropriate in areas of civil strife and social dislocation. (102)

It is also possible that not every CS performed for an absolute maternal indication resulted in a maternal death avoided (estimate 3). Although a number of women would have died during or after childbirth without surgery, others might have survived with long-term disability as a consequence. According to WHO and UNICEF, maternal morbidity is 20 times higher than maternal mortality. (103)

Estimates of perinatal mortality

Estimate 1

Making Pregnancy Safer, WHO, developed comparative baseline figures for perinatal mortality. [xxiv] (69) Figures quoted for the DRC are 76 per 1000 births for perinatal mortality, (104, 105) with 42 stillbirths and 35 early neonatal deaths per 1000 births. During the observation period, the reported number of stillbirths in health structures was 103 (44 fresh stillbirths) and the reported number of early neonatal deaths 39, a total of 142 perinatal deaths over six months. The perinatal death rate, using the number of deliveries in all health structures providing some EMOC (2724) as the denominator was (142/2724) = 52/1000. The numerator and the denominator in this estimate respectively include perinatal deaths and deliveries at two larger health facilities providing some EMOC which were not included in the sampling frame for the case-control study (Bomoi and Saio). Based on this figure, the highest estimate, the expected number of perinatal deaths in 2008 would have been (52x9851)/1000 = 512.

Using the figures from the WHO model, the expected number of perinatal deaths would have been [(76x9851)/1000] = 749. According to this calculation, the number of perinatal deaths avoided during the year 2008 was (749 – 512) = 237. This is 32% less than the expected perinatal mortality.

Estimate 2

The most recent WHO estimate of early neonatal deaths (106) was 56/1000 live births. With a perinatal mortality of (42+56) = 98/1000 the expected number of perinatal deaths would have been (98x9851/1000) = 965 and (965-512) = 453 perinatal deaths would have been avoided, 47% less than the expected perinatal mortality.

Estimate 3

Since 32% of CSs were performed to save the life of the mother, the remaining 68% (CI: 60.6-74.8) would have been performed mainly to save the life of the child. The number of perinatal deaths avoided at 100% effectiveness would be (479x0.68) = 326 (CI: 290-358) over a period of six months. However, a number of perinatal deaths occurred in the EMOC

[xxiv] Perinatal mortality rate is the "number of deaths in the perinatal period during a specified period of time per 1000 total births (live births plus fetal deaths) during the same period of time." The perinatal period "commences at 22 completed weeks (154 days) of gestation (when birth weight is normally 500g) and ends seven completed days after birth.

facilities. Cases in the study sample reported 13 perinatal deaths, reducing the effectiveness of caesareans at saving the child's life by 7.3% (13/178). The number of perinatal deaths avoided over a six month period of time would therefore be (326x0.927) = 302 (CI: 269-332) and the number of perinatal deaths avoided in 2008 would be 604 (CI: 538-664).

Estimates of effectiveness of humanitarian assistance at reducing perinatal deaths

<u>Estimate 1</u>

An estimated additional 561 CSs were performed in Bunia in 2008 as part of humanitarian assistance. If the estimated reduction in perinatal mortality was attributable to the additional EMOC from the humanitarian provider, avoiding one additional perinatal death at the current level of service provision required (561/237) = 2.4 caesarean sections.

<u>Estimate 2</u>

If 453 perinatal deaths were avoided, (561/453) = 1.24 caesarean sections were required to avoid one perinatal death.

<u>Estimate 3</u>

To avoid 604 perinatal deaths, (479x2) = 958 caesareans would have been performed in 2008. Avoiding one perinatal death required (958/604) = 1.59 caesarean sections. Since the emergency hospital BM performed 75% of all caesareans during the study period, (604x0.75) = 453 (CI: 403 - 498) perinatal deaths were avoided by EMOC as part of humanitarian assistance in 2008.

Cost-effectiveness estimate in Health Adjusted Life Expectancy (HALE)

Estimate of expected life years saved

Making an estimate of the total number of (healthy) life years saved would allow comparison between the cost of caesarean section and other potentially life-saving interventions. In 2008 total life expectancy at birth in the DRC was 48 years (both sexes), while healthy life expectancy (HALE) at birth was 45 years in 2007. (106) The estimated HALE at age 60 was 10.2 years (uncertainty range 9.5-11.1 years) for Congolese women in 2002. (107) Doing a simple linear interpolation between the two healthy life expectancy figures, the healthy life expectancy of a 24 year old woman would be 31 years (i.e. the median age at the end of HALE = 55 years).

Adding together the expected healthy years of life for neonates and mothers results in a lower estimate of [(20x31) + (237x45)] = 11,285 years gained. According to the highest estimate, based on 32% maternal and 68% foetal indications, the total HALE gained amounted to [(304x31) + (604x45)] =36,604 years (CI 35,742-37,258).

With a 75% contribution of humanitarian assistance to EMOC 27,453 HALE years (CI: 26,877-27,928) were gained by the additional services provided at BM. At an annual cost of 103,514.22USD (explained below), the cost of humanitarian EMOC per year of Healthy Life Expectancy gained would be 9.17 USD for the lowest estimate of effectiveness and 3.77 USD (CI: 3.71-3.85) for the highest estimate.

3.3. COST OF CAESAREAN SECTION

3.3.1. PROVIDER COST

The cost of performing CSs at the 2008 level of performance was calculated for BM, CME, HGR and RW.

EMOC as a proportion of major surgery

The number of major surgical procedures was the only information available to calculate CSs as a proportion of surgical workload. Information regarding the type of major surgery performed was limited and likely to differ between hospitals. HGR did not employ a professional surgeon. The theatre at CME was used by a general surgeon and by an ophthalmic surgeon. A gynaecologist specialized in repair of VVF visited RW quarterly. BM only accepted emergencies; at the time of the study, the main activities of the hospital were paediatrics, obstetrics and gynaecology. For the purpose of costing, management of abortion complications was included under major surgical procedures. Although abortion complications could be considered to be part of EMOC, the treatment costs of abortion complications were not included in this study. When complications of abortion are included as major surgical procedures, CSs as a proportion of major surgery ranged from 12.2% to 66.6%. Information on the time and resources required for various different operations was not available. The proportions are based on the number of surgical interventions performed under general anaesthesia.

Caesarean sections as a proportion of in-patient admissions

Compared to the total number of admissions, the proportion of CSs was 3% at HGR, 5% at BM (2007 annual reports) and 4% at CME. (108) Because admission figures were not available for RW, the highest figure of 5% was used as an approximation.

Table 3.3.1: caesarean sections as a proportion of surgical procedures (6 months)

Procedure→ Hospital↓	**CS**	**Major surgery**	**Total (a)**	**Proportion CS**	**Abortion complications**	**Total (b)**	**Proportion CS**
BM	359	43	402	89.3%	137	**539**	66.6%
CME	28	186	214	13.1%	15	**229**	12.2%
HGR	41	134	175	23.4%	20	**195**	21.0%
RW	28	85 (VVF)	113	24.8%	7	**120**	23.3%

(a) excluding abortion complications; (b) including abortion complications

Caesarean section as a proportion of maternity admissions

CS patients as a proportion of deliveries were 9.2% at HGR, 13.5% at RW, 18.9% at CME and 22.8% at BM.

Table 3.3.2: caesarean sections as a proportion of deliveries (6 months)

Hospital→ Procedures↓	**BM**	**RW**	**CME**	**HGR**
Deliveries	1573	208	153	445
Caesarean sections	359	28	29	41
Proportion	22.8%	13.5%	18.9%	9.2%

The number of maternity beds allocated to surgical patients at BM was 50%. Bed-occupancy for obstetric surgery at BM was reported to be 119%. The head of the BM maternity unit estimated the proportionate maternity use for surgical delivery patients at 60%.

At the other hospitals, the proportion of maternity use by CS patients was unknown. Patients who underwent a CS were estimated to stay two-to-three times longer than those who had a vaginal delivery. Assuming a hospital stay of six days for CSs and three days for vaginal deliveries, the proportional use of maternity beds by CS patients would be 23.7% for RW, 31.8% for CME and 16.9% for HGR.

Table 3.3.3: proportionate use of maternity beds for surgical patients (6 months)

Hospital→ In-patient days	RW	CME	HGR
Caesarean sections	(28x6) = 168	(29x6) = 174	(41x6) = 246
Vaginal deliveries	(180x3) = 540	(124x3) = 372	(404x3) =1212
Proportion	(168/708) = 23.7%	(174/546) = 31.8%	(246/1458) = 16.9%

Provider cost estimates

a) Average cost of caesarean section

All known costs were added to obtain the total annual expenditure attributable to CS. Where some costs were unknown, estimates were made using the figures from another Bunia hospital, or international data as a reference. (Cost estimates are summarised in Annex 8, sheets 1-4). The total cost of providing CSs at the current level of service provision was estimated for each of the four hospitals. The cost of medicine was calculated as the average cost per CS, using international estimates as a baseline, and multiplied by the number of CSs for each hospital. The cost of feeding one patient for five days (the average hospitalization for a CS patient at BM) was multiplied by the number of CSs at BM.

For most of the costs, the total annual estimate was divided by the expected number of CSs to be performed at the health structure during the year 2008. The denominator was twice the number of CSs recorded over the six month observation period. Although no seasonal variations were expected, it is possible that CSs as a proportion of admissions increased towards the end of 2008 in CME and HGR, as BM aimed to reduce the number of admissions in anticipation of its closure. The effect of an increase in CSs in CME and HGR is tested in the incremental cost calculations below.

Some costs only applied to one or two structures: for example ambulances were only used at HGR and BM, and ultrasound equipment was only available at CME and BM. Only BM used two-way radios as a means of communication. Solar panels had been installed at RW as an alternative to an electricity generator.

Applying the methods described in the methodology chapter and using the above assumptions, the total cost in 2008 of providing CSs at BM was 103,514.22 USD. The average cost per CS was 144.17 USD at BM.

Table 3.3.4: total and average cost of caesarean section by hospital

Hospital→	**BM**	**RW**	**CME**	**HGR**
Total cost USD	103,514.22	6,432,28	11,600.17	14,069.97
Average cost USD	144.17	114.86	200.00	171.58

The respective totals for the other hospitals were: 6,432.28 USD at RW, 11,600.17 USD at CME and 14,069.97 USD at HGR. At RW the average cost was 114.86 USD; at CME the average was highest at 200.00 USD and at HGR the average amounted to 171.58 USD.

While the total annual cost of performing CSs at BM was much higher, the average cost per CS at BM was lower than the average for HGR or CME. The total cost per annum and the average cost per CS were lowest at RW, where reported salaries were also lower than at the other hospitals.

b) Sensitivity analysis

The reported maternity workload for EMOC at BM was 60%. Using this figure resulted in a higher proportional allocation of capital cost and salaries than in other hospitals. To estimate the effect of this discrepancy, the provider cost was remodelled for all four hospitals, assuming that admissions for surgical delivery took three times more resources than normal deliveries (Annex 9). If the admission period for CSs was three times longer, the respective figures would be 31.8% for RW, 41.2% for CME and 23.3% for HGR, and 47.0% for BM.

Assuming the latter proportions, the total estimate for BM went down to 91,225.45 USD and the average cost per CS was 127.05 USD. For the three other hospitals the figures increased to: RW total 7339.52 USD and average 131.06 USD; CME total 12,281.60 USD and average

211.75 USD; at HGR the total was 14,243.01 USD and the average 173.70 USD (Table 3.3.7).

Table 3.3.5: proportionate use of maternity beds for surgical patients (6 months): 2nd estimate: 6 days/CS and 2 days/vaginal delivery

Hospital→ / In-patient days↓	RW	CME	HGR	BM
Caesarean Sections	(28x6) = 168	(29x6) = 174	(41x6) = 246	(359x6) = 2154
Vaginal deliveries	(180x2) = 360	(124x2) = 248	(404x2) = 808	(1214x2) = 2428
Proportion	(168/528) = 31.8%	(174/422) = 41.2%	(246/1054) = 23.3%	(2154/4582) = 47.0%

The estimated average cost per CS by structure was strongly influenced by variations in the amount of salaries paid, and by the proportions of salaries and vehicle use that were allocated to EMOC.

The cost of medicine was based on international prices for 2006 with a relatively low mark-up of 25% for overheads. Any increase or decrease in the cost of medicine would be reflected in the average cost of one CS.

Table 3.3.6: Effect of proportional change in maternity use on total and average CS cost

Hospital↓	**Estimate 1 Total USD**	**Estimate 1 Average USD**	**Estimate 2 Total USD**	**Estimate 2 Average USD**
BM	103,514.22	144.17	91,225.45	127.05
RW	6432.28	114.86	7339.52	131.06
CME	11,600.17	200.00	12,281.60	211.75
HGR	14,069.97	171.58	14,243.01	173.70

c) Incremental cost

At the time of the study, the NGO managing BM was reducing investment in hospital services to prepare for the NGO's withdrawal from Bunia. RW was not providing round-the-clock EMOCS, and the hospital's short-term capacity to increase EMOC was limited. The incremental cost of CSs was calculated for CME and HGR (Annex 8, sheets 5-6).

Incremental costs were based on the assumption that both HGR and CME would be able to absorb a substantial increase in the number of patients requiring EMOC, initially without additional capital investment or new staff employment. At CME the average number of CSs at the time of the study was 4.8 per month, slightly more than one CS every week. It would be possible to double, or possibly triple this number, without overburdening the available human resources. CME had moved at the end of 2007 from rented premises in the town centre to a permanent location (Yambi). The new hospital was still partly under construction. In-patient numbers in 2008 were lower than before the move, while the number of nurses had remained unchanged. The increase in total annual cost would at first be influenced mainly by the additional need for renewable supplies, together with a rise in the proportion of capital costs, salaries and overheads.

At HGR, the monthly number of CSs was 6.8 or just over three CSs every two weeks. Given the available resources, it would be possible to double the number of procedures to at least three CSs per week without additional investments other than medicine and renewable supplies. The hospital premises were spacious, although not well maintained. A total of 43 nurses were employed at HGR. Compared to the other hospitals in the study, this was a high number, while in-patient admissions (1,559 in 2006) (109) had declined due to the proximity of BM (estimated 9000 in-patients/year)[xxv], which provided good quality free emergency healthcare.

Assuming that the total obstetric workload in Bunia would remain unchanged after the closure of BM, other health structures would have to admit the obstetric patients who would have gone to BM otherwise. At the time of the study, an annual estimated number of 3146 women delivered at BM, 718 of these by CS. Women expected to have a normal delivery were encouraged to go first to a health centre. Assuming that a limited proportion of additional CSs could be taken care of by RW and that some of the wealthier patients would

[xxv] The reported total number of in-patients from January to May 2008 was 4520 (from hospital records)

opt for a private structure, the expected increase in EMOC workload to be carried out by HGR and CME would be between 600 and 650 CSs annually. The theatre at HGR had been rehabilitated with support from WHO in 2007. Although a large number of surgical procedures could be carried out at HGR, an important increase in demand for beds and nursing care would require capital investment and new staff recruitment.

CME facilities were still under construction, and the amount of theatre space and equipment, as well as the number of beds were limited.

With regard to nursing staff, the following assumptions were based on the opinion of a former head nurse at the University Hospital, Leuven (Belgium):

- One nurse on ward duty can care for a maximum of seven surgical patients
- A nursing shift has a maximum of eight hours and three nurses are needed to cover 24 hours
- Nurses have on average one day off (includes recuperation, weekends and holidays) for every two days on duty.

Following this assumption, one nurse would be effectively able to cover (365/3x2) = 243 eight-hour shifts, or (243/3) = 81 full days in one year.

As CME is a small structure with limited admission capacity, capital investment would be required to provide sufficient space to accommodate more patients. Incremental cost was calculated for three CSs per week, assuming space was added for three more beds and one additional trained midwife recruited.

Performing three CSs weekly at CME would add up to 156 CSs a year, an annual increase by 98 procedures compared to 2008, representing (98x6) = 588 in-patient days. Since one nurse can care for seven patients at one time, this represents (588/7) = 84 nursing days, three days more than the above estimated full annual duty of one nurse.

The total (estimated) number of deliveries in 2008 was 306, including 58 CSs. If the number of vaginal deliveries remained the same, the total number of deliveries would increase to 404, bringing the proportion of CSs to (156/404) = 38.6%. Assuming that CS patients stay twice as long in hospital, the proportional bed occupancy of EMOC patients for the maternity ward would increase to 55.7% If no other changes occurred in the surgical workload, CSs as a proportion of major surgery, including abortion complications, would increase to (156/556) = 28%.

At a rate of three CSs weekly, the total provider cost for CME would be 25,959.29 USD, an incremental cost of 14,359.12 USD. The average cost per CS would be reduced by 33.59 USD to 166.41USD. (Table 3.3.7)

At HGR, the incremental cost was calculated for four CSs per week, an annual increase by 126 procedures to a total of 208. Compared to 2008, this would represent (126x6) = 756 in-patient days and (756/7) = 108 nursing days. To cover this workload, more than one full-time additional nurse would be needed. To cover (108-81) = 27 additional full nursing days, one third of the nursing time of a second full-time employee would be sufficient. Since salary estimates at HGR were overall less accurate, the incremental cost calculation for HGR was based on two added full-time salaries.

Space for four beds was added to the maternity ward. In practice, this would require the purchase of new beds to be placed in the existing space. In the calculations, maternity space is increased by (4x6) = $24m^2$.

The number of general nurses Grade A2 was increased from 18 to 20, with two imputed monthly salaries of 120USD added, increasing the total salaries paid to 66,228USD. To reflect the increase in the total workload, the proportion of salaries attributed to CSs was increased from 11% to 15%.

The estimated number of deliveries in 2008 was 890 including 82 CSs. Keeping the number of vaginal deliveries unchanged, the total number of deliveries would increase to 1016, bringing the proportion of CSs to (208/1016) = 20.5%. The proportional bed occupancy in the maternity ward would increase to 29%. CSs as a proportion of major surgery would increase to (208/516) = 40.3%.

At a rate of four CSs weekly, the total provider cost for HGR would be 25,441.30 USD, an incremental cost of 11,371.33 USD. The average cost per CS would be reduced by 49.27 USD to 122.31 USD.

These calculations demonstrate that, in order to deal with the increasing demand for EMOC, both hospitals would incur a rapid increase in total cost, together with a gradual reduction in the average cost of one CS. The above calculations apply to a short term total increase in workload by 224 CSs for the two hospitals combined. Since BM performed an estimated 718 CSs in 2008, a higher demand would be expected.

Table 3.3.7: Incremental cost at CME and HGR

Hospital →	**CME** (three CSs/week)	**HGR** (four CSs/week)
Total Cost	25,959.29 USD	25,441.30 USD
Incremental Cost	14,359.12 USD	11,371.33 USD
Average Cost/CS	166.41 USD	122.31 USD
Reduction Average	33.59 USD	49.27 USD

Competing alternatives

The baseline for comparison was the "null-hypothesis," a situation which would have occurred if BM had not been providing EMOC in Bunia. Since the study focus was on the effect of EMOCS as part of humanitarian assistance, alternatives for improving maternal and perinatal health were considered in this context. The study proposal referred to the "Mother-Baby Package" (92) of essential interventions to reduce maternal and newborn mortality and morbidity. The accompanying WHO costing spreadsheet for estimating the cost of implementing a set of maternal and newborn health interventions uses a hypothetical rural, low-income district population as the default setting. To make a rough estimate of the cost of standard treatment, the default settings can be used with minimal modification. Locally collected data are required to analyse the actual cost of current services, and to estimate the cost of upgrading the services to the standards in the "Mother-Baby Package."

Full package of maternal and neonatal care

The DRC health system differed substantially from the WHO default model. Adapting the WHO spreadsheets of the mother-baby package to the Bunia situation would have required extensive changes to the proposed model to allow calculating the current cost of providing maternal healthcare. Since the present study concentrated on the cost of EMOCS, actual costs were not systematically collected for health centres.

The mother-baby package estimated the total cost of implementing a standard package for a population of 500,000 with 17,000 births at 906,293 USD, and the cost of avoiding one death at 2,369 USD. The estimated total number of deaths avoided annually was 383, comprising 54 maternal and 329 perinatal deaths avoided.

To provide an approximate estimate of the cost of applying the standard package, the total cost was reduced to reflect the proportional difference in the number of expected births between the standard population and the Bunia population (9851/17,000 = 58%). On this assumption, a full package of maternal and neonatal healthcare would cost (906,293 x 0.58) = 525,650 USD.

As for the number of lives saved, applying the full standard package to the Bunia population would avoid (54 x 0.58) = 31 maternal deaths and (329 x 0.58) = 191 perinatal deaths. Compared to the lowest estimates of effectiveness of EMOC in 2008 (in results section 2) the difference in maternal deaths avoided would be: (31-20) = 11. Compared to the lowest estimate of 237 perinatal deaths avoided in 2008, implementing the standard Mother-Baby Package would have avoided less perinatal deaths: (191-237) = - 46. The Mother-Baby Package estimates in the WHO standard model were based on a 5% CS rate. Implementing the Mother-Baby Package at 95% coverage would possibly have avoided 11 additional maternal deaths. The time and resources available for the present study were insufficient to calculate the cost of upgrading services to a full package of maternal and neonatal healthcare. Repeated assessments of health centres confirmed that the quality of antenatal and obstetric care was generally low, although ANC attendance was relatively high. With the exception of tetanus toxoid (TT) vaccination[xxvi] and promotion of breastfeeding, priority interventions were not included in the current package of antenatal care provided. It would take a considerable amount of time and resources to introduce the full package and scale up all interventions to 95%. During the early stages of the crisis in Bunia, this would not have been the preferred option.

Strengthening EMOCS of existing providers

In 2007, WHO donated theatre equipment valued at 12,818 USD to HGR, as well as staff incentives amounting to 28,998 USD. The European Commission supported the health system in the DRC through the European Development Fund (EDF). During and immediately after the Congo wars, additional emergency funding came from the EC Humanitarian Office (ECHO). The NGO MEDAIR, a principal recipient of ECHO funding, assisted the HGR and selected health centres with essential equipment, medical supplies and staff incentives. Several other international organisations were involved in health system support. Training of health workers on a range of subjects was conducted by various different aid agencies.

[xxvi] Seventy one percent of interviewees reported two or more TT injections

Although the total cost of all training conducted was not measured, the 2006 WHO budget for a nine day training of 50 midwives and theatre nurses in Bunia amounted to 16,033 USD.

Mobile clinics

Outreach services would have been another option. In late 2004, the NGO managing BM set up a service for victims of sexual violence using mobile clinics. A selective service would have been inappropriate; therefore the mobile clinics were announced as women’s health services. In 2005, following a serious security incident (abduction) the service was suspended. By 2008, mobile clinics had resumed, mainly to provide primary healthcare to displaced populations. However, as a provider of emergency humanitarian assistance, the NGO did not offer routine antenatal or postnatal care. Because of the security situation, the clinic schedules were subject to sudden change, making the service unsuitable for preventive care. Daytime mobile services are of limited use for providing obstetric care.

3.3.2 USER COST

More details on the user cost of CS and on the social cost of maternal death are provided in the results chapter dealing with focus groups.

The user cost of CS was obtained from the focus group discussions and from the case interview questionnaires. Of the 145 cases (82% of respondents) who answered the question regarding the cost of hospitalization, 70 (48.3%) said they anticipated no cost. The median amount of payment estimated by the remaining 75 (51.7%) was equivalent to 68.8 USD. Estimated costs for going to and returning home from the hospital were 1.4 and 1.7 USD respectively (total 71.9 USD direct and indirect cost from interviews).

The focus group estimates for the user cost ranged between 40 USD and 200 USD. Other than hospitalization and transport, user costs mentioned were food, clothes for mother and baby and remuneration of the caregiver. Total estimates varied, but some groups agreed on the cost of food (2 USD/day) and the remuneration of the caregiver (2 USD/day). The cost of transport was not discussed in the focus groups. Combining the responses of interviews and focus groups, a total direct plus indirect user cost of 85-100 USD seemed a reasonable conservative estimate.

Although the intangible costs, i.e. the cost of losing a wife, mother, or sister, or the cost of losing a newborn child, are not measurable as such, the culture of paying bridewealth made it possible to place a value on the cost of marrying another woman after maternal death.

The bridewealth depends on the ethnicity and wealth of the girl's family and on her personal qualities and education. The amount is expressed as the number of goats or cows to be paid. Estimates in monetary terms ranged from 100 USD to more than 2,500 USD. Most participants in the discussion groups agreed that the cost of remarrying was the same as the cost of a first marriage. The custom of "*sororate*" (a sister or female relative taking the place of the deceased wife) was frequently mentioned. When "*sororate*" was practiced, the additional amount asked for the new wife was small or symbolic.

In most cases, the newborn child of a deceased mother would be cared for by maternal relatives. Some focus groups talked about orphanages as an alternative option, especially when the mother was suspected to have been HIV positive. The cost of caring for a newborn child without a mother was not analysed in detail.

Other costs discussed by the focus groups were the funeral expenses for an adult woman, estimated to range between a minimum of 150 USD and a maximum of 500 USD. Participants agreed that friends, relatives and neighbours contribute in cash and/or kind when there is a funeral. Surprisingly, the same respondents replied that the possible amount they could ask for as a loan in case of an obstetric emergency was very limited. In the case of a loan, the need to repay was considered an important limitation.

3.4. FOCUS GROUPS

Each of the nine focus groups was composed of 12 to 20 adults living in Bunia who volunteered to participate in the discussion. The groups included: Protestant theology students (Shalom University of Bunia, USB), unemployed men and women, widows, Catholic men and women, Muslims and students from the Higher Institute of Public Health (ISPASC).[xxvii] The main findings of the focus group discussions are summarized below.

[xxvii] Institut Supérieur Pan-Africain de Santé Communautaire

Question 1: Why would a man want to get married?

All groups responded that marriage was important for a man to gain respect in the community, and a customary obligation. Several groups thought that marriage was required to follow God's will. Sexual satisfaction and the need for procreation were mentioned, with some groups emphasizing the avoidance of promiscuity, and sexually transmitted infections. The need for support, assistance and security, the need to extend the family ties and the importance of mutual assistance were emphasised.

The responses indicated that, in the Ituri society, marriage and reproduction are essential aspects of adult life. Apart from the wish to have children and raise them in a family context, marriage was said to be necessary to obtain the social status of a responsible adult in the community. Since bachelors were not invited to participate in communal meetings, they were excluded from the decision-making process in the village. The social importance of a man's married status in an urban environment was not explored. The discussions did not enter into the subject of polygamy (*polygyny*), a practice that remains widespread, although illegal. (110) The 2007 Demographic and Health Survey (87) found that 66.2 percent of marriages in the Oriental province were monogamous.

Question 2: What is the price paid for a first wife? Describe and put a value to the factors influencing the amount to be paid.[xxviii]

Agreements on the payment of *bridewealth*[xxix] are legally binding and part of the amount has to be paid before the wedding (Article 361-367 of the "*Code de la famille"*). The focus groups spent a lot of time discussing the variations between ethnic groups and sub-groups in existing traditions surrounding marriage, and maternal and neonatal death. All groups confirmed that a bride had to be paid for, though the amount and modalities of payment were determined by the socio-economic status and ethnicity of the bride's family, and specific qualities of the girl, such as character and education.

[xxviii] Women interviewed for the case-control study reported a median monthly family income of 60USD

[xxix] Congolese collaborators used the French word "dot," to indicate a payment made by the groom's family. A common translation is "dowry." Some authors prefer using the term "bridewealth," to distinguish the practice from payment made by the bride's family, which is then called dowry. (In: Tshimalenga Mukenge, Culture and customs of the Congo, p.121, Greenwood Publishing Group, 2002) While the latter custom has been reported in other parts of Congo, there was no mention of this by any of the focus group participants, nor by other interlocutors met in Bunia.

Each group provided extensive descriptions of different ethnic customs, with the exception of the Muslims who estimated that the amount to be paid ranged from 100 USD to 1000 USD, depending on the family's socio-economic status and whether or not the bride was a virgin. Other groups expressed the value of payment in goats, cows and chickens, agricultural tools and clothing. They explained that the actual payment usually consists of money. The price of a cow was considered to be equivalent to 120-160 USD, while a goat was said to be worth around 35-50 USD. Students pointed out that an educated girl is considerably (about 30%) more valuable. The local custom requires that the final agreement and the celebration of marriage are preceded by an initial gift of less value, indicating the approval of the relationship by both families. Although this was not made explicit by the focus groups, there appears to be a link between ethnicity and socio-economic status, which is reflected in the monetary value of the bridewealth. (4) Cattle raising Hema expressed the price to be paid in cows. The value of the total amount demanded was higher than among other ethnic groups. It was estimated that wealthy Hema families could ask up to 16 cows (one cow valued at 120-160 USD, total 1920-2560 USD) for an educated girl. The precariousness of a neonate's life is reflected by the fact that, in some communities, part of the bridewealth can be returned to the husband's family once the first born child has its first tooth. Annex 13 provides a detailed description of payments, made by ethnic groups living in the north-eastern part of the DRC, at the first marriage of a woman who has not had any children before.

Among groups with a lower socio-economic status, the payment, which was expressed in goats, chickens and household items amounted to more than 350 USD for a young woman who had not had children before.[xxx] While the payment of bridewealth by the man's family was observed, Islamic people said they preferred to negotiate in monetary terms, rather than in cows and goats (100 -1000 USD).

Question 3: What are the responsibilities a man expects from his wife?

In traditional rural society, the social functions of a married woman outside the homestead are of limited importance. They sometimes contribute to the family finances through small-scale economic activities. (111) A wife was expected to share the household chores (to reduce expenses), and take part in the upbringing of the children. Submission and obedience, respect, a welcoming attitude and kindness were repeatedly mentioned. Other responses were procreation and providing and sharing sexual satisfaction of the husband.

[xxx] The lowest estimate made (245USD) was for Budu, who live in Haut-Uele.

Most groups added that the woman is expected to keep the house clean, take care of the household and the children, work in the field, and assist the in-laws. There was some agreement that, in the case of a widower re-marrying, a new wife should have the same qualities as the previous one. She was expected to look after any surviving offspring of the deceased, and to have children with her husband.

Question 4: What are the costs implied when a woman has a caesarean section? (List the costs, including hospital, medicine, transport etc.)

The costs associated with CS ranged from a minimum of 40 USD (Muslim group) to a maximum of 200 USD (widows). The cost of transport was not discussed. Only USB provided more details, such as the cost of food and clothing, as well as surgery and the remuneration of a caregiver (*garde-malade*). The lower figure estimates direct cost, while the higher estimates include indirect costs, some of which are difficult to verify. Total estimates between groups ranged from 150 USD to 200 USD.

Table 3.4.1: expenses related to CS (ISPASC students made no monetary estimates)

Expenses↓	**USB**	**Muslims**	**Catholic Women**	**Catholic Men**	**Unemployed Women**	**Unemployed Men**	**Widows**
Surgery	50	40-70			60		
Food	70					(2USD x7 days) = 14	
Clothes	25-50						
Caregiver	14						
Total	159-184	-	170	150	175	-	150-200

Within groups there was more agreement, with some groups making precise estimates including the cost of the surgical intervention, the price of medicine, new clothes and other necessities. Other groups only listed the expenditures without being able to make a precise estimate, saying that the cost of medical treatment varied from one hospital to another.

Question 5: How much would you pay for a caesarean section?
(Consider the possibility of a loan)

The groups did not question the necessity of having a caesarean section in case of an obstetric emergency. One group mentioned that those better off would be able to pay up to 80 USD; another group estimated the capacity to pay at 150 USD. Overall, the estimated capacity and willingness to pay were low, with figures ranging between 20 and 50 USD.

Rather than taking out a loan, some groups suggested the possibility of paying in instalments, or in kind. The necessity to find money for medicines was stressed, because treatment would be withheld otherwise. One group mentioned the risk of the mother and baby being held in hospital until payment was made. Another group said that if the person does not have the means to pay the entire amount, it is possible to complete the payment at a later stage. Something (an object) of the same value as the outstanding amount could be given in lieu of payment.

Question 6: If a woman dies because of pregnancy or delivery, what happens to the bridewealth?

Most participants agreed that customs vary between the different ethnic groups. Possible reimbursement of the bridewealth after the death of a wife in childbirth was influenced by the view of death as "a natural occurrence" by some, while others saw it as a reason for punishment of the husband to atone for the "bloodshed" he had caused. One group said that if a woman dies before the payment has been made the price is doubled, though the custom varies from one ethnic group to another. If she dies after the price has been paid, there is no extra charge. If the woman dies shortly after the wedding and she has not delivered a child, part of the payment can be returned to the groom's family. Some participants added that it was customary among one ethnic group to bury the woman if the dowry had been paid. If not, the relatives of the woman would put pressure on the husband's family and threaten them by saying that the body could not be buried until the full payment had been made. Sometimes the family of the deceased received a compensation for the loss of a daughter.

Bridewealth was also associated with the woman's role in assuring descendants to the family of the husband. The children left by a deceased wife are considered a valued addition to the husband's family and taken into account in the financial settlement between families in the event of a maternal death. If there are no children, part of the price can be returned.

While the same values were upheld for the choice of a new wife after maternal death, the practice of "*sororate*"[xxxi] was frequently mentioned (sometimes incorrectly referred to as "*levirate*," the marriage of a widow to a brother of her deceased husband). If a sister or close female relative of the deceased wife married the widower, this was sometimes considered an alternative to reimbursement of the bridewealth by the deceased woman's family, and the additional payment required was said to be lower, or symbolic. The Islamic group referred to "*sororate"* as a tradition rooted in Islam, although the practice was mentioned by other groups as part of the local culture. (112) Several focus group participants emphasized that "*sororate"* could only take place when both parties agreed. The possibility of coercion into acceptance was not mentioned, although refusal by a woman to marry the widowed husband of a deceased relative would have important financial repercussions for her family.

The custom of "*sororate"* raises the question of the value placed on a woman as an individual human being. All groups agreed that the dowry for a second wife was based on the same principles as for the first one, but in case of "*sororate"*, payment made in the past was taken into account. A symbolic payment should be added in case of "*sororate*".

Question 7: What does a man expect from a second wife (the woman he marries after the death of a first wife)?

Looking after the children of the deceased wife was specifically mentioned by all but one group. Some groups put consolation first. Several groups replied that the man would want children with the second wife. Many participants included "the good qualities of the previous wife" as an expectation. Some mentioned the expectation to live with her until death. The second wife was also expected to love and respect her husband and to look after him. One group added the need for equilibrium in society.

Question 8: What is the amount of bridewealth for a second wife?

Most groups made a distinction between the custom of "*sororate",* where the previous payment is taken into account, and the case of the husband choosing a new wife outside the family of the deceased.

[xxxi] Encyclopaedia Britannica: custom or law decreeing that a widower should, or in rare cases must, marry his deceased wife's sister. The term comes from the Latin word *soror*, "sister," and was introduced by the British anthropologist Sir James George Frazer. The "sister" may be a biological or adopted sister of the first wife or a person who is socially classified as such. The sororate often co-occurs with the levirate, or marriage of a widow to her deceased husband's brother. They appear to be the most common of preferential secondary marriages. Either may be permissive rather than obligatory.

Some groups insisted that the new wife should be considered separately, and that the same customs and obligations as for a first marriage applied to the widower wishing to marry her.

Among the groups that took the possibility of "*sororate"* into account, some replied that there would be no additional charge. The other groups said that in case of "*sororate"* the amount would be reduced or "symbolic".

Question 9: Are there any traditional customs to be observed after the death of a woman in childbirth? Who is supposed to look after the newborn child, if the baby was alive? Who has to feed the child and how?

One group said that, when a person of high social standing dies, it is customary to organise a traditional dance at the funeral. Several groups mentioned that, although customs were changing, it was customary to beat the husband or demand a fine. Some groups replied that if both the mother and child had died, it was customary to remove the foetus from the womb and bury the bodies separately. One group specified that this only happened when the woman was more than five months pregnant and that not all ethnic groups followed the custom of separating mother and child. The same group added that in certain traditions, only women were allowed to attend the funeral. Some ethnic groups removed the foetus in the graveyard, while others performed the procedure indoors and prepared two coffins and two graves. The person who performed the autopsy would receive some compensation. In some customs, the body of the deceased woman is washed in the river upstream.

Some ethnic groups demand that the widowed husband should wait "as long as possible" before getting married again. Among others, the family of the deceased decides on a date for re-marriage of her husband.

According to most groups, if the child was alive, it would be kept by a relative, usually an aunt or the maternal grandmother. It was usual to find a breastfeeding woman in the family to feed the baby. If such a woman could not be found, some ethnic groups made tattoos on the breasts of another woman in the family until she had milk. Other ethnic groups would find a breastfeeding woman outside the family, or the baby could be taken to an orphanage. Sometimes a caregiver was found and the baby was fed with diluted cow's milk, formula or soy milk. One group mentioned that the father might be left in charge of the baby. Another group said that, if HIV was suspected, people aware of the issue preferred to leave the baby to the convent or in an orphanage.

Question 10: What are the expenses to be expected for an adult woman's funeral?

The total cost varied with the socio-economic status of the families involved, ranging from 150 to 500 USD. There was said to be no difference in funeral expenses for an adult man or a woman. Participants mentioned that relatives and neighbours were expected to contribute in cash or kind to cover the cost of the funeral.

One group said that most of the money would be spent on feeding visitors and offering them drinks, and that failure to provide refreshments would be severely criticised. Other groups made a detailed list of funeral expenses. The total cost for a coffin, a burial sheet and blanket, a dress, powder and perfume, the burial cost at the graveyard, as well as food, was estimated around 250 USD. One group added the cost of a radio announcement and family contributions, such as a cow, a goat and other goods.

Summary of findings from focus group discussions

In Ituri, marriage is an important part of adult life, regulated by customary and legal conventions. Payment of bridewealth to the bride’s family is obligatory. The estimated amount of bridewealth varied in accordance with ethnicity and social status of the families, as well as personal qualities and education of the bride. Variations in estimates were considerable, with the lowest equivalent to around six months of income for an average family in Bunia, and the highest representing several years of earnings. The role of a married woman was described mainly in function of her responsibilities within the household and with regard to her offspring. Whether or not such activities were considered of economic importance was not specified. The customs in relation to payment or reimbursement of bridewealth in case of maternal death confirmed that procreation was thought to be an essential function of a wife.

While in principle a widowed man should pay the same amount as for a first marriage when marrying another woman, the practice of *sororate* was repeatedly mentioned. In case of *sororate*, earlier payments are taken into account. Although polygamy is known to be common in rural Ituri, none of the groups talked about this.

The estimated total user cost of CS ranged from 150 to 200 USD. While this amount was lower than most estimates for bridewealth, willingness to pay was low. Given the possibility of taking out a loan, most participants opted for a small amount. The cost of an adult woman’s funeral was estimated between 150 and 500 USD. In the latter case, family and neighbours were expected to contribute. The possibility of asking financial assistance with medical bills was not considered. Alternative options given were paying in instalments, or leaving a valuable object as a deposit. It was also said that treatment would be withheld if medicines were not paid beforehand.

Detailed descriptions were made of different customs related to maternal death, confirming awareness of its occurrence. HIV/AIDS was mentioned with regard to the care of a surviving baby as a reason for taking the child to an orphanage. Wet-nursing, stimulating a woman's breasts to produce milk, and bottle feeding were referred to as feeding practices.

This section about the focus groups ends the analysis of results. An in-depth discussion of the study findings follows in Chapter 4.

CHAPTER 4

DISCUSSION

4.1. DESIGN AND PURPOSE

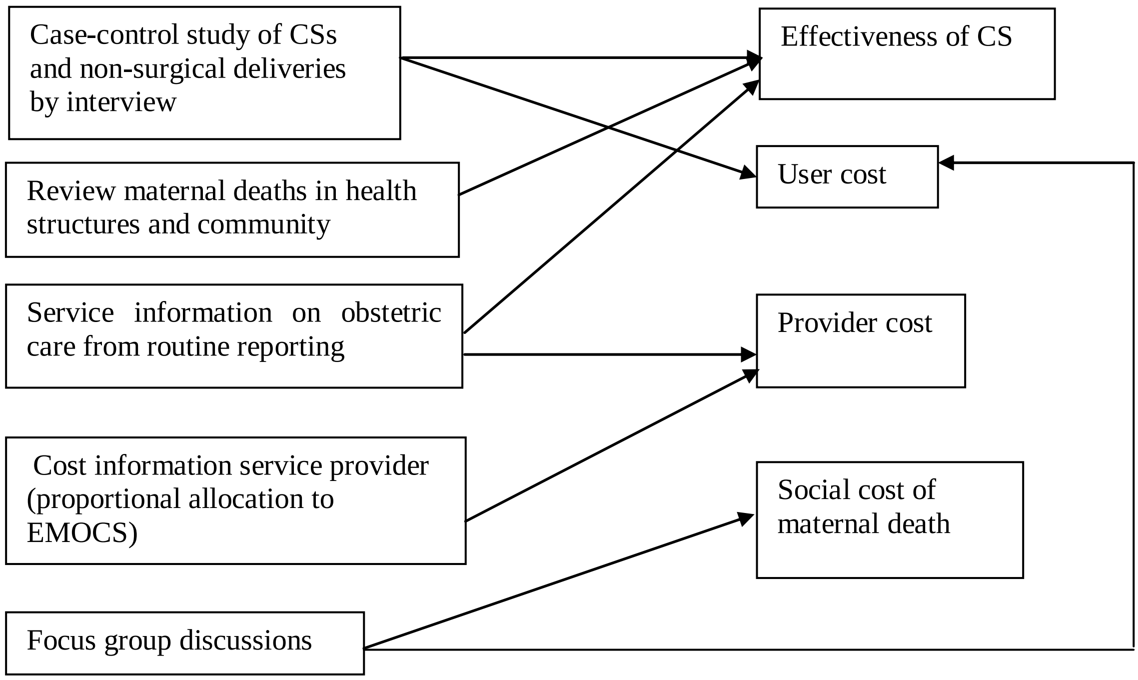
Evaluating the impact of humanitarian assistance serves multiple purposes. Donors and providers of assistance insist on accountability and lesson-learning. (113) Evaluating ongoing programmes also serves to provide feedback for planning. (114) Because humanitarian aid is intended to be temporary, the “connectedness” between humanitarian healthcare services and the existing health system may affect the provision of future (post-crisis) services. At the start of a humanitarian crisis, the choice is between strengthening the existing system, setting up parallel services, or a mixture of both. At the end, the remaining providers will need to decide how much of the needs covered by the humanitarian provider are likely to continue in the future, and which additional services will be required. The cost of providing those services will have to be estimated and budgeted.

At the time of the study, emergency healthcare was provided as part of humanitarian aid at the Bon Marché (BM) hospital, managed by an international humanitarian NGO. The NGO functioned independently from the existing health system in Bunia, but accepted referrals by other healthcare providers. A large number of patients received emergency obstetric care (EMOC) at BM. The CS rate in the Health Zone was 9.7%, more than twice the reported national figure of 4%. (87)

To make a cost-effectiveness analysis (CEA) of EMOC services possible, a link between process indicators and the effect on mortality had to be established. A case-control study investigated the determinants of CS in Bunia, a crisis environment. Information on various different costs was collected in the study area and from the literature. The social cost of maternal death was explored in focus group discussions, which also provided information on user cost.

The study design is outlined below.

Fig 4.1: study design and resulting information



Emergency Obstetric Care in a humanitarian context

The choice of EMOC Services (EMOCS) for evaluation was guided by the observation that many maternal and perinatal deaths are avoidable, even in resource-poor settings. (115) The latest maternal mortality estimates in the DRC rank the country sixth down from highest. A recent analysis of maternal mortality found that the proportion of maternal deaths from countries in sub-Saharan Africa in comparison to the worldwide estimates had increased from 23% in 1980 to 52% in 2008. (100) The estimated maternal mortality ratio (MMR) in 2008 for the DRC was 534/100,000 live births. With the exception of Sudan, national estimates for neighbouring countries were lower than for the DRC, but higher than the Bunia estimate from this study.[xxxii] In many high income countries, the MMR is below 10/100,000 live births. (100)

In 2006, estimated perinatal death rates ranged from 5/1000 in high income countries (Sweden, Singapore) to more than 100/1000 (Liberia, Mauritania). The perinatal mortality for the DRC, derived through regression and other estimation methods, was estimated at 76/1000, (105) in other words one in 13 deliveries was thought to result in stillbirth or early neonatal death.

[xxxii] MMR estimates 2008: Tanzania 449, Uganda 352, Sudan 306 and Kenya 413

The provision of reproductive health services, including the management of pregnancy and delivery, is a recognised priority in protracted crises. Ways of providing such services can vary, and evidence for what works best where is limited. (116, 117) It was thought that cost-effectiveness evaluation of EMOCS in the given setting could help to inform humanitarian organisations about the potential impact of their activities on maternal and perinatal mortality in similar environments. In addition, EMOCS are part of a basic package of services to be provided through the PHC system. The effectiveness of EMOCS could therefore give an indication of PHC coverage and equity of access. An estimate of the cost-effectiveness of EMOCS in the context of humanitarian assistance in Bunia, 2008 could advise future practice.

Planning in a humanitarian context

The wider purpose was to demonstrate the feasibility of economic analysis in a crisis environment as a tool for decision-making. Applying CEA to EMOCS at the observed level of service provision would help to predict the cost of maintaining the same level of care in the absence of humanitarian assistance. In 2002, private expenditure on health in the DRC was estimated to be 69.8% of the total health expenditure, down from 90.1% in 1998. Over the same time period, the Government contribution to healthcare financing as a proportion of GDP went up from 3.7% to 4.1%. International donor contributions increased from 6.7% to 28.4%. In 2006, an estimated 70% of the countries' population had no access to healthcare. The amount of donor support to healthcare was estimated to be in the range of 2-3USD/person/year. (33) In 2008, the DRC was in a period of transition, during which humanitarian and development assistance overlapped. The phasing out of humanitarian aid entailed re-application of user charges in the health system. In Bunia, only one international provider of emergency healthcare services continued to offer healthcare free of charge.

With the political and military situation stabilizing in Ituri, humanitarian inputs are bound to be further reduced and the cost of emergency healthcare will have to be borne by others. The most likely sources of payment are public finances shored up by international development donors, and users. For planning purposes, anticipating the amount of public resources that will become available for healthcare in a post-crisis situation is of little use. (118) Conversely, assessing the amount, use and results of healthcare expenditure by aid organizations could inform the Ministry of Health and international donors about priority needs to be included in their budget.

This study investigated whether CEA of humanitarian aid in the health sector could be used to estimate future input requirements and associated costs in areas such as reproductive health where workload is unlikely to diminish with time.

4.2. CAESAREAN SECTION AS AN INDICATOR OF EMOC

The use of process indicators, including CS rates, is recommended to evaluate the effectiveness of EMOCS. (119) With the relation between CS rates and survival of mother and child under debate, (120-123) the research attempted to clarify the effectiveness of CSs (and EMOCS) in the context of humanitarian assistance, on maternal and perinatal mortality in Bunia.

4.2.1 APPROPRIATENESS OF CAESAREAN SECTION

Including reports from all healthcare providers, the CS rate during the study period was 9.7% of the expected number of deliveries. Although there is no "optimum," WHO has recommended since 1985 that CS rates should not exceed 10-15% of all births. (124) The recommendation was based on observed CS rates in developed countries at the time. The higher limit took account of possible higher obstetric risk in low-income populations with poor living conditions. Due to lack of evidence, the upper limit has been removed since then. An approximate figure of less than 5% indicates that women who are in need may not be receiving CS at birth. (125 -127)

A WHO review of CSs in Asia recently concluded that performing CSs for non-medical reasons increased morbidity and mortality in mother and child. (122) In countries with high CS rates, the risk of maternal death following surgical delivery has been found to increase two- to four-fold. (128) A WHO survey in Latin America in 2005 found CSs to be associated with greater severe maternal morbidity and mortality. (129) The study concluded that increasing CS rates to more than 10% of births did not improve pregnancy outcome. The denominator used in the analysis cited above was not specified, but appeared to be the number of institutional births. The same study found that CS rates were mainly influenced by primiparity, previous CS and complexity of the health structure as determined by an "institutional delivery index."

High maternal and perinatal mortality has also been found in low-income countries with CS rates of less than 10%. (121) A systematic review of CS rates for maternal indications in sub-Saharan Africa estimated the need for CSs for maternal reasons at 5.4% of deliveries (CI: 3.6-6.5). (130)

Fees-for-services or output-based financial incentives may increase the proportion of surgical procedures. (131) Since private-for-profit structures were not included in the sampling frame, the likelihood of provider preference in the study sample was small. Only 3.7% of all CSs (18/479) recorded during the study period were performed in a private-for-profit health structure. At the time of the study, except for BM, all the health structures in Bunia charged user fees. Of the women who had a CS, 75% delivered at BM. Salaries at this hospital were based on qualifications and experience and paid monthly in accordance with the time spent on duty. There were no output-based incentives. It is therefore unlikely that provider preference influenced decisions regarding CSs at BM.

The HGR was included in the development assistance programme of the European Commission (EC), the 9th European Fund for Development (EDF). The Assistance Fund for Support to Health Services (FASS, Fonds d'Assistance aux Services de Santé) included a performance-related component. An EC commissioned study to estimate the real cost of healthcare took place in December 2007 and was published in March 2008. Meanwhile, the EC assistance to hospitals concentrated on inputs such as medicine, and financial incentives. (132) During the study period, less than 10% of all CSs in Bunia were performed at HGR.

Cases were recruited in two other hospitals working on a cost-recovery basis. Each of them covered a small proportion (6% each) of the total number of procedures. Both hospitals were managed by faith-based organizations. RW did not have a surgeon on stand-by, and the decision to call a doctor, or to refer a patient to another hospital for EMOC was made by experienced midwives. CME was a training facility for the nursing college (Institut Supérieur de Techniques Médicales) in Bunia. Clinical supervision and case reviews were part of the daily activities.

Indications for caesarean section

The worldwide increase in CS rates has led to calls for routine reporting procedures to facilitate service monitoring and audit. (133) Although uniform reporting of indications for CS is widely promoted, a single classification system has yet to be agreed upon.

A recent systematic review identified 27 different classifications. The full range included: “women-based,” “urgency-based,” indication-based,” “potentially complicated CS” and other existing classifications, as well as a theoretical model. While the review concluded that women-based systems were generally more useful, the authors noted that the *reason* for CS was not given in the preferred classification. (134) The relatively simple, all-inclusive and mutually exclusive Robson system would therefore be of limited use at retrospectively determining the appropriateness of the intervention.

Another element in favour of uniform reporting would be the possible detection of antenatal factors predicting the likelihood of CS at delivery. A systematic international approach would allow easier comparison between different populations and help to detect trends over time. A cohort study of women recruited during the antenatal period in England during the 1990s found emergency CS to be associated with nulliparity, maternal age, malpresentation, bad obstetric history, epidural anaesthesia and previous CS. (135)

During the research in Bunia, indications from theatre records were cross-checked by asking mothers if they knew why they had been operated on and to explain the reason. Indications mostly concurred, although patients reported more previous CSs than were mentioned in theatre records. The “life-saving” aspect of the intervention could not be assessed from the mothers’ replies.

There were no elective (planned) CSs in the sample. Among ten CSs in the study performed on a woman not in labour, the indication “foetal distress” was recorded once. Foetal distress is an uncertain diagnosis, particularly in a resource-poor setting. The patient was pregnant for the fifth time and had no other children alive.

Absolute maternal reasons

Around one third (32%; CI: 25.2% - 39.4%) of indications from theatre registers could be categorized as “absolute maternal indications” (antepartum haemorrhage due to placenta praevia or abruption, abnormal presentation, major foeto-pelvic disproportion and uncontrollable post-partum haemorrhage) (Annex 6). Women with these problems are unlikely to survive if they do not have a CS.

The observed incidence of absolute maternal indications was higher than the figure proposed in the 2009 Handbook “Monitoring Emergency Obstetric Care” (77) but lower than estimates from other sub-Saharan African countries. (130)

The 1.4% figure of the 2009 Handbook is the median of referral rates for absolute maternal indications among population groups considered to have no difficulty in accessing EMOC in Benin, Burkina Faso, Mali and Niger. (137) Whether or not this figure can be universally applied has not been established.

Previous caesarean section

Previous CS was the indication in the theatre register in 21.9% of cases (n= 39) and the strongest predicting factor for surgical delivery. The number of cases reporting at least one previous CS was close to 30%. In the multivariate analysis, the odds ratio of a CS delivery for women who reported a previous CS was 23.79 (95% CI 8.60-65.83).

No significant difference in duration of labour was found between cases and controls with a previous CS. This could be due to the small number (n=5) of controls reporting a previous CS. The median reported duration of labour in cases with a previous CS was 8.5h, while controls with a previous CS reported a median of 7h labour for this delivery. The results suggest that most women with a previous CS had a surgical delivery after trial of labour.

Duration of labour

The interview contained two questions about the duration of labour. One question asked respondents to estimate the duration of labour in hours. The next question, intended for those unable to make an accurate estimate in hours, asked whether labour was "not as long" or "longer" than the time between sunrise and sunset. Since Bunia is close to the Equator, daylight lasts for 12 hours with little seasonal variation.

The median reported duration of labour among cases in the study was 10 hours, with 47/117 cases (40% of those responding) reporting labour of 24 hours or more. The median reported duration of labour among controls was 6 hours, significantly less. Among controls reporting duration of labour in hours, 25/141 (17.7%) reported labour of 24 hours or longer.

In the multivariate analysis, all responses on duration of labour were conservatively re-coded in three groups (<12h; 12-24h; >24h) including "longer than the time between sunrise and sunset" as "12-24 hours". This resulted in a higher number of subjects included in the analysis, increasing the predictive value of the model. Reported labour of 12-24h was a strong predictor of CS (OR=3.89; 95% CI 2.13-7.08).

The odds of CS among women reporting labour of more than 24h were even higher (OR=6.61; 95% CI 2.76-15.85). Reported labour of more than 24 hours was the second most significant predicting variable for CS.

Foetal distress

According to the theatre registers, 25% of caesareans in the sample were performed for foetal distress as the main indication. In 17.4% of cases (n=31) foetal distress was the only indication recorded in the theatre register. International estimates of the incidence of intrapartum hypoxia vary between 3/1000 and 4/100 deliveries. (138, 139) A recent study in Pakistan found 48 indications of foetal distress among 225 emergency caesareans in a tertiary care hospital (21.3%). (140) In a university hospital in Bahrain with a CS rate of 21% (n=1245), the proportion of CSs for foetal distress was 19%. Interestingly, a large number of these (n=51, 27.7% of those diagnosed with foetal distress) were not in labour at the time of surgery. Seven neonates had a low Apgar score five minutes after birth, and only one baby required intensive care. The hospital did not have facilities for foetal blood analysis. (141)

Detection of foetal distress in the study environment relied on monitoring of the foetal heart rate, usually by fetoscope or Doppler ultrasound, and amniotic changes i.e. meconium. Facilities for continuous monitoring of the foetal heart rate or for foetal blood analysis were not available. It is known that a non-reassuring foetal heart rate does not in itself accurately predict the condition of the foetus. Since foetal hypoxia is an important risk factor for perinatal death or disability, the decision to perform a CS for suspected foetal distress needs to balance the risk of CS against the risk of vaginal delivery to mother and child. Although the immediate risk of performing a CS may be small, complications related to a scarred uterus can occur during later pregnancies, with the risk of placenta praevia and abruption known to increase in pregnancy following a previous CS. (142, 143)

Women reporting one or more previous stillbirths (n=50) were asked if they knew the reason. One reply was recorded in the interview as "paediatric death," another as "abortions"; 12 of the respondents said they did not know. Among the remaining responses (n=36), ten women (28%) said that the child had been "tired". Other reasons given were bleeding, infection or disease in pregnancy, abnormal presentation and foeto-pelvic disproportion. Multivariate analysis showed a strong negative correlation between CS and the number of surviving children on the day of the interview, with the odds of CS being halved for every additional child alive on the day of the interview.

The relative importance of intra-uterine, neonatal and infant mortality among the children that did not survive was not assessed. Reported previous stillbirth was not found to be a significant predictor of CS in the multivariate analysis.

Age of the mother and number of pregnancies

The mean age of the study sample was 24 years, with no significant difference between cases and controls. In the multivariate analysis, maternal age was an independent predicting factor for CS. While more cases than controls reported this to be their first delivery, (1/3 of cases compared to 1/4 controls, statistically not significant) the odds of having a CS increased with the number of pregnancies, as would be expected, almost reaching statistical significance with p=0.07 (OR=1.28; CI 0.98-1.68).

The indications for CS were separately reviewed for first pregnancies and for multiparous women. Foeto-pelvic disproportion, narrow pelvis and dystocia were the indication for CS among more than half of the primiparous cases. Height measurements were not recorded in this study. It is known that many women in Ituri are of short stature (<150cm). Ethnicity and childhood malnutrition are possible contributing factors.

Theatre records included foetal distress in almost one third of CSs for first deliveries. Some theatre records reported more than one indication, e.g. malpresentation and foetal distress. Foetal distress was the *only* reason for CS in one quarter of first deliveries. Seventy five percent of the interviewed cases reporting this to be their first delivery said that labour had been longer than 12 hours. The difference in duration of labour between cases and controls delivering for the first time was statistically significant.

In multiparous women, foetal distress was a less frequent indication. In the study sample, 20/178 cases (11.3%) had been pregnant seven or more times. Just over 20% of cases with seven or more pregnancies had a CS for foetal distress. Malpresentation, bleeding and imminent rupture or ruptured uterus were more frequent indications among multiparous women. Problems in the obstetric history, as well as prolonged labour for this delivery were the strongest predicting factors for CS. The positive correlation with the mother's age and number of pregnancies, together with the negative correlation with the number of children alive, confirms that a large proportion of CSs were performed to avoid foetal death. While foetal distress is an uncertain diagnosis, the results suggest that in many cases foetal distress was a sign of obstructed labour.

Disease in pregnancy

While cases and controls were not significantly different regarding health problems during the last pregnancy, reported urinalysis was found to be a strong independent predicting factor for CS in the study sample. It is possible that the predictive value of "urinalysis" finds its interpretation in the fact that women with proteinuria, a risk factor for eclampsia, would have been referred to the hospital for further assessment, an event that could have caused recall bias. Pre-eclampsia was the indication for CS in two cases (1.1%) in the sample. During the study period, 20 records of pre-eclampsia or eclampsia were copied from registers in hospitals providing some form of EMOC. Eighteen of these were treated at BM hospital.

Summary of findings regarding appropriateness of caesarean section

The CS rate in Bunia during the study period was within the acceptable range. The findings of the case-control study do not support the hypothesis that CSs were performed for non-medical reasons. Absolute maternal indications were recorded for one third of the cases in the sample, and foetal distress was the only indication for one sixth of CSs. Previous CS was the indication in the theatre register in more than one fifth of additional cases. Although cases and controls reported a similar number of pregnancies and deliveries, the number of surviving children was significantly higher for controls. Risk factors in the obstetric history, and prolonged labour during the last delivery were the most important predicting factors for CS.

For each intervention, the risk of performing a CS should be weighed against the risk of not doing a CS. In spite of improving maternal and perinatal mortality rates, the obstetric risk for mother and child in Bunia remained elevated, with an estimated MMR of 345/100,000 and a perinatal death rate of 52/1000. With more than one out of every 20 children dying during or shortly after childbirth, and an important proportion of these deaths caused by prolonged labour with foetal distress, efforts should be directed towards reducing possible delays in access to EMOCS. With an average of 6-7 deliveries in a lifetime, more than 2% of women would die in childbirth, assuming the risk is the same with each pregnancy. On the other hand, the increasing CS rate in developing countries is a cause of concern for those arguing that women in low-income countries may have difficult access to care and find the experience too frightening to go to a hospital during the next pregnancy and delivery. (144)

4.2.2 ACCESS TO SERVICES

Obstacles in accessing services could have resulted in late arrival of women needing a CS, decreasing the effectiveness of EMOCS. If women in need of a CS could not reach the hospital, the result would be maternal or perinatal death, or both, among women with a vaginal delivery. Perinatal mortality in the study sample was significantly higher among cases than among controls. On the day of the interview, cases reported 7.3% (n=13) of newborn children not to be alive. Controls said that three babies (1.7%) were not alive. The median time of interview was closer to the time of delivery for cases and the difference could be larger. The study did not include questions about the cause of perinatal death for the most recent delivery. The higher perinatal mortality among cases is consistent with the higher proportion of cases reporting prolonged labour, possibly resulting in foetal hypoxia. This could be related to delayed access to EMOCS.

Causes of maternal death

Among 15 reported maternal deaths, three women had a CS. The most likely causes of death for the women who died after CS were: obstructed labour, antepartum haemorrhage and possibly intra-uterine infection. In two of the three CSs resulting in maternal death the child was stillborn. The death following obstructed labour was linked to delayed referral (from health centre to hospital) of an adolescent girl, pregnant after being raped. The two other surgical deaths were adult multiparous women, one of whom was said to have delayed seeking professional care.

The research team recorded four maternal deaths outside a hospital, two of which occurred at a health centre. One death in the community was reported by the nurse from a nearby health centre; another woman had been transferred to the hospital and was dead on arrival. Haemorrhage was the cause of one reported death at the health centre. The cause of the other maternal deaths outside the hospital could not be established. A further review of the 11 reported maternal deaths in hospitals suggested that at least six could have been avoided by earlier referral (prolonged labour, haemorrhage, ruptured uterus, and three with septic shock). One of the women who died of septic shock had been admitted with a vesico-vaginal fistula after delivering a live baby. The transcript of reviews of maternal deaths reported to the research team can be found in Annex 7. Maternal deaths at health centres and in the community confirm the possibility of delays at these levels. The main possible reasons for reduced access to services are discussed below.

Security

An insecure environment will affect access to all levels of care. At the time of the data collection, security in Bunia was maintained by the national police and army, with support from the UN peacekeeping force, MONUC. The streets in the urban area were unsafe during the night. The roads that led in-and out of town were closed at night and guarded by armed troops. RW hospital, situated on the edge of the urban area, did not admit patients outside daytime working hours. The HGR and BM had ambulances to transport emergency referrals, the latter providing a free service, the former reportedly charging 10 USD on average for a single trip within the town area.

Travel to the place of delivery

Although there was a significant difference between cases and controls in the median distance travelled and in travel time, most women reported travelling only a short distance. Just over 10% of cases (17/161) and only two controls (1.1%) said they had travelled more than 10km. Cases reported a higher travel cost than controls, with the median estimated cost of going to the hospital for cases 700 Congolese Francs (Francs congolais, FC) (1.4 USD) and for controls 500 FC (one USD). The estimated median cost of going back home was also significantly different: 850 FC (1.7 USD) for cases and 600 FC (1.2 USD). Considering the amount paid for travel in comparison to the cost of CS, it is unlikely that travel cost was an important factor in deciding where and how to deliver. Since 90% of cases were residing close to the place of delivery, other barriers (security, availability of transport) could have restricted access for those living further away.

The number of deliveries in health structures recorded during the study period (n=4154) was 84.3% of the expected total (n=4925). The proportion of deliveries in health centres (n=1664) was 40% of the total number of births recorded, and 33.7% of all expected deliveries. In the study sample, 74% of controls were recorded as having delivered at a hospital. When asked, the interviewers said that in Swahili it is difficult to make the distinction between the words for hospital and health centre. The word hospital could have been used for some of the larger health centres, especially for private structures. Since the median date of interview for controls was a week later than the date of delivery, the majority of interviews of controls took place at home. Usually, after a vaginal delivery, women would have left the health structure within 48 hours.

At the time of the study the maternities at HGR, CME and RW admitted all women in labour. Although BM had an emergency-only policy, of the 1573 deliveries recorded at BM during the study period, only 359 were CSs. More detailed records of activities in hospitals and health centres in the study can be found in Annex 10 and 11. According to Dr Nancy Wood, a long-term medical practitioner in Bunia, the number of deliveries in smaller health centres was low.[xxxiii]

According to the 2007 Demographic and Health Survey, the overall proportion of births in health structures in the DRC was 70.1%. The proportion for the Oriental province was 65.9%. In urban areas the proportion was much higher (89.1%) than in rural areas (58.1%). In the North and South Kivu provinces, long-term recipients of humanitarian assistance, respective proportions of 84.9% and 84% of births taking place in health structures were found. (87) The findings in this study were consistent with the national data.

User cost of medical care

Interviewees were asked how much they were paying for staying at the place where they delivered, including anticipated future costs of hospitalisation. Data were analysed including and excluding those who said they did not pay. Cases who responded they paid reported a median of 34,400 FC as the estimated amount (68.8 USD). When zero responses ("I pay nothing") were included, the median amount for cases dropped to 500 FC (one USD). In comparison, the median of the amount reportedly paid for delivery by women who did not require surgery was 5,300 FC (10.6 USD) for those reporting a cost and 3,725 FC (7.45 USD) including zero replies. The results indicate that a large proportion of cases in the sample, mostly women who had delivered at BM, expected not to be paying for hospitalization. Those who paid for a CS anticipated the amount to exceed 30,000 FC (60 USD), the median reported monthly disposable income. A CS was 6.5 times more expensive to the user than a vaginal delivery.

The monthly disposable income reported by cases was slightly higher than the amount given by controls. The median of the amount reported by cases was 30,000 FC, (equivalent or close to 60 USD); the median of the income reported by controls was 26,000 FC (around 52 USD).

[xxxiii] Personal communication by e-mail, pandnwood@yahoo.com 21/07/2010

The World Health Organization quotes an annual Gross National Income of 270 USD per person from the 2006 estimates reported in the 2008 World Health Statistics report (145) (WHOSIS). (146) The CIA World Factbook estimated the income per person in the DRC in 2009 at 300 USD. (147) A difference of 8 USD represented around four days of work in Bunia. Although the difference in disposable income did not reach statistical significance, the results sustain the possibility that women, or their family, who paid to deliver by CS had a higher income.

BM, which had an emergency-only admission policy, provided EMOC free of charge. CME offered a pre-paid care package including antenatal care followed by a normal delivery for 20 USD. In case of a CS, additional payment was requested to cover the cost of surgery and medical treatment. HGR and RW followed a cost-recovery policy based on displayed prices. Interviewers in the research team suggested that some health structures demanded an initial payment to cover the cost of recurrent supplies before admitting the patient. Information from the focus groups confirmed the practice. This study did not look into the effect of modes of payment on access to care.

Skilled delivery attendance

The availability of skilled personnel at the first level of care affects the efficacy of the referral system. International agencies and organisations attracted local personnel, removing them from the public health system by offering better service conditions and higher salaries. In order to provide a high standard of care, recruitment criteria were set high to select employees with the most advanced skills and experience. The DRC health system has a shortage of medical doctors and nurses, especially midwives.[xxxiv]

There were several private-for-profit medical practices in Bunia, a densely populated urban area. Continuing armed violence had resulted in people moving out of surrounding villages, causing rapid growth of the town population. Bunia, the Ituri headquarters of the MONUC peacekeeping force and of many international aid organizations, was safer and offered better economic opportunities for survival. The private-for-profit sector and international aid organisations potentially drained human resources from the public sector.

[xxxiv] www.minisantrdc.cd/ The official website of the Ministry of Health, DRC, quotes the 1999 data of the African Development Bank, UNAIDS and the World Bank: 21 medical doctors and 44 nurses per 100,000 population (accessed 30/06/10)

Training in the use of the new WHO partograph, which starts labour charting at 4 cm cervical dilatation, had been conducted. According to the WHO guidelines, (148) crossing the “alert line” is an indication that labour is slow and health centres should transfer the woman to the hospital. The action line is the critical point for decision making in a hospital setting. The Ministry of Health promoted this version of the partograph in all health centres and hospitals. (see partograph fig. 4.2).

The use of oxytocin to augment labour requires continuous monitoring and the possibility to perform a CS if complications occur. (149) Health centres were not entitled to perform major surgery.[xxxv] With the exception of Saio (Clinique Davenport) and Centrale, vacuum extraction equipment was not available at health centres.

Detailed information about the precise cause and circumstances of maternal deaths was difficult to obtain. Initially, interviewers had been instructed to use the questionnaire of the case-control study to interview relatives of deceased mothers. They found this to be culturally unacceptable. Instead, the reports were based on information gathered during informal talks with relatives and hospital personnel. This approach was perceived to be less intrusive in the case of grieving families and less threatening with regard to health personnel.

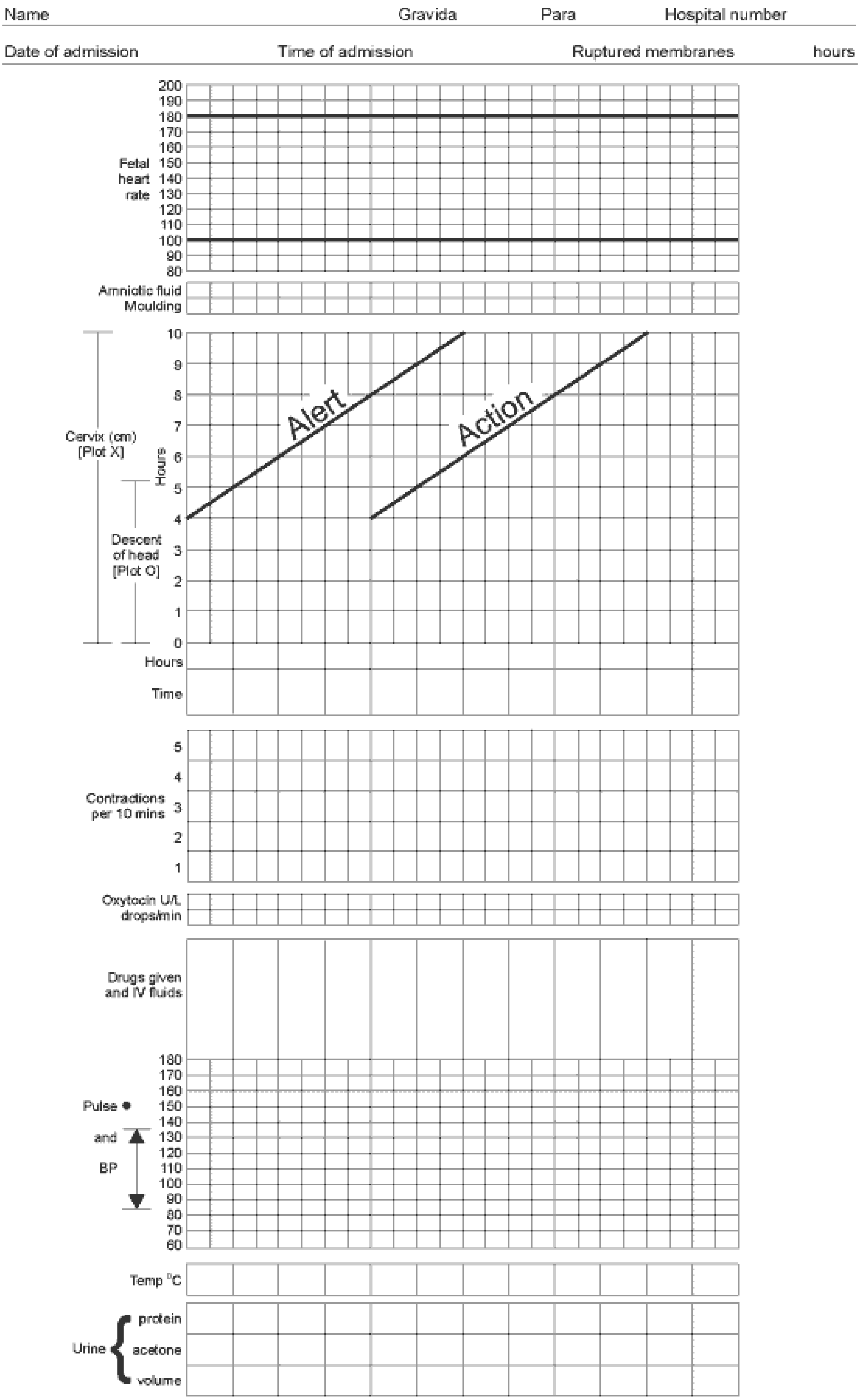
The cause of perinatal death was even more difficult to establish. Out of 17 deaths reported by the interviewers, seven were intra-uterine deaths. Foetal distress and foeto-pelvic disproportion were the possible cause of six deaths. The transcript of records can be found in Annex 3.

Consent

Eighty five percent of cases said they had needed consent from someone before the operation. Almost 90% of those who needed consent said that the process of obtaining consent had delayed the decision to perform surgery. Consent is asked from a male relative, usually the husband.

[xxxv] Bunia Cité and Saio functioned as referral health centres until January 2008 with an operating theatre. Medical doctors were no longer deployed to health centres in 2008. Bomoi, a private for profit structure continued to perform caesareans

Fig 4.2: the modified WHO partograph



4.3. IMPACT OF EMOC AS PART OF HUMANITARIAN ASSISTANCE

Humanitarian action did not resolve the complex political and military situation in Bunia and Ituri. (150) Renewed fighting broke out between the national army and armed opposition groups in December 2009. In April 2010 IRIN reported that 167,000 people were displaced in Ituri. After several months of fighting, the Congolese Government decided to establish a humanitarian corridor, allowing people trapped behind the frontline south of Bunia to move to safety.[xxxvi]

Five years after the peak of the humanitarian crisis, 75% of all CSs in the Bunia Health Zone were performed at BM. Maternal deaths in health structures and in the community were recorded between December 2007 and June 2008. There were no maternal deaths among the women selected to be interviewed. Three of the direct maternal deaths in hospitals during the study period occurred in women who had a CS (0.6%). Therefore, assuming that all CSs were appropriately targeted, CSs were 99.4% effective at avoiding maternal death. However, limited access to services reduced the potential impact of the programme.

To quantify the impact of CSs, as part of humanitarian assistance, on maternal mortality in Bunia, observed maternal and perinatal mortality figures were compared to projected figures based on the expected mortality without EMOCS, as well as on recent national estimates of maternal and perinatal mortality in the DRC. All known methods for measuring maternal mortality are fraught with uncertainties. The estimates obtained in this study are equally subject to errors of measurement. Based on the study findings, the MMR in Bunia was estimated at 345/100,000. This was 37% lower than the expected MMR of 549/100,000 of the 2007 national estimates of the DHS. The MMR estimate of 345 was arrived at by adding 30% to the figure obtained on the basis of all reported deaths in health facilities and in the community. THE DHS estimate was based on the direct sisterhood method, without further adjustments. (87) Estimates of maternal deaths avoided in comparison to a situation without EMOC were considerably higher.

The perinatal mortality estimate of 52/1000 was 32% lower than the expected 76/1000 of the 2006 WHO model for the DRC. The Bunia estimate of perinatal deaths was based on deliveries in all health facilities providing some form of EMOC. Although some perinatal deaths were reported in other health structures and in the community, estimates using the

[xxxvi] Integrated Regional Information Networks (IRIN), a project of the UN Office of the Coordinator for Humanitarian Affairs (OCHA)

total number of deliveries as the denominator would have resulted in a lower perinatal mortality rate. Detailed records of perinatal deaths by health structure can be found in Annex 10 and 11. The highest estimate was used in the CEA.

Saving the life of the mother has a demonstrated impact on the survival of young children in the family. A recent study in Bangladesh found the cumulative probability of survival up to age 10 after the death of a mother to be 24%, compared with 89% in children whose mother was alive. (151) A study in Haiti found that maternal death was associated with a 55% increase in the odds of losing a child below 12 years of age in the same family. (152) A Medline search did not retrieve similar studies in sub-Saharan Africa. A 1996 study in the north-eastern part of former Zaire (now DRC) found that chronic illness of the mother reduced child survival (RR: 1.2-9.0). The authors of this article underlined the importance of other caregivers for child survival in case of chronic maternal disease.(153)

The impact of EMOCS is related to access and quality. The assessed quality of care at BM was high. A skilled obstetric surgeon was available during most of the study, except for the period around New Year. None of the other EMOC-providing facilities employed a specialist obstetrician. The main identified limitations to access were security and transport problems, and the fact that the BM hospital only admitted emergencies. The study confirmed that EMOCS in Bunia were mainly used by the urban population. Although the security situation had improved, travelling around Ituri was difficult, especially during the rainy season.

Other factors influencing maternal and perinatal survival

Reducing maternal and neonatal mortality requires more than the availability of comprehensive EMOC, including CSs. Developmental strategies emphasise the importance of family planning and safe abortion, together with skilled birth attendance.(154,155) The WHO “CHOICE” (Choosing Interventions that are Cost-Effective) project has ranked priority interventions in order of cost-effectiveness. Most cost-effective were: community-based newborn care (e.g. promotion of breastfeeding), antenatal care (Tetanus Toxoid, pre-eclampsia screening, screening and treatment of asymptomatic bacteriuria and syphilis), skilled attendance at birth, and emergency obstetric and neonatal care around and after birth. Scaling up of all included interventions to 95% would halve maternal and neonatal deaths. (74) The CHOICE project did not evaluate the cost-effectiveness of interventions to prevent HIV transmission. During the first half of 2008, voluntary counselling and testing of pregnant women had not yet started in Bunia.

A high proportion of women in the Bunia Health Zone attended antenatal consultations. Among the women interviewed as cases or controls, 86.6% reported receiving one or more tetanus toxoid injections during pregnancy, including 71.2% who said they had two doses. With the exception of private health structures and antenatal outpatient facilities associated with hospitals (CME and RW), health centres were unable to perform basic laboratory tests such as haemoglobin checks or urinalysis. Test strips for rapid screening for proteinuria were usually available.

The study population was exposed to environmental risk factors for anaemia, including endemic malaria (Plasmodium Falciparum), Schistosomiasis (S. Mansoni) and hookworm (Ancylostoma duodenale). The 2007 DHS (87) found that 53% of adult Congolese women were anaemic (haemoglobin <12 gm/dl), with 16% having moderate anaemia (7-9.9gm/dl) and 1% suffering from severe anaemia (<7gm/dl). Anaemia in pregnancy is defined by WHO as a haemoglobin level below 11 gm/dl. The most frequent cause of anaemia in pregnancy is iron-deficiency.

Iron and folate supplements were supplied free of charge for the duration of pregnancy. Sulfadoxine-pyrimethamine was given twice in pregnancy as a presumptive malaria treatment. In Mozambique, this was found to be an effective intervention at reducing neonatal mortality. (156) Distribution of insecticide impregnated bed nets to pregnant women in the area was intermittent and coverage incomplete. In 2005, ECHO aimed for 60% retention and correct use of distributed bed nets. (157)

The local prevalence of haemoglobinopathies was unknown. Historically, Pygmies from the Ituri forest are known to have a high incidence of the sickling gene. (158) A recent screening project for sickle cell anaemia in Kinshasa found that 16.9% of newborns had sickle cell trait, while 1.4% were homozygous for HbS.(159)

The 2007 DHS (87) reported that 19% of women aged 15-45 years had a Body Mass Index of less than 18.5 which was the cut-off point for under-nutrition. Malnutrition, together with a high burden of communicable diseases such as HIV and malaria increases the prevalence of anaemia. In 2006 the prevalence of HIV among pregnant women attending antenatal consultations in Bunia was 3.5% according to surveillance figures from the national programme to combat HIV and sexually transmitted infections (Programme National Multi-sectoriel de Lutte contre le SIDA, PNMLS).(88)

Although the 2006 annual survey of the PNMLS found positive syphilis serology in 4.7% of pregnant women, no systematic screening for syphilis took place and the price of laboratory testing (Rapid Plasm Reagin, RPR) was relatively high (3 USD). HIV testing was not included in antenatal services during the study period. At the time of the study, availability of affordable treatment for HIV positive adults in the DR Congo was limited (estimated 5% of people in need), and there were no established facilities outside major urban centres for treating children with HIV. In 2005 only Kinshasa, Lubumbashi and Mbuji Mayi had laboratories where CD4 count could be performed. (160) Training on prevention of mother-to-child transmission was ongoing.

4.4. ECONOMIC ANALYSIS

Provider cost was calculated for four hospitals, three of which offered comprehensive EMOC. Because of security concerns, the theatre at RW was closed outside daytime hours. Both the total (6,241.87 USD) and the average cost (111.46 USD) of CS at RW were lower than at the other hospitals.

The average cost per CS at the evaluated level of service provision for the three round-the-clock providers was 171.58 USD for HGR, 200.00 USD for CME and 144.17 USD for BM. CS cost estimates using a comparable method found similar provider costs in other developing countries. (161)

The annual cost of providing EMOCS, as measured by the total cost of performing CSs was 14,069.97 USD for HGR, 11,600.17 USD for CME and 103,514.22 USD for BM. The cost calculations excluded international travel and housing cost for foreign employees. The actual expenditure of the NGO managing BM, and of the Christian church groups supporting CME, can therefore not be imputed from the calculations in this study. It is notable that the total annual cost of performing CSs at BM in 2008 was more than seven times (7.3) the amount estimated for HGR and almost nine times (8.9) the estimated EMOC expenditure for CME during the same year.

Sensitivity analysis looked at the effect of a proportional change in workload on cost. With maternity bed-occupancy by EMOC patients only available for BM, the first analysis used the available figure of 60% for BM, and assumed three in-patient days for non-surgical and six days for surgical deliveries in the other hospitals.

The sensitivity analysis assumed two in-patient days for non-surgical and six in-patient days for surgical patients in all four hospitals (Table 3.3.6). For BM, the second analysis resulted in a cost reduction by 11.9%. For HGR there was a slight increase in cost by 1.2%. For CME, the cost increased by 5.8%. The difference was largest for RW, with the cost of CS increasing by 14%. It can therefore be concluded that the first calculations for BM did not under-estimate the cost of EMOC in comparison to the other hospitals in the study.

An estimated 718 women received EMOC at BM in 2008. Assuming that all CSs were performed to avoid maternal *or* foetal death, the cost per expected healthy life year (HALE) gained ranged between 3.77 USD and 9.17 USD. The highest cost estimate was based on the lowest estimated number of maternal and perinatal deaths avoided.

Studies expressing the cost-effectiveness ratio (CER) in HALE are less common than those using disability adjusted life years (DALY). HALE was used as a composite measure without further discounting. Although DALY and HALE are not directly comparable, a study in Ghana found that DALY was usually valued higher in childhood than HALE, and that the difference between the two indices was relatively small for communicable, maternal and perinatal conditions. (162)

As the denominator in this CEA included both maternal and neonatal lives, a change in estimated HALE of either group would influence the CER. The HALE estimate at birth was taken from the WHO Statistical Information System (WHOSIS).(163) The life tables used for these estimates started from a systematic review of all available evidence on levels and trends in child and adult mortality. (164) To make information comparable between UN member states, population and mortality data were informed by assessments from WHO, UNICEF, and the UN Population Division. The tables took account of trends in child mortality and of the magnitude of the effect of HIV in countries with a substantial epidemic.

WHOSIS mentions the lack of reliable data on morbidity and mortality, especially from low-income countries, (such as the DR Congo) as a limiting factor. Since the literature provided no HALE estimate for 24-year old women, this figure was derived by interpolation between HALE at birth and HALE at age 60. While the validity of this procedure is open for debate, maternal survival accounts for a small fraction of HALE in the equation.

The estimated perinatal death rate in Bunia at the time of the study was based on recorded stillbirths and early neonatal deaths in all health structures providing some EMOC.

Some perinatal deaths were reported by other health facilities. To include these in the numerator, the denominator would have to include all deliveries in health centres. This would have resulted in a lower estimated perinatal death rate.

Since the cause of perinatal death was often difficult to determine, the assumption that the difference between the observed and the expected rate was due to CSs performed in the context of humanitarian assistance cannot be confirmed. However, since there was no evidence of provider-or-user preference, the indication for CS would have been maternal, foetal, or possibly both. Global estimates of intrapartum stillbirths and intrapartum-related neonatal deaths suggest that these account for 23% of neonatal deaths, and are responsible for 10% of deaths in children under five years of age. (165) The probability of dying under five in the DR Congo was 205/1000 in 2006.[xxxvii] In the CER, the estimated number of perinatal deaths avoided was 237. As mentioned before, 25% of CSs in the study sample were performed because of foetal distress, or included foetal distress as an indication. Out of an expected total of 958 CSs in 2008, the number of CSs for foetal distress would have been 239.

With the closing down of BM in the transition from relief to development, the workload at other hospitals was bound to increase. To provide care for the additional number of patients at the Government Hospital, HGR, and at the Mission Hospital, CME, resources would need to be scaled up. The incremental cost for these hospitals was modelled to reflect an increase to four CSs per week at HGR and three per week at CME. The required additional investment for one year was estimated at 11,371.33 USD at HGR and 14,359.12 USD at CME. The average cost of performing one CS would drop to 122.31 USD at HGR and to 166.41 USD at CME. At this rate, the two hospitals combined would cover one third of the expected additional number of patients needing EMOC.

The incremental cost calculations relied on unconfirmed assumptions with regard to additional staff needs. Following the recommendation of a former head nurse in a Belgian hospital, a maximum of seven surgical patients was assumed for one nurse during one shift. In 1997, MSF estimated that, in refugee camp situations, one nurse would be able to take care of 20 patients during an eight-hour shift. (166) However, health facilities set up in refugee camps usually rely on the nearest referral hospital for major surgery and EMOC.

[xxxvii] http://www.who.int/countries/cod/en/

Fourteen nurses (13 general nurses and one midwife) worked in the BM maternity at the time of the study. Assuming 60% of their time was allocated to EMOC (14x0.6) = 8.4 nurses were needed to take full-time care of 14 surgical beds. If one nurse works on average two days out of three, this would mean 5.6 nurses on duty for eight hours each, or 1.9 nurses for each shift. The staff employment in BM was close to the estimate of one nurse for seven patients.

The additional staff needs in the calculations were relatively small (one full-time nurse for CME, two for HGR), with 55.7% of one monthly salary of 161USD added for CME and 15% of two salaries of 120 USD for HGR. The study was unable to establish whether nursing staff already employed at CME and HGR had spare time while on duty.

In cost-effectiveness analysis, interventions costing less than 100 USD/year gained are sometimes described as highly cost-effective. (167) Some health economists argue that setting a threshold is not possible, because of the interaction between cost-effectiveness, burden of disease and available funds.(168) The Commission on Macroeconomics and Health recommended the use of Gross Domestic Product (GDP) as an indicator. Interventions costing less than the GDP per capita were qualified as highly cost-effective.[xxxviii] In either case, the results of the study suggest that EMOCS were a cost-effective part of humanitarian assistance in Bunia. The observed effectiveness of CS was similar to international standards and the average cost per CS at BM was in the same range as estimates for the other hospitals in the area.

Cost estimates did not cover expenses specific to employment of expatriate staff such as international travel and housing. The investment required from national and developmental sources to completely take over EMOCS provision at the 2008 level would therefore approximate the annual cost of EMOC at BM. At the time of the study, CME relied on user fees and international charity, while HGR received developmental assistance from the EC in addition to user fees. It seems unlikely that either hospital would be able to rapidly scale up its budget for EMOC to the 2008 level of BM.

In countries recovering from violent conflict, there are many difficulties with continued funding of healthcare. In areas such as maternal and childcare, the withdrawal of emergency relief organizations will leave unfulfilled needs unless other providers take over service provision.

[xxxviii] http://www.who.int/choice/costs/CER_thresholds/en/index.html

Examples of delays in transitional funding abound. In 2005, two years after the end of the second Liberia war, USAID and OFDA co-hosted a workshop aiming to harmonise the US Government's health programmes in Liberia in order to promote the best possible transition from emergency assistance to health development. Maternal and child health (MCH) was identified as one of five priority areas. Priority interventions for MCH were the "establishment and re-invigoration" of referral centres, together with training of health workers. (169) In June 2010, MSF, an emergency–oriented international NGO, handed over its last two hospitals in Liberia to the Ministry of Health. (170)

Next best use of resources

<u>Strengthening PHC</u>

The emergency-only policy implied that BM did not perform first line PHC activities, including ante- and postnatal care, or uncomplicated deliveries. In spite of this, 1214 vaginal deliveries took place at BM during the study period of six months. The majority were women who arrived at the hospital in an advanced stage of labour. Reasons for choosing BM as the place to deliver were free services and good quality of care.

At the time of the study, changes in the national health policy were being implemented, defining the functions to be performed at different levels of care. Activities at health centres concentrated on preventive and first line curative action, as well as normal deliveries, with referral of complications to the hospital. The NGO managing BM was also active in training local health workers.

Using the same life-expectancy estimates, according to the WHO standard package, implementing the full mother-baby package including EMOC would cost (525,650/9556) = 55USD per expected healthy year of life gained. Investing in improving ANC and perinatal interventions at health centres and in the community would have been a less cost-effective short-term strategy.[xxxix]

The additional cost of providing more comprehensive maternal and neonatal healthcare, as described in the WHO "Mother-Baby Package" could not be estimated during the study period. Improving the capacity of health centres, in addition to the provision of EMOC, is a long-term challenge. (171)

[xxxix] Neonatal (191x45) = 8595 years and maternal (31x31) = 961; total (8595+961) = 9556 years HALE gained

PHC services at health centres would need to be strengthened further to increase the coverage of antenatal care, including the cost-effective screening tests proposed by WHO (CHOICE). Laboratory tests and subsequent treatment if needed would have to be available and affordable. Increased use of family planning would require long-term changes in the attitude of providers and users. Strategies to influence those changes exceed the usual activities of humanitarian action.

<u>Strengthening existing referral services</u>

The violent conflict in Ituri is historically rooted in ethnic differences. Politico-military allegiances and economic power reflect this ethnic division. The NGO managing BM abandoned an initial attempt at strengthening the existing public hospital, partly because of problems with equity of access. (172) Faith-based organisations working in healthcare had been co-opted into the public health system. They followed the national health policy regulations, though organisations applied their own rules on fee exemption for destitute patients. Especially in the context of ethnic violence, judgements concerning beneficiaries may be biased.(173) None of the faith-based service providers had the capacity to expand services quickly, in order to accommodate the increasing number of patients during the peak of the conflict in 2003.

Setting up an emergency hospital in parallel to existing services made it possible to provide free healthcare without modifying the health system, which was based on cost-sharing and cost recovery. It also allowed equitable access in a context of severe ethnic tension.

During and after the conflict, international donors supported government health structures with structural maintenance, equipment and supplies, as well as with staff incentives. In 2007, WHO obtained financing from the Central Emergency Relief Fund (CERF) to refurbish the theatre at HGR and to conduct staff training in sterilisation techniques. Meanwhile, plans were made for the closure of BM, with a handover of services to other health structures.

The options for increasing coverage of EMOC beyond the urban area are twofold: establishing EMOCS in rural hospitals, or increasing access to existing services in the town area. The first option was being put into practice, with limited success, due to a shortage of skilled health workers willing to live in the rural areas.

The possibility of creating waiting mothers' shelters in the town had not been considered. A World Bank publication claims that an increase in institutional deliveries with reduction of maternal mortality has been found in several countries, for example in Cuba, where the maternal mortality ratio reportedly fell from 118 to 31/100,000 as a result of maternity waiting homes. (174)

According to Congolese criminal law, induced abortion was illegal at the time of the study. (175) The UN listed the DRC among countries where abortion is permitted to save the life of the woman, specifying that "the abortion laws in these countries do not expressly allow abortions to be performed to save the life of the woman, but general principles of criminal legislation allow abortions to be performed for this reason on the ground of necessity." (176) The same UN source estimated the use of modern contraceptive methods at 4%.[xl]
Mortality related to unsafe abortion is highest in Africa, with an estimated ratio of 110 deaths per 100,000 live births. (177) While advocating human rights is an important part of humanitarian action, the legal framework would have to be clarified before advocating safe induced abortion at HGR. In the faith-based health facilities CME and RW, induced abortion was prohibited on religious grounds.

4.5. HUMANITARIAN ASSISTANCE AND DEMAND FOR HEALTHCARE

It has been argued that humanitarian assistance, and the presence of foreign aid workers contribute to changes in the environment, attracting local people and creating a demand for more and different services from what was previously available. (178)

Sudden population movements are known to increase healthcare needs. The provision of relief services in response to a complex emergency or following a sudden disaster is organised in phases, with the initial response aiming at immediate survival of the affected population. (166) Where possible, arrangements are made for referral of emergency surgical cases, including those requiring EMOC, to an existing hospital. In the case of Ituri, widespread armed conflict caused a protracted crisis with large numbers of internally displaced people (IDPs). In January 2003, an estimated 115,000 IDPs in Bunia needed emergency assistance. (179) The growth of the urban population resulting from the armed conflict around Bunia is likely to have preceded the arrival of humanitarian aid teams.

[xl] http://www.un.org/esa/population/publications/2007_Abortion_Policies_Chart/2007_WallChart.pdf, accessed 01/02/2011

Although Operation Artemis, the UN sanctioned international military intervention from May to August 2003, ended the fighting in Bunia, international forces were unable to impose a lasting peace in Ituri. Armed groups continued to be active in the surrounding territories, preventing people from returning home. In August 2005, MSF Suisse published a report (37) highlighting the needs of the population in the areas outside Bunia and the difficulties of NGOs trying to gain access to them.

The response to the events in Ituri included the construction in May 2003 of a field hospital in Bunia (BM) financed and managed by an international NGO. (180) The purpose of the 300-bed hospital was to perform emergency surgery linked to the conflict, and offer inpatient and outpatient care for women and children. (38) Maternal (95) and child mortality (76) in the eastern part of the DRC were known to be elevated. Other public and private health structures in Bunia were also providing EMOC. Two years later, the temporary structure at BM was replaced by a semi-permanent hospital building. By 2008, the maternity ward had 28 beds in constant use, half of these for obstetric surgery patients. The reported bed occupancy in the maternity ward exceeded 100%.[xli]

While healthcare was an important aspect of humanitarian assistance, there was no evidence that availability of healthcare services influenced the pattern of population movement. BM responded to the emergency needs of the local population, including recent arrivals. Five years after the hospital was opened, the use of EMOC as part of humanitarian aid appeared to reflect an additional need that could not have been covered by previously available services.

Long-term neglect of government health services had caused severe structural deterioration, leading to low professional motivation and a degrading quality of care. At the start of the crisis, one international NGO decided to act as a separate provider. Other humanitarian actors opted for assistance to the health system with various inputs to help accommodate an increasing number of patients, many of whom had a limited capacity to pay. User fees were temporarily waved or reduced. Financial incentives were given to health workers to compensate for the increased workload and potential loss of income. During the transition period, starting from 2007, these incentives were gradually abolished. By 2008, user fees were re-applied, with the various charges listed and displayed at health centres and hospitals.

[xli] In November 2007, the reported bed occupancy rate for the maternity was 119% (personal communication, Dr Claude Ngabu, hospital director)

Sexual violence and complications of abortion

Although rape and associated violence in the eastern part of the DR Congo were brought to international attention, (181. 182) quantitative data on its occurrence are difficult to evaluate. MSF recorded up to 300 reports of rape monthly, with 7000 survivors treated over a period of four years in Ituri (2003-2007). (38) In 2009, MSF reported treating more than 1000 women at the hospital in Bunia, mainly for rape. (183) An NGO working in the psycho-social sector collected information on referrals from psycho-social services in its intervention zone. During a recording period of five months (August-December 2008) in 17 Aires de Santé (health areas) in the Djugu district north of Bunia, 480 survivors of sexual violence were referred to a health structure.[xlii] Djugu is a rural district, with small settlements. With an estimated population of 170,000-200,000 covered, the incidence of reported sexual violence was between 5.6 and 6.8/1000 population/year. Comparative figures are hard to locate. At the national level, a USAID/DCHA assessment found "a large increase" of rape cases treated in hospitals in Goma and Bukavu after 1996, with several thousands of patients referred between 2002 and 2004. (184)

The Executive Summary of the Comprehensive Strategy on Combating Sexual Violence in the DR Congo, published in 2009, cites a figure of 200,000 reported cases in the country since 1996. [xliii] (185)

Since induced abortion was illegal, the only information collected by the research team was the number of procedures carried out at health structures to treat "complications of abortion." In developing countries, the estimated risk of death following an unsafe abortion procedure is estimated at 1/270. (186) Emergency contraception was made available to survivors of rape. MSF reported that among those seeking medical care, only 30% arrived at a health facility within 72 hours. (37)

[xlii] These data were collected by the COOPI psycho-social department during the time when the lead researcher was COOPI's manager for reproductive health in Bunia (Aug 2008-Jan 2009)

[xliii] In 2009, the UK office for crime statistics reported 13,093 rape cases (12,129 women and 964 men) in England and Wales for the previous year, *The Stern Review*, a report by Baroness Vivien Stern of an independent review into how rape complaints are handled in England and Wales, Government Equalities Office, Home Office 2009

The theatre in RW was used periodically for fistula repair by a visiting surgeon. The population of Ituri was informed beforehand through the media of the surgeon's arrival in order to reach a large number of patients. In 2008 until November alone, 132 fistula patients were treated at Rwankole hospital. According to this surgeon, 5% of the women presenting for repair of vesico-vaginal fistula had been raped. Late or unavailable CS (75%) and professional errors during obstetric surgery (20%) were the main causes of fistula.[xliv]

Potentially harmful practices

In a paper written for the "Expert group meeting on good practices in legislation to address harmful practices against women" held in Addis Ababa, *sororate* and *levirate* are considered harmful, as they do not take the cause of death into account. (187) Some authors claim that the social group takes precedence over the individual in traditional African society. (188) Little is known about the importance of gender, and the effect of war on the interconnection between an individual as a person and communal identity. (189) *Sororate* was mentioned by several of the focus groups, some explicitly indicating the need for agreement by the individuals concerned. While HIV/AIDS was discussed in the context of the question regarding care of the newborn in case of maternal death, focus groups did not make a direct link between *sororate* and the risk of contracting HIV.

4.6. FUNDING EMOCS DURING TRANSITION AND RECOVERY

The national cost-sharing health policy was a major obstacle to channelling humanitarian assistance through government services. The revised national policy on reproductive health, published in 2008, described a comprehensive package of services. Responsibility for mobilising resources, however, was left to the community, while advocacy was called for at all other levels. (190)

Household health expenditure is deemed "catastrophic" when it is equal to or greater than 40% of the capacity to pay, defined as the household non-subsistence effective income. In a multi-country study carried out by the Evidence and Information for Policy Department of WHO, the poverty-line was based on the proportion of households with average food expenditure in the 45th to 55th percentile range of total expenditure.

[xliv] Personal communication from Dr Christina de Wind during an interview at Rwankole hospital, 2008 cmdewind44@yahoo.com

Using survey data from 59 countries, the analysis found that out-of-pocket spending was strongly related to catastrophic healthcare spending. Other factors were poverty and access to health services. Catastrophic expenditure was highest in countries with a high proportion of poor households, easy access to and high use of healthcare services. The study recommended social insurance and general taxation as funding methods for healthcare, in preference to direct user payments. (191)

Subsistence spending, the minimum requirement to maintain basic life at the household level, is closely linked to food expenditure. As the proportional household expenditure on food varies, some studies have used modelling techniques to adjust for known variables such as family size. The WHO methodology on fairness in financial contributions fixed subsistence spending at a dollar per person per day. (192) The poverty line in the DRC in 2008 was set at 240 USD for rural, and 380 USD for urban dwellers. (193) The median monthly income of questionnaire respondents in the case-control study in Bunia was 30,000 FC (60 USD). The question referred to the disposable family income. With a median annual family income of 720 USD, a large proportion of the Bunia population could be described as absolute poor.

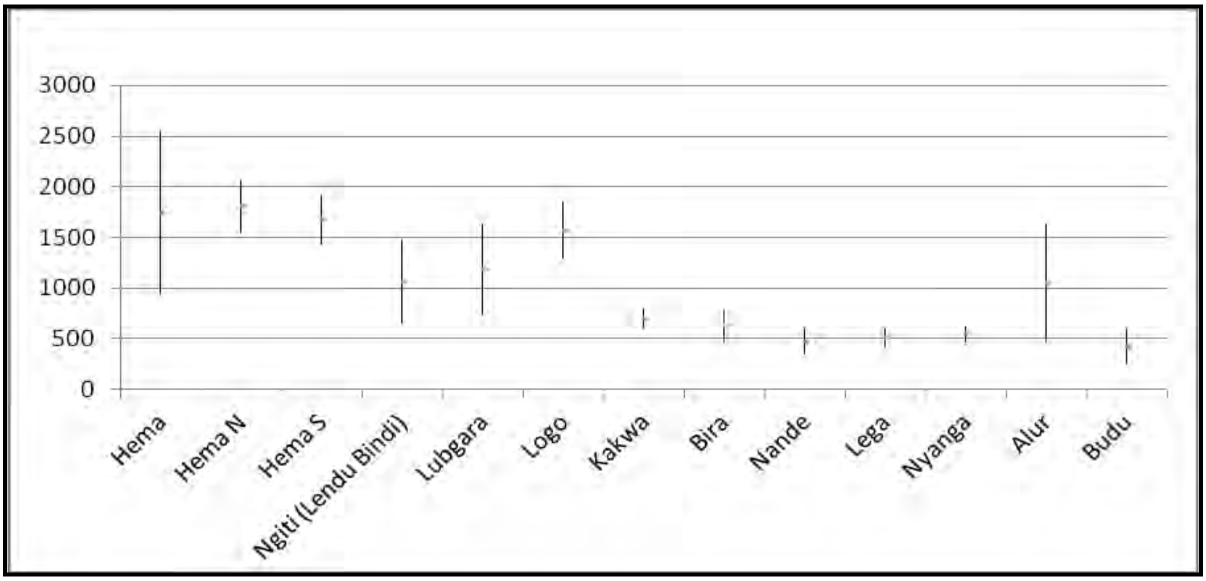
Prepayment mechanisms for risk pooling to avoid catastrophic health expenditure can be insurance-or tax based. With a small number of registered tax payers, government tax revenues in sub-Saharan Africa are generally low. (194) Limited experience with voluntary community insurance schemes in the DRC has been encouraging. (195) In 2009, UNHCR estimated that the private scheme of the BDOM[xlv]covered one fifth of the population of the capital Kinshasa. The UN agency paid 30 USD monthly per refugee family for health insurance coverage. (196) The extent to which the lowest income group can take part in such schemes needs to be further examined.

Fees for services are known to influence user behaviour. (197) The case-control study, as well as the focus group discussions confirmed that most users could afford only limited out-of-pocket payment. The responses of focus group participants indicated that the nuclear family expected to bear the cost of an obstetric emergency, rather than sharing the financial burden with the extended family. A similar finding has been reported in neighbouring Tanzania. (198) The questions to the focus groups also explored the social implications of maternal death in childbirth, with a view to develop social marketing messages promoting health insurance for obstetric emergencies.

[xlv] Bureau Diocesain des Oeuvres Médicales, Diocesan Office of Medical Works

When compared to the average bridewealth paid by a man's family, the responses seemed to indicate that the benefits of not losing a wife would largely outweigh the user cost of CS.

Figure 4.3: Amount of bridewealth by ethnic group; Y-axis in USD equivalent



However, the amount of money or payment in kind that constitutes the bridewealth is not directly comparable to the expenses incurred for a CS. The financial and material arrangements surrounding a wedding establish a bond between the families of bride and groom. The debt incurred by the groom towards his parents and their family shapes the relationship of the adult son towards them. Any outstanding payment towards the in-laws may entitle them to demand his labour. (199-201)

Assuming it would take a man ten years to repay the bridewealth to his parents, the average amount of payment made by different ethnic groups could be used to estimate a reasonable baseline for insurance contributions. (Table 4.1)

The annual payment at the lower end would be 42 USD, and the highest annual payment would be 181USD, a monthly obligation of between 3.5USD and 15USD. While healthcare is potentially life-saving, reimbursing any incurred debt is likely to take priority over insurance against the obstetric risk to the mother.

Table 4.1: Average total bridewealth in USD by ethnic group

Ethnic Group	Bridewealth (average in USD)	Ethnic Group	Bridewealth (average in USD)
Hema	1745	**Kakwa**	700
Hema N	1807.5	**Bira**	627.5
Hema S	1680	**Nande**	475
Ngiti	1602.5	**Lega**	510
Lubgara	1190	**Nyanga**	547.5
Logo	1572.5	**Alur**	1047.5
		Budu	422.5

The comparison does not consider the user perception of EMOC, and the perceived risk of surgical delivery to mother and child. An important proportion of CSs was performed for foetal indications. The negative correlation between the number of children alive, and CS as the mode of delivery, suggests that user concern about survival of the baby is a factor influencing the decision whether or not to accept surgical delivery. The value placed on the life of a neonate was not investigated in this study.

Community-Based Health Insurance (CBHI) schemes cover 0.2% of the African population. They typically charge low premiums (often less than one USD/month), which causes limitations in sustainability and managerial capacity. Due to their small scale and limited coverage, the effect of CBHI on creating equitable and effective health systems is thought to be small. The poorest often remain excluded.

For example, experience in Rwanda found that, after introduction of health insurance schemes, utilization of health services remained low. Continuing co-payment, low quality of services and long distances to travel were the reasons given. (202)

Since it would not be possible to impose private health insurance on every person or family, alternative resources would need to be found to ensure access to EMOC for the most vulnerable. Women's participation in the national economy of the DR Congo is hard to quantify, as they represent only a small proportion of the formal sector.

In 1996, the Food and Agricultural Organization (FAO) found in a survey of nine African countries that women's contribution to the production of food crops in the DRC was as high as 80%. In sub-Saharan Africa, 25% of employees in the non-agricultural informal sector (petty trading and home-based activities) are female. (203) Although they are an economically active group, most individual women are excluded from State protection or benefits, and the value of their work is underestimated. (204)

The ethical argument in favour of State-funded maternal healthcare is grounded in the right of women to health, including but not restricted to healthcare. (205) The DRC Constitution upholds the principle of gender equality. The DRC also ratified the "Convention to Eliminate all forms of Discrimination against Women (CEDAW)," which calls for the elimination of prejudices based on stereotyped roles for men and women (article 5). Maternal mortality can be effectively reduced by providing access to healthcare, including EMOC. Provision of health services in connection with pregnancy, confinement and the post-natal period, granting free services where necessary, is stipulated in article 12 (2) of the CEDAW. (206)

At the time of the study, humanitarian funding for the health sector in Ituri was declining and BM hospital was due to be closed in 2010. The study findings indicate that user fees charged by the remaining providers were lower than the average cost of a CS. Therefore additional funds would have to be raised in order to expand EMOCS at CME and HGR. In practice, capital investment was ongoing at CME with the construction of a new hospital, and the theatre of HGR had been rehabilitated in 2007.

While there are some arguments in favour of cost-sharing in resource-poor developing countries, the implementation of the same policy in crisis and transitional environments is more likely to increase than decrease inequities. (207) Neither the official end of the war in 2003, nor the 2006 elections brought peace to the north-eastern part of the DRC. Economically, the DRC was on the brink of bankruptcy in 2009, and the FC lost half of its value between mid-November 2008 and mid-April 2009. (208) In a 2008 UN report, the DRC was mentioned for its persisting high maternal mortality. (209)

A commitment from the Government and international donors is needed to ensure equitable access to EMOC, essential to achieve the fifth Millennium Development Goal: Improve Maternal Health.

This study found that offering free access to EMOCS was a cost-effective approach towards reducing maternal and perinatal mortality. Cost-effectiveness is not the only aspect to be considered when deciding about priority services in healthcare. Eliminating inequities systematically associated with social disadvantages or marginalisation, including the pursuance of equity in health, is considered a moral obligation. Social inequalities cause inequities in health. Financial barriers act as a disincentive for the poor to the use of healthcare, further enhancing the existing inequities. (210) With regard to EMOCS, the equity argument is even stronger when women have limited access to financial resources within the household, as was found to be the case among the study population. Both efficiency and equity concerns can be used to advocate free access to EMOCS.

Another factor in decision making is the "Rule of Rescue." The soundness of this rule has been the subject of debate, especially with regard to the treatment of incurable diseases in high income countries. (211) The "Rule of Rescue" is based on the psychological imperative to come to the rescue of individuals whose life is in imminent danger. (212) Although the argument is complicated when life-threatening conditions require expensive treatment to extend life for a short time only, EMOCS are efficient at avoiding loss of life and severe disability for mother and/or child. The moral obligation to assist a person in a life-threatening situation also applies to EMOC.

This study found no evidence of provider preference in Bunia. Policy makers should focus on maintaining the demonstrated health gains, and where possible improve on them, before worrying about a possible increase of CS rates beyond an optimum level.

After this detailed discussion of the study findings, the next and final chapter of this dissertation gives a summary of the conclusions in relation to the research environment, and their wider policy repercussions in the context of transition from humanitarian to development assistance.

CHAPTER 5

CONCLUSIONS

5.1. RESEARCH IN UNSTABLE ENVIRONMENTS IS POSSIBLE

Conducting field research in a humanitarian crisis environment is challenging, but possible. The UN staff security system categorised the situation in Bunia as phase three (Fig 5.1).

Fig 5.1: UN phases of security

UN phases of security	
1	Precautionary
2	Restricted movement
3	Relocation
4	Programme suspension
5	Staff evacuation

Phase three indicates "a substantial deterioration in the security situation, which may result in the relocation of staff members or their eligible dependants."(213) While international organisations outside the UN system applied their own rules concerning staff safety, aid workers shared security information during regular and freely accessible meetings at OCHA. Aid organisations were encouraged to inform the UN regarding their out-of-town activities, and to report any incidents.

All parties approached in Bunia agreed on the importance of independent research and were willing to collaborate, on condition that the study would not interfere with their work. Transparency regarding aims and methods, and careful planning in the execution of the study components facilitated the field work.

5.2. EMERGENCY CAESAREAN SECTIONS IN BUNIA WERE PERFORMED FOR APPROPRIATE REASONS IN 2008

The additional provision of EMOC by an international NGO improved access to CS in the Health Zone. Although the proportion of surgical deliveries approached ten percent of the expected number of deliveries, the findings of the field study refute the hypothesis that they were performed for non-medical reasons. Predicting factors associated with CS were indicative of problems during this and/or previous delivery.

The population of Bunia is unlikely to decline in the near future. It would take time for a possible decrease in the fertility rate to reduce the total number of births. The 2008 level of EMOC provision should therefore be maintained.

5.3. ADDITIONAL EMOCS MAY BE REQUIRED TO COVER EXISTING NEEDS IN A HUMANITARIAN CRISIS

Heavy fighting in 2003 caused large-scale population displacement towards the Bunia town area. Previously existing local health structures were unable to cope with the need for equitable access to emergency healthcare. Provision of emergency healthcare should be impartial. When this is not the case, support for existing structures may be an inadequate response. While the separate provision of hospital services is considered unusual, (214) humanitarian assistance should be guided by an assessment of local circumstances, including priority needs and response options.

Setting up an additional healthcare facility was a quick way of responding to the emergency. The results of this study indicate that EMOC was a cost-effective part of the additional services provided. Both maternal and perinatal mortality were about one third lower than expected for Bunia in 2008, most likely as a result of the free provision of effective EMOC by a humanitarian provider.

5.4. COST ESTIMATES ARE IMPORTANT FOR TRANSITIONAL DECISIONS

The cost to the humanitarian provider of performing CSs in Bunia can be taken as an approximation of the cost of EMOCS at the 2008 level of service provision. Since the humanitarian assistance programme was temporary, future healthcare providers would need to invest additional resources to achieve the same results. BM functioned parallel to the existing health system. The management of the Health Zone saw the hospital as an extraneous phenomenon, and its services too costly to consider in the long term. The study findings contradict this opinion. While the total cost of EMOCS at BM was higher, the cost per CS was lower than for the other round-the-clock providers. To maintain the gains in maternal and perinatal survival, a gradual take-over of the services provided by BM is possible and necessary.

5.5. A LONG TERM INVESTMENT WILL BE NEEDED TO EXPAND EMOCS TO THE REQUIRED LEVEL

The total annual cost of CSs at BM in 2008 (103,514.22 USD) was higher than the entire hospital expenditure reported by HGR in 2006 (96,632.83 USD). (215) Revenue from user fees, the main source of income for local health structures, would be insufficient to raise the necessary funds for capital investment.

The estimated user charges for EMOC were high from the user perspective, but considerably lower than the provider cost. Funding from the national health budget and/or from developmental donors will be required to take over the services from humanitarian providers.

5.6. THE ECONOMIC CONTEXT INFLUENCES CAPACITY TO PAY FOR EMOC

Following the war, a large segment of the population had no regular source of income. In a subsistence economy, charging a lump sum payment for emergency healthcare may not be appropriate. The median of user charges for CS at the time of the study was higher than the median reported monthly income. More research would be required to evaluate alternative modes of payment, including cash instalments and deposits in kind. An assessment of the capacity to pay health insurance premiums should also look into the size and characteristics of population groups unable to contribute to private insurance. From an ethical point of view, the demand of a down payment before emergency treatment is given should be opposed.

5.7. AN UNDERSTANDING OF VALUE SYSTEMS IS CRUCIAL IN THE PLANNING AND PROVISION OF SERVICES

To be successful, health promotion needs to be understood and accepted. Before messages are formulated, it is important to investigate local customs. Marriage and procreation are essential parts of adult life in Ituri. The custom of paying bridewealth is embedded in a complex system of wealth transfer and social relations between families. Bridewealth is influenced by socio-economic factors. In Bunia, the range of the amount to be paid was wide (from 100 USD to more than 2,500 USD). The social value of an adult woman's life is linked to her child-bearing capacity. Polygamy, although illegal, continues to be widespread. In the event of maternal death, *sororate,* the marriage of a widower to his deceased wife's sister, is customary among many population groups. While the social value of an adult woman may be high, the value attached to the life of a specific female person could be low.

It is usual to ask the husband or a male relative for consent before obstetric surgery. The perceived risk of obstetric surgery needs to be assessed as well as its life-saving potential for mother and child. This has important implications for health promotion and Information, Education and Communication (IEC) strategies. In addition, the user perception of the risk/benefit ratio is likely to influence willingness to contribute to private insurance schemes.

5.8. EVALUATING COST-EFFECTIVENESS REQUIRES TIME AND DEDICATED RESOURCES

Evaluation guidelines insist that organisations implementing humanitarian programmes demonstrate the effectiveness and efficiency of their activities. Cost-effectiveness analysis requires data to be collected over a period of time in a structured, reproducible way. As a method for micro-economic evaluation, cost-effectiveness analysis does not give an answer to questions about the overall appropriateness of humanitarian action. However, this study shows that it is possible to derive broader conclusions from its findings, by choosing an intervention area representative of a large part of the sector under review.

5.9. THE NEED FOR OTHER ESSENTIAL EMERGENCY HEALTHCARE SHOULD BE CONSIDERED

Since EMOC is an essential part of PHC, the adequacy of EMOCS gives an indication of the functionality of the health system overall. Among other services, BM hospital also offered free emergency paediatric care, medical services for survivors of sexual violence, and free voluntary counselling, testing and treatment for HIV/AIDS. Since this study only assessed the cost-effectiveness of EMOCS, the impact of other activities cannot be quantified. In an unpublished background document, Epicentre, the research branch of MSF, reported an estimated average of 350 paediatric admissions monthly at BM in 2007. (216) At the time of the field study, there was no paediatrician in Bunia other than the expatriate doctor working as a volunteer at BM.

5.10. WOMEN'S RIGHTS CAN BE USED TO ADVOCATE STATE SUBSIDY OF EMOC

Arguments in favour of state subsidy for EMOC are linked to women's human rights with regard to health. Advocacy for subsidised EMOC is sensible in countries with high maternal and perinatal mortality rates. Where salaries are linked to hospital revenue, performance-related financing of healthcare has the potential of acting as an incentive to carry out more surgical deliveries than medically indicated. Mechanisms to avoid personal financial incentives for performing unnecessary CSs need to be developed.

Statements from women and adolescent girls who became pregnant following rape (217) confirm frequent discrimination and social exclusion of the mother and child. Safe abortions cannot be performed in a context of illegality. Advocating a review of the Congolese law regarding abortion is an issue for health and human rights activists.

The results of this study confirm the importance of unimpeded access to EMOC. Such services can be provided effectively and at a low cost per year of healthy life expectancy added. Offering EMOC as part of a package of parallel emergency healthcare services may be the most effective way of achieving this during a humanitarian crisis and, as this study has shown, can be accomplished in the early stages of an emergency. User fees reduce accessibility to services and are insufficient to fund the additional resources required for remaining providers, if the same needs are to be covered during transition to development. Governments and development donors can base their assessment of investment needs by analysing the cost of EMOCS in the context of humanitarian assistance.

Recommendations for policy and planning:

- Gradually expand EMOC services of the remaining round-the-clock providers in the Bunia Health Zone to achieve and maintain equitable access to EMOC.
- As part of the revitalization process, assess the need for EMOC in other Health Zones, estimate the gap in EMOCS provision, and determine how it can be closed.
- Remove financial barriers to access. Ideally, provide EMOC free of charge. If this is not possible, review the user cost and the mode(s) of payment. Set a reasonable maximum for the total user cost of treatment.
- Advocate increased funding of EMOC with development donors and Government authorities as a cost-effective method of reducing maternal and perinatal mortality.
- Limit the number of EMOC facilities and improve their functionality in each Health Zone, while maintaining equity of access, to achieve economies of scale.
- Strengthen antenatal care and other cost-effective, community-based services to further improve maternal and neonatal survival.

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ANNEXES

ANNEX 1

TIMELINE (1994-2010)

July 1994

More than a million Rwandans cross the border into the eastern provinces of (former) Zaire (now DR Congo). The Interahamwe militia hide among civilians in the refugee camps around Goma and contribute to destabilisation in the region.

May 1997

Laurent Kabila enters Kinshasa with his rebel army and takes presidency from an ailing Mobutu, who dies in Rabat, Morocco, in September 1997.

August 1998

Anti-Kabila armed opposition, backed by Rwanda and Uganda, attempt to take the capital. Kabila gets support from Zimbabwe, Angola and Namibia.

November 1998

Ugandan forces (UPDF) occupy Ituri with support from Rwanda (clashes in Kisangani in May 1999 ended support).

June 1999

A land dispute erupts between pastoral Hema and agricultural Lendu, leading to widespread conflict in Ituri.

July 1999

Lusaka ceasefire agreement signed.

November 1999

UN peacekeeping mission is approved (resolution 1279). Violations of ceasefire continue.

February 2000

Security Council authorizes deployment of more troops (resolution 1291) amidst increasing violence and destruction.

January 2001

Laurent Kabila killed by bodyguard and replaced by his son Joseph.

October 2001

Start of Inter-Congolese Dialogue (ICD).

September 2002

Ugandan troops start withdrawing from Ituri.

December 2002

Global and All-inclusive Agreement signed in Pretoria for implementing the Government of National Unity and Transition.

April 2003

Final session of ICD in Sun City (South Africa);
Ituri Pacification Commission is established (MONUC, April 2003).

May 2003

Renewed fighting in Ituri;
UNSC resolution 1484 authorizes deployment in Bunia of Interim Emergency Multinational Force until 1 September 2003, in close co-ordination with MONUC under Chapter VII. “Operation Artemis” succeeds in controlling the fighting in Bunia, but fails to pacify the district. After withdrawal of the Multinational Force, MONUC in Bunia is enforced with 3,800 troops (Ituri Brigade).

July 2003

New national (transitional) government takes up its duties.
CONADER established; DDR to be completed by 2005.

July 2006

First round of national elections with indecisive result.

October 2006

Second round of national elections: run-off between Joseph Kabila and opponent Jean Pierre Bemba gives victory to Kabila, but confirms split votes between east and west.

October 2007

Fighting between FARDC and FNI (led by Peter Karim) displaces around 10,000 civilians in the Libi-Wadza area, 120 km northeast from Bunia.

October 2008

Clashes between FARDC and new rebel group “Front Populaire pour la Justice au Congo” (FPJC) in Kagama, Bukiringi and Nyakunde (near Bunia).

December 2009

FARDC starts offensive against remaining militia in Irumu.

April 2010

The Government of RDC establishes a humanitarian corridor to evacuate hundreds of civilians trapped by fighting between army and rebel militias 100km south of Bunia.
OCHA reports 448,139 displaced persons in the Oriental Province.

May 2010

UN Organization Stabilization Mission (MONUSCO) established to take over from MONUC on 01/07/2010.

ANNEX 2

MEASURING MATERNAL MORTALITY

The 10th International Classification of Diseases (ICD-10) defines maternal death as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes. Late maternal deaths are deaths occurring between 42 days and one year after delivery. The definition of "maternal death" requires cause of death information to exclude incidental causes. (218) Direct obstetric deaths result from obstetric complications of the pregnant state (pregnancy, labour and puerperium), from interventions, omissions and incorrect treatment, or from a chain of events resulting from any of the above. Indirect obstetric deaths result from previously existing disease or disease that developed during pregnancy which was not due to direct obstetric causes, but which was aggravated by the physiological effects of pregnancy. (219, 220)

Because maternal death is a rare event and often under-underreported in resource-poor settings, measuring its occurrence and the evolution of death rates over time is complicated. The Maternal Mortality Ratio (MMR) is the number of maternal deaths, during a given time period, per 100,000 live births during the same period. The maternal mortality rate uses the number of maternal deaths during a given time period per 100,000 women of reproductive age as the denominator. MMR is a commonly used measurement. An approximation of the number of live births is the estimated number of live children aged 0 to one month, which is used in planning childhood vaccination programmes.

The "(indirect) sisterhood method," which uses retrospective data from household surveys, was developed in the 1980s to obtain information in countries with unreliable vital registration systems. The results apply to a time period of about 10-12 years before the study. Therefore, the indirect method cannot be used to assess the immediate effects of an intervention to reduce maternal mortality. A variation on this method is the direct sisterhood method, equally based on household surveys, but using a different, more elaborate questionnaire. This technique results in estimates that apply to a narrower timeframe of about 4 years, closer to the period during which the data were collected. Health facility based sampling has also been used in some settings [Nicaragua, (101) Cambodia (221)], in an attempt to reduce the cost of data collection. However, all methods have wide confidence intervals as a limitation. Another method, the Reproductive Age Mortality Survey (RAMOS), uses triangulation of different sources of data on deaths of women of reproductive age coupled with record review and/ or verbal autopsy to identify maternal death. (222)

NOTE – Annex 3 is not available online due to data confidentiality.

ANNEX 4
COLLECTIVITIES LIVING IN ITURI

Professor Pilo, who lectures sociology of the family at the "Institut Supérieur Pédagogique de Bunia,"(Institute of Higher Education, associated to the University of Kisangani) clarified the distribution of ethnic groups in Ituri in a personal interview, held in Bunia on 23 June 2008. Each province in the DR Congo has several territories, inhabited by a number of collectivities.[i] Ituri is a district in the Oriental Province and counts 46 collectivities living in 5 territories: Mambasa, Irumu, Djugu, Mahagi and Aru (Fig 1.2). Bunia is situated in the Irumu territory. It is the largest urban settlement of the Ituri district and its capital.

Irumu is home to Ba Bira (4 collectivities), Ba Hema (4 collectivities), Ba Giti, (Ngiti) also called Wa Lendu Bindi (one collectivity) and Ba Nyari (one collectivity). The Ba Njugu, Wa Lendu (3 collectivities), Ba Hema (4 collectivities), Wa Mbisa (one collectivity), Ndo Okebo (one collectivity), Wa Nyari (one collectivity) and Wa Bindi (one collectivity) live in Djugu. Mambasa counts 3 collectivities, the Ba Lese, Ba Mbote (pygmies) and Ba Bila (or Ba Bira).[ii] Mahagi is the territory of Alur and Wa Lendu Wadzi. The Lobara (or "Lubgara"), Kakwa, Kaliko and Ndo Okebo have settled in Aru.[iii] Most ethnicities were mentioned by the focus groups, except Kaliko and Ndo Okebo (Aru), Mbisa (Djugu) and Mbote (Mambasa).

iThe division of the land into "territories" and of the population into "collectivities" dates from colonial times, according to Thomas Turner, in "Congo Wars: conflict, myth, reality," 2007 Zed Books

ii"Ba" or "Wa" signifies "people". The letters "l" and "r" are often interchangeable, for example in Bira, also called Bila.

iiiIt is thought that the conflict in Ituri opposed (Ba) Hema and (Wa) Lendu, although these two ethnic groups together constitute only a minority (40%) of the population living in the district.

ANNEX 5

CONSENT FORM

"I have understood the information about the research, as explained to me by the researcher. I have been told that my participation can help to make changes to maternity care in the future. I have been told that the study will take place in this area for a period of about one year. As a participant, I will be asked to answer a list of written questions only on one occasion. There will be no other tests.

I have had the opportunity to ask questions about the study. I have been satisfied to the answers given to my questions. I understand that my participation is totally voluntary, and that any treatment I am receiving now or may need in the future will not be better or worse when I take part in this study. I do not have to take part if I do not want to. I have the right to withdraw from the project at any time, without any obligation to explain my reasons for doing so.

I have been explained that the data collected during the research will not be identifiable. My answers will be read only by the people who work on this study. Furthermore, I understand that the information I provide may be used for analysis and subsequent publication, and give my consent that this might happen.

With my signature on this paper I confirm that I have consented to act as a participant."

Name and signature

A copy of the same form will be given to the participant, with the name, address and local phone number of contact person.

ANNEX 6 Indications for CS

Narrative	**ID number**		**Code**	**PL/OL**
dynamic dystocia and acute foetal distress	2		D	1
dynamic dystocia	3		D	1
narrow pelvis *(1st pregnancy)*	5		N	**1**
foeto-pelvic disproportion	7		FPD	1
abruptio placentae	9		AP	0
foeto-pelvic disproportion, *previous section (x1)*	11	Previous C/Sx1	previous	1
narrow pelvis	13	previous C/Sx1	previous	**1**
brow presentation	14		M	1
dynamic dystocia	15		D	1
abruptio placentae	18		AP	0
previous section (x1) acute foetal distress	20		previous	1
foetal distress	23		**FD**	0
Twins, 2nd twin shoulder, acute foetal distress	24		T	0
oblique breech presentation	25		M	1
previous section (x1) narrow pelvis	28		previous	1
acute foetal distress	29		**FD**	0
previous section (x2)	31		previous	1
acute foetal distress	33		**FD**	0
ruptured uterus, (C/S and hysterectomy)	36		R	0
prolapsed cord and arm, tubal ligation (10th pregnancy)	37		M	1
placenta praevia	39		PP	0
cord prolapse, foot and hand	42		M	1
breech presentation of stillborn baby	44		M	1
narrow pelvis (iterative C/S, first caesarean)G5	46		N	0
placenta praevia, foetal distress G11	48		PP	0
foeto-pelvic disproportion	50		FPD	1
toxaemia in pregnancy (*pre-eclampsia, first pregnancy)*	52		E	0
foeto-pelvic disproportion	54		FPD	1
transverse lie, post-term	55		M	1
foeto-pelvic disproportion	57	(previous section x2?)	previous	1
imminent rupture of uterus (1st pregnancy)	60		R	0

Code: AP= placenta abruption; PP=placenta praevia; FPD =foeto-pelvic disproportion; FD= foetal distress; previous= previous CS; R=rupture;E=eclampsia; M=malpresentation; N=narrow pelvis; OL=obstructed labour; PL=prolonged labour; D=dystocia.

ANNEX 6 Indications for CS

Narrative			ID number		Code	PL/OL
previous section (x1) narrow pelvis			62		previous	1
dynamic dystocia			64		D	1
pre-eclampsia and foeto-pelvic disproportion			66		E	0
foeto-pelvic disproportion, prolonged labour, "bad" presentation			68		FPD	1
dynamic dystocia			70		D	1
bregmatic presentation with prolonged labour			73		M	1
dynamic dystocia of the cervix			75		D	1
narrow pelvis			77		N	**1**
previous section (x1) narrow pelvis			79		previous	1
Previous CS (x4), slow labour, foetal distress; tubal ligation			81		previous	1
Dynamic dystocia, prolonged labour, stationary dilatation 8cm			83		D	1
dystocia of the cervix			87		D	1
dynamic dystocia			88		D	1
breech presentation and cervical dystocia			90		M	1
dystocia of the cervix			91		D	1
previous section (x1) and large baby			93		previous	1
foeto-pelvic disproportion			95		FPD	1
foeto-pelvic disproportion, previous section (x1)			97	Previous C/Sx1	previous	1
dynamic dystocia and cord around leg			100		D	1
dynamic dystocia of the cervix			101		D	1
transverse lie			103		M	1
previous section (x1) narrow pelvis			105		previous	1
acute foetal distress with prolonged labour			107		FD+	1
previous section (x2) foetal distress			108		previous	1
narrow pelvis G6			112		N	**1**
cord prolapse, previous section (x1)			114		previous	0
ruptured uterus, (caesarean and hysterectomy)G3			116		R	0
register inaccessible			118		N/A	0
acute foetal distress			119		**FD**	0
cervical oedema and foetal distress			121		**FD**	0
foeto-pelvic disproportion			123		FPD	1

Code: AP= placenta abruption; PP=placenta praevia; FPD =foeto-pelvic disproportion; FD= foetal distress; previous= previous CS; R=rupture;E=eclampsia; M=malpresentation; N=narrow pelvis; OL=obstructed labour; PL=prolonged labour; D=dystocia.

ANNEX 6 Indications for CS

Narrative		**ID number**		**CODE**	**PL/OL**
malpresentation (bregma) and foetal distress		125		M	1
acute foetal distress		127		**FD**	0
foetal distress and chorio-amnionitis		129		FD+	0
foeto-pelvic disproportion		131		FPD	1
previous section (x2) prolonged labour		133		previous	1
dynamic dystocia of the cervix		135		D	1
acute foetal distress		137		**FD**	0
foetal distress		139		**FD**	0
narrow pelvis *(1st pregnancy)*		140		N	**1**
previous section (x1) narrow pelvis		143		previous	1
previous section (x1) narrow pelvis		145		previous	1
foetal distress, post-term pregnancy		147		FD+	0
foetal distress		149		**FD**	0
placenta praevia		151	G11	PP	0
prolonged labour with ruptured membranes *(2 previous stillbirths)*		153		D	1
narrow pelvis (foeto-pelvic dysproportion)		155		N	1
placenta praevia		157		PP	0
acute foetal distress, *ruptured membranes x3 days*		159		FD+	0
acute foetal distress and hyperkinetic uterus		161		FD+	0
acute foetal distress		163		**FD**	0
previous section (x1) for narrow pelvis; acute foetal distress		165		previous	1
previous section (x2) narrow pelvis		167		previous	1
previous section (x2)		169		previous	1
dynamic dystocia and acute foetal distress		171	Previous C/Sx1	previous	1
previous section (x2)		173		previous	1
foeto-pelvic disproportion		175	previous C/Sx3	previous	1
cord prolapse and acute foetal distress		177		M	0
third trimester bleeding and cord around neck		179		B	0
foeto-pelvic disproportion		181		FPD	1
previous section (x1) and narrow pelvis		183		previous	1
dynamic dystocia of the cervix and oligo-amnios		185		D	1
stationary dilatation and cord around neck (x5)		187		PL	1

Code: AP= placenta abruption; PP=placenta praevia; FPD =foeto-pelvic disproportion; FD= foetal distress; previous= previous CS; R=rupture;E=eclampsia; M=malpresentation; N=narrow pelvis; OL=obstructed labour; PL=prolonged labour; D=dystocia.

ANNEX 6 Indications for CS

Narrative	**ID number**	**Code**	**PL/OL**
narrow pelvis	189	N	**1**
dynamic dystocia of cervix and acute foetal distress	191	D	1
acute foetal distress; iterative caesarean	193	**FD**	0
Foetal distress and cord ligature (previous C/S0	195	previous	**0**
narrow pelvis	197	N	**1**
acute foetal distress	199	**FD**	0
previous section (x3) narrow pelvis	201	previous	1
previous section (x3) narrow pelvis	203	previous	1
acute foetal distress	205	**FD**	0
acute foetal distress	209	**FD**	0
"vicious presentation" and acute foetal distress	211	M	1
narrow pelvis and acute foetal distress *(2nd pregnancy)*	213	N	**1**
acute foetal distress; narrow pelvis *(4th pregnancy)*	215	**FD**	0
acute foetal distress, foeto-pelvic dysproportion *(3rd pregnancy)*	217	FD+	0
narrow pelvis and weak contractions	219	N	**1**
previous section (x2) narrow pelvis	220	previous	1
acute foetal distress and narrow pelvis	222	FD+	0
dynamic dystocia	224	D	1
occiput posterior position and foeto-pelvic dysproportion	226	M	1
acute foetal distress	229	**FD**	0
acute foetal distress	231	**FD**	0
previous section (x1) and acute foetal distress	233	previous	1
previous section (x2)	235	previous	1
acute foetal distress	237	**FD**	0
imminent rupture of uterus (10th pregnancy)	239	R	0
previous section (x1) acute foetal distress	241	previous	1
acute foetal distress	243	**FD**	0
previous section (x1) and precious pregnancy (1st child died)	245	previous	1
acute foetal distress and narrow pelvis	247	FD+	0
dynamic dystocia and acute foetal distress	249	D	1

Code: AP= placenta abruption; PP=placenta praevia; FPD =foeto-pelvic disproportion; FD= foetal distress; previous= previous CS; R=rupture;E=eclampsia; M=malpresentation; N=narrow pelvis; OL=obstructed labour; PL=prolonged labour; D=dystocia.

ANNEX 6 Indications for CS

Narrative	Id number		Code	PL/OL
foeto-pelvic dysproportion and acute foetal distress	251		FPD	1
previous section (x1) an foetal distress with meconium in liquor	253		previous	1
acute foetal distress	255		**FD**	0
foetal distress	257		**FD**	0
intra-uterine death and asymmetrical pelvis	258		FPD?	0
foeto-pelvic disproportion and acute foetal distress	260		FPD	1
previous section (x1) and large foetus	263		previous	1
foetal distress and precious pregnancy (11 y after 1s child)	265		FD+	0
foetal distress and "vicious" presentation	267		FD+	1
hydramnios and foetal malformation	269		other	0
brow presentation and foetal distress	271		M	1
severe bleeding and suspicion of imminent rupture of uterus	273		B	0
secondary arrest of labour and foetal distress	275		PL	1
foeto-pelvic disproportion	277		FPD	1
acute foetal distress	279		**FD**	0
narrow pelvis and occiput posterior position	281		M	1
abruptio placentae	282		AP	0
arm presentation	285		M	1
acute foetal distress with "vicious" presentation	287		FD+	1
foeto-pelvic dysproportion	289		FPD	1
cord prolapse and occiput posterior position	291		M	1
previous section (x1) acute foetal distress	293		previous	1
acute foetal distress	295		**FD**	0
face presentation and acute foetal distress	297		M	1
oedema of cervix and acute foetal distress	299		FD+	0
acute foetal distress	301		**FD**	0
previous section (x1) narrow pelvis	303		previous	1
placenta praevia	305		PP	0
previous section (x1) narrow pelvis	307		previous	1
acute foetal distress	309		**FD**	0
acute foetal distress	311	(mother ill)	**FD**	0

Code: AP= placenta abruption; PP=placenta praevia; FPD =foeto-pelvic disproportion; FD= foetal distress; previous= previous CS; R=rupture;E=eclampsia; M=malpresentation; N=narrow pelvis; OL=obstructed labour; PL=prolonged labour; D=dystocia.

ANNEX 6 Indications for CS

Narrative	ID number		Code	PL/OL
stationary dilatation and cord around neck (x2)	313		PL	0
transverse lie	316		M	1
previous section (x3) and latent phase of labour	317		previous	1
acute foetal distress	319		**FD**	0
placenta praevia	321		PP	0
acute foetal distress	323		**FD**	0
mechanical dystocy	325		D	1
foetal distress	327		**FD**	0
foeto-pelvic dysproportion	329		FPD	1
previous section (x2)	331		previous	1
Hydramnios, 31 weeks pregnancy, bleeding	333		bleeding	0
foeto-pelvic disproportion and mechanical dystocia	335		FPD	1
bleeding	338		B	0
foetal distress	340		**FD**	0
cervical dystocia	342		D	1
acute foetal distress with prolonged labour	345		FD+	1
marginal placenta praevia	349		PP	0
premature rupture of membranes, iterative section	350	previous (1)	R	0
foetal distress and dynamic dystocia	353		FD+	1
foetal distress and vicious presentation	355		FD+	1
foeto-pelvic disproportion	356		FPD	1
transverse lie, placenta praevia	357		M/PP	0
acute foetal distress	359		**FD**	0
				107

Code: AP= placenta abruption; PP=placenta praevia; FPD =foeto-pelvic disproportion; FD= foetal distress; previous= previous CS; R=rupture;E=eclampsia; M=malpresentation; N=narrow pelvis; OL=obstructed labour; PL=prolonged labour; D=dystocia.

NOTE – Annex 7 is not available online due to data confidentiality.

Possible cause of death

1. Shock
2. Haemorrhage
3. Kaposi's Sarcoma (indirect cause) in a HIV+ patient (child died)
4. Haemorrhage
5. Prolonged labour without skilled attendant before transfer to hospital
6. Maternal death outside a health structure, no details
7. Ruptured uterus
8. Prolonged (obstructed) labour with caesarean section
9. Septic shock after prolonged labour
10. Haemorrhage and infection
11. Sepsis with VVF (died following hysterectomy and attempted repair of fistula)
12. Details unknown: transfer to hospital following macerated stillbirth at health centre
13. Septic shock
14. Antepartum haemorrhage, caesarean section and stillbirth (possible placenta abruption)
15. Antepartum haemorrhage, caesarean section and stillbirth

ANNEX 8 BM (Total and average cost)

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	Total	Assumptions
Buildings	Maternity (28 beds)= 178sqm	250	44500	2225	60.00%	1335.00	Total construction cost 250USD/sqm. Bon Marché is a hospital for emergencies. About 60% of deliveries are by caesarean.
	Gynaecology+intensive care=178sqm	250	44500	2225	5.00%	111.25	1-2 beds are in use for maternity patients
	operating theatre=256sqm	300	76800	3840	67.00%	2572.80	Tiled floors are 300 USD/sqm. During study period majority of surgical cases were caesareans
	laundry/sterilization =120sqm	250	30000	1500	10.00%	150.00	Laundry includes linen for other hospital patients, e.g. Paediatrics
	laboratory=25sqm	250	6250	312.5	8.00%	25.00	Average laboratory workload related to EMOCS=8%
	kitchen =40sqm	250	10000	500	5.00%	25.00	Caesareans average 5% of admissions (45/900/month)
	OPD (benches/plastic sheeting)		0				The OPD cost related to EMOCS is negligible and omitted in all calculations
							Caesareans average 5% of admissions (45/900/month)
Vehicles	ambulance (x2)	40000	80000	11428.57	10.00%	1142.86	Assume 10% of ambulance use related to obstetric emergencies
	cars (4x4)(x5)	30000	150000	21428.57	5.00%	1071.43	cars are equally used by all staff, including EMOCS
	Motorbikes (125 cc)	600	0				
	bicycles	90	0				
Communications	telephone	0					only recurrent phone cost for mobiles are included
	computer (x6)	1200	7200	3600	5.00%	180.00	Computers are used for administration, caesareans are 5% of admissions
	Printer (x1)	300	300	150	5.00%	7.50	Use for administration
	2-way radio VHF base	1500	1500	750	20.00%	150.00	Mainly used for emergency procedures, assume same proportion as ambulance
	handset (x15)	750	2250	1125	5.00%	56.25	Assume all expatriate staff has handset, 5% of activity is EMOCS related
	2-way radio HF long distance	5000	5000	2500	20.00%	500.00	
	battery	180	180	90	20.00%	18.00	
	battery charger (10 amp)	250	250	125	20.00%	25.00	

ANNEX 8 BM (Total and average cost)

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	Total	Assumptions
Furniture	beds (x17)	60	1020	145.71	100.00%	145.71	15 maternity beds and 2 intensive care for EMOCS
	tables/desks (x2)	40	80	11.43	100.00%	11.43	locally purchased furniture
	wardrobes (x2)	150	300	42.86	100.00%	42.86	
	chairs (x6)	15	90	12.86	100.00%	12.86	
	bench (x2)	20	40	5.71	100.00%	5.71	
	shelf (x2)	80	160	22.86	100.00%	22.86	
	sink/hand washing basin (x3)	25	75	10.71	100.00%	10.71	enamel washing basins
	laboratory table	50	50	7.14	8.00%	0.57	Locally produced wooden table
Equipment	examination bed (x2)	270	540	108	100.00%	108.00	
	operating table (x1)	4560	9120	1824	67.00%	1222.08	Caesareans represent 67% of major surgical workload
	speculum (x10)	8	80	16	20.00%	3.20	
	stethoscope (x15)	5	75	15	60.00%	9.00	
	Sphygmo-manometer (x3)	15	45	9	60.00%	5.40	
	dressing pack (x4)	25	100	20	85%	17.00	Price from MSF order in Euros multiplied by 1.5 (3 instruments)
	suture set (x5)	18.75	92.5	18.5	67.00%	12.40	Price in euros multiplied by 1.5 taken from COOPI order sheet
	delivery pack (vaginal delivery)(x9)		0		0		
	caesarean section pack (x4)	1300	5200	1040	100.00%	1040.00	
	hysterectomy pack	1600	1600	320	2%	6.40	
	instruments evacuation of uterus (x4)	545	2180	436	0		
	ultrasound (x1)	4000	4000	800	10.00%	80.00	no OPD except emergencies, assume 10% ultrasound use for EMOC based on proportion haemorrage
	microscope (solar)	510	510	102	8.00%	8.16	
	centrifuge	70	70	14	8.00%	1.12	
	vacuum extraction set	90			0		
	sterilisation drum (x4)	13	52	10.4	100.00%	10.40	
	autoclave	2541	2541	508.2	67.00%	340.49	
	pressure cooker (large)	470	470	94	67.00%	62.98	Pressure cooker is also used for sterilizing small equipment

ANNEX 8 BM (Total and average cost)

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	Total	Assumptions
	crockery and cutlery	cost not included					
	generator (small)	350	350	50	67.00%	33.5	Generates 2,500Watt, 7 years amortization, mainly used for theatre
	generator (large)	1200	1200	171.43	5.00%	8.57	Supplies hospital, 10KVA, 7 years amortization
	refrigerator	350	350	50	8.00%	4	Proportion reflects laboratory use for EMOCS
Linen	Bed sheets (34)	6	204	102	100.00%	102	Each EMOCS bed uses 2 sheets and 1 blanket
	operating theatre linen/meter (x30)(x4)	6	720	360	100.00%	360	
	blankets (x17)	3	51	25.5	100.00%	25.5	
	mosquito net (x17)	4	68	34	100.00%	34	
RECURRENT	**INPUT**	**UNIT COST (USD)**	**EXPENDITURE (USD)**	**TOTAL COST / annum**	**Proportion EMOCS**	**Total**	**Assumptions**
Medicine	blood transfusion	10USD/case	210			210	Price of transfusion represents cost; 3% of caesareans have a transfusion
	Antibiotics						
	Oxytocics						
	IV fluids						
	Anaesthetics						
	Analgesics						
Medical supplies	syringes						
	needles						
	Cotton swabs						
	Dressings (sterile)						
	Adhesive tape						
	Disinfectant						
	Soap						

ANNEX 8 BM (Total and average cost)

RECURRENT	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	Total	Assumptions
	Medicine/supplies 718 sections/year	28.5		20463	100.00%	20463	Total cost of recurrent supplies for one case, as calculated from cost of UNFPA kit 11
			recurrent supplies/section				
Food	Rice	1.1/kg	50gm/person/meal	1615.5	100.00%	1615.5	gruel =0.5 USD/kg=0.04/mealx5/7=0.2 USD/patient (1 meal /day)
	Beans	0.5/kg	300gm/person/meal				+rice=1.1USD/kg=0.055/meal=0.11/dayx5/7=0.55/patient (2 meals/day)+
	Gruel (maize flour)	0.5/kg	80gm/person/meal				beans=0.5 USD/kg=0.15/meal=0.3/dayx5/7=1.5/patient (2meals/day)=
							TOTAL FOOD =1.5+0.55+0.2=2.25 USD/patient
RECURRENT	**INPUT**	**UNIT COST (USD)**	**EXPENDITURE (USD)**	**TOTAL COST / annum**	**Proportion EMOCS**	**Total**	**Assumptions**
Salaries	Medical doctor (specialist exp)(x1)	2763	2763	33156	60.00%	19893.6	Based on MSF salary for expatriate 5y experience
	Medical Doctor general (x1)	450	450	5400	10.00%	540	
	Nurse general (A1)(x13)	160	2080	24960	60.00%	14976	
	Midwife trained (exp)(x1)	2431	2431	29172	60.00%	17503.2	Based on MSF salary for expatriate 3y experience
	nurse assistant (x4)	104	416	4992	60.00%	2995.2	
	pharmacist (exp)(x1)	2944	2944	35328	5.00%	1766.4	Based on MSF salary for expatriate 6y experience
	Pharmacist (x8)	192	1536	18432	5.00%	921.6	
	pharmacy technician (x2)	125	250	3000	5.00%	150	
	Laboratory technician (x1)	192	192	2304	8.00%	184.32	
	laboratory assistants (x8)	160	1280	15360	8.00%	1228.8	
	administrator expatriate (x1)	2974	2974	35688	5.00%	1784.4	Class B 3years experience
	administration assistants (x2)	192	384	4608	5.00%	230.4	
	hygienists (cleaning)(x13)	86	1118	13416	10.00%	1341.6	
	guards (x26)	72	1872	22464	5.00%	1123.2	
	kitchen staff (x13)	86	1118	13416	5.00%	670.8	
	WATSAN (chlorine & distribution) (x5)	104	520	6240	5.00%	312	***Total salaries***
	carpenters (x3)	104	312	3744	5.00%	187.2	***65808.72***

ANNEX 8 BM (Total and average cost)

RECURRENT	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	Total	Assumptions
Maintenance				80000	5.00%	4000	Total annual maintenance for hospital was 80,000 USD
Stationery	paper						
	registers and forms						
	pens etc.						
telephone (mobile)	50 USD/month						
Water	$20m^{3/}$/day about $700m^3$/month						
electricity	350USD/month						
Fuel	Generator=150L/month						
	cars =300-500L/month						
						103214.22	
Land Rent	500 USD/month	500		6000	5.00%	300	Caesareans average 5% of admissions (45/900/month)
						103514.22	
							Divide total by annual caesareans (718 sections)
							144.17
NOTE 1 (amortization in years)		**NOTE 2 (exchange rate)**					
Facility	20	1000 USD= 1149.10 SWF					
Furniture and beds	7	1000 SWF= 870.25 USD					
Refrigerators, coolers	7						
Medical equipment	5						
Comm. Equipment	2						
Vehicles	7						
Other	2						

ANNEX 8 RW (Total and average cost)

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	Assumptions
Buildings	Maternity (17beds) = 102 sqm	250	25500	1275	23.70%	302.18	Assume 6sqm total space for 1 hospital bed
	Intensive care (10 beds)	250	15000	750	5.00%	37.5	
	Gynaecology( )= sqm	N/A					
	operating theatre (30sqm)	250	7500	375	23.00%	86.25	Dimensions as estimated without corridor or dressing room
	laundry/sterilization =25sqm	250	6250	312.5	10.00%	31.25	Temporary building, estimated dimensions as for CME
	Laboratory (12sqm)	250	3000	150	2.00%	3	Estimated from visit
	OPD						
Vehicles	ambulance	0					
	cars (4x4)	0					
	Motorbikes (125 cc)	0					
	bicycles (x2)	90	180	25.71	5.00%	1.29	
Communications	telephones		0				
	computers (X1)	1200	1200	600	5.00%	30	
	2-way radio		0				
	printer(X1)	300	300	150	5.00%	9	
Furniture	beds (X17)	60	1020	145.71	23.70%	34.53	
	mattress (x17)	35	595	85	23.70%	20.15	
	tables/desks (x2)	40	80	11.43	23.70%	2.71	Furniture cost based on MEDAIR estimates for locally purchased items
	wardrobes (x1)	150	150	21.43	23.70%	5.08	
	chairs (x4)	15	60	8.57	23.70%	2.03	
	bench (x1)	20	20	2.86	23.70%	0.68	
	shelf (x1)	80	80	11.43	23.70%	2.71	
	sink/hand washing basin (x2)	25	50	7.14	23.00%	1.64	
	laboratory table (x1)	50	50	7.14	2.00%	0.14	
Equipment	examination bed (x1)	270	270	54	23.70%	12.798	
	operating table (x1)	4560	4560	912	23.00%	209.76	
	speculum (x6)	8	48	9.6	23.70%	2.2752	

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	Assumptions
	Stethoscope (x10)	5	50	10	23.70%	2.37	
	Sphygmo-manometer (x2)	15	30	6	23.70%	1.422	
	caesarean section pack (x2)	1300	2600	520	100.00%	520	
	hysterectomy pack	1600	1600	320	2.00%	6.4	
	dressing pack (x1)	25	25	5	23.00%	1.15	
	ultrasound	4000	0				
	microscope (solar)(x1)	510	510	102	2.00%	2.04	
	centrifuge	70	70	14	2.00%	0.28	
	suture set	18.75	18.75	3.75	23.00%	0.8625	
	sterilisation drum (x5)	13	65	13	23.00%	2.99	
	pressure cooker (large)(x1)	470	470	94	23.00%	21.62	
	kitchen stove	0					
	crockery and cutlery	0					
	generator (small)(x1)	300	300	42.86	5.00%	2.14	
	generator (large)	0					
	Refrigerator (x1)	350	350	50	2.00%	1	
	Solar panel (x2)	750	1500	150	14.00%	21	Assume 10 years amortization for solar panels
Linen	Bed sheets (x17)	11	187	93.5	23.70%	22.16	
	linen for operating theatre (x30)(x2)	6	360	180	23.00%	41.4	
	blankets		0				
	mosquito net (x17)	4	68	34	23.70%	8.058	

RECURRENT	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	Assumptions
Medicine	Antibiotics						
	Oxytocics						
	IV fluids						
	Anaesthetics						
	Analgesics						
							Rwankole refers patients who need transfusion
Medical supplies	syringes						
	needles						
	Cotton swabs						
	Dressings (sterile)						
	Adhesive tape						
	Disinfectant						
	Soap						
	x56 caesareans/year	28.5	1596		100.00%	1596	
Food	Rice						
	Beans						
	Gruel					0	
Salaries	Medical Director (x1)	202	202	2424	5.00%	121.2	Based on monthly distribution of average hospital revenue, assuming no additional remuneration
	Medical Doctor general (x2)	120	240	2880	10.00%	288	
	Nurse Director (x1)	104	104	1248	5.00%	62.4	
	Nurse generalA2 (x3)	101	303	3636	23.70%	861.732	
	Nurse A3 (x5)	77	385	4620	23.70%	1094.94	
	Midwife trained (x1)	98	98	1176	23.70%	278.712	
	pharmacy assistant(x1)	88	88	1056	5.00%	52.8	
	Laboratory technician (x2)	88	176	2112	2.00%	42.24	
	administrator (x1)	104	104	1248	5.00%	62.4	
	administration assistants (x1)	88	88	1056	5.00%	52.8	
	hygienists (cleaning) (x3)	66	198	2376	10.00%	237.6	
	guards (x2)	66	132	1584	5.00%	79.2	***Total salaries***
	chaplain (x1)	88	88	1056	5.00%	52.8	***3286.824***

RECURRENT	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	Assumptions
Maintenance							
Stationery	paper	56		672	5.00%	33.6	Assumes 1 ream of paper monthly used for all hospital administration
	registers and forms						
	pens /printer cartridges						
	telephone credit (monthly)	10		120	5.00%	6	
Water	$m^{3/}$/day about m^3/month	40		480	5.00%	24	
electricity	USD/month	40		480	5.00%	24	
Fuel	Generator=10L/month	20		240	5.00%	12	
	cars =L/month	0					
						6432.28	***Divide total by annual caesareans (56 sections)***
							114.86
NOTE 1 (amortization)							
Facility	20						
Furniture and beds	7						
Refrigerators, coolers	7						
Medical equipment	5						
Comm. Equipment	2						
Vehicles	7						
Other	2						

ANNEX 8 CME (Total and average cost)

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	PROPORTION EMOCS	TOTAL	ASSUMPTIONS
Buildings	Maternity (12 beds)=72sqm	250	18000	900.00	31.80%	286.20	Assume 6sqm total space for 1 hospital bed
	gynaecology+intensive care	250	15000	750.00	5.00%	37.50	
	operating theatre=165sqm	300	49500	2475.00	12.00%	297.00	
	laundry/sterilization=25sqm	250	6250	312.50	10.00%	31.25	
	laboratory=36sqm	250	9000	450.00	5.00%	22.50	
	OPD						no specific cost allocated other than ultrasound
	kitchen	0		0.00			patients receive no food
Vehicles	ambulance		0				
	cars (4x4) (x2)	30000	30000	4285.71	10.00%	428.57	used by doctor for attending theatre emergencies
	Motorbikes (125 cc)(x1)	600	600	85.71	4.00%	3.43	general use
	bicycles	90	0				
Communications	telephones (mobile)(X5)	20	100	50.00	4.00%	2.00	senior staff receive telephone and credit
Equipment	computers(X3)	1200	3600	1800.00	4.00%	72.00	
	2-way radio	0		0.00			
	printer (X1)	300	300	150.00	4.00%	6.00	
Furniture	beds (X12)	150	1800	257.14	31.80%	81.77	
	mattress (X12)	35	420	60.00	31.80%	19.08	
	tables/desks (X1)	40	40	5.71	31.80%	1.82	
	wardrobes (X1)	150	150	21.43	31.80%	6.81	
	chairs (X3)	15	45	6.43	31.80%	2.04	
	bench (X1)	20	20	21.43	31.80%	6.81	
	shelf (X1)	80	80	11.43	31.80%	3.63	
	sink/hand washing basin (X2)	25	50	7.14	12.00%	0.86	
	laboratory table (X1)	50	50	7.14	5.00%	0.36	
Equipment	examination bed (X1)	270	270	54.00	31.80%	17.17	
	operating table (X1)	4560	4560	912.00	12.00%	109.44	

ANNEX 8 CME (Total and average cost)

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	PROPORTION EMOCS	TOTAL	ASSUMPTIONS
	speculum (X6)	8	48	9.60	31.80%	3.05	
	stethoscope (X10)	5	50	10.00	31.80%	3.18	
	Sphygmo-manometer (X2)	15	30	6.00	31.80%	1.91	
	caesarean section pack(X3)	1300	3900	780.00	100.00%	780.00	
	hysterectomy pack (X2)	1600	3200	640.00	2.00%	12.80	
	instruments evacuation of uterus(X2)	545	1090	218.00	0		
	ultrasound (X1)	4000	4000	800.00	19.00%	5.10	All pregnant women have ultrasound, caesareans are 19% of maternity admissions
	microscope (solar)(x1)	510	510	102.00	5.00%	5.10	
	centrifuge (x1)	70	70	14.00	5.00%	0.70	
	dressing pack (x2)	25	50	10.00	12.00%	1.20	based on 12% use as proportion of all surgery
	sterilisation drum (x5)	13	65	13.00	12.00%	1.56	
	pressure cooker (large)(x1)	470	470	94.00	12.00%	11.28	
	pressure cooker (small)(x2)	150	300	60.00	12.00%	7.20	
	suture set	18.75	18.75	3.75	12.00%	0.45	
	generator (small)(x1)	300	300	42.86	12.00%	5.14	Assume same amortization as for refrigerators, coolers
	refrigerator (x1)	350	350	50.00	5.00%	2.50	
Linen	Bed sheets (x12)	11	132	66.00	31.80%	20.99	
	linen for operating theatre/m (x3)(x30)	6	540	270.00	12.00%	32.40	
	blankets			0.00			cost combined with bedsheets
	mosquito net (x12)	4	48	24.00	31.80%	7.63	

ANNEX 8 CME (Total and average cost)

RECURRENT	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	PROPORTION EMOCS	TOTAL	
Blood Transfusion	Blood Transfusion	10/case	20			20.00	Assume 3% of caesareans require transfusion
Medicine	Antibiotics						
	Oxytocics						
	IV fluids						
	Anaesthetics						
	Analgesics						
Medical supplies	syringes						
	needles						
	Cotton swabs						
	Dressings (sterile)						
	Adhesive tape						
	Disinfectant						
	Soap	28.5	x58	1653.00	100.00%	1653.00	
Food	N/A						
Salaries	Medical doctor specialist (expat.)(x1)	1020		12240.00	4.00%	489.60	
	Medical Doctor general (expat)(x1)	1020		12240.00	8.00%	979.20	
	Medical doctor specialist (x1)	500		6000.00	4.00%	240.00	
	Medical Doctor general (x4)	250		12000.00	8.00%	960.00	
	Nurse specialist (x1)	229		2748.00	4.00%	109.92	
	Nurse general	120	x13	18720.00	8.00%	1497.60	
	Midwife trained	161	x3	5796.00	31.80%	1843.13	
	nurse assistant	83	x5	4980.00	4.00%	199.20	
	Laboratory technician	154	x3	5544.00	5.00%	277.20	
	laboratory assistants	0					
	administrator	230	x2	5520.00	4.00%	220.80	
	administration assistants	154	x2	3696.00	4.00%	147.84	
	pharmacist	196	x1	2352.00	4.00%	94.08	
	hygienists (cleaning)	75	x2	1800.00	8.00%	144.00	

ANNEX 8 CME (Total and average cost)

RECURRENT	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	PROPORTION EMOCS	TOTAL	
	guards	71	x1	852.00	4.00%	34.08	
	kitchen staff	0		0.00			
	WATSAN (chlorine & distribution)						
	carpenters						***Total salaries***
	drivers	85	x1	1020.00	8.00%	102.00	***7338.65***
Maintenance							
Stationery	paper	56		672.00	4.00%	26.88	
	registers and forms						
	pens etc.	5		60.00	4.00%	2.40	
Water	$m^{3/}$/day about m^3/month	35		420.00	4.00%	16.80	
electricity	USD/month	45		540.00	4.00%	21.60	
Fuel	Generator=L/month	350		4200.00	4.00%	168.00	
	cars =L/month						
Telephone calls	monthly call charges	30		360.00	4.00%	14.40	
						11600.17	***Divide total by annual caesareans (58 sections)***
							200.00
NOTE 1 (amortization)							
Facility	20						
Furniture and beds	7						
Refrigerators, coolers	7						
Medical equipment	5						
Comm. Equipment	2						
Vehicles	7						
Other	2						

ANNEX 8 HGR (Total and average cost)

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	*Assumptions*
Buildings	Maternity (24beds)=144 sqm(	250	36000	1800	16.90%	304.20	The average proportion of caesareans among maternity patients is12%
	Gynaecology (beds)= 0sqm						The ward is not in use
	operating theatre=326sqm	250	81500	4075	21.00%	855.75	Caesareans are 21% of major surgical procedures
	laundry/sterilization= 261.5sqm	250	65375	3268.75	6.00%	196.13	Caesareans are 3% of admissions, but need more laundry than non-surgical patients
	laboratory=28sqm	250	7000	350	4.00%	14.00	The useful dimension of the laboratory is similar to other hospitals in Bunia
	OPD	0					no specific cost allocated to OPD, except ultrasound
Vehicles	ambulance (x1)	40000	40000	5714.29	10.00%	571.43	Assume proportion obstetric emergencies requiring ambulance same as proportion major surgery
	cars 4x4 (x1)	30000	30000	4285.71	3.00%	128.57	Personal car of hospital director, assume 3% of his activities are related to EMOCS
	Motorbikes 125 cc	0					
	bicycles	0					
Communications	telephone (mobile)(x1)	20	20	10	21.00%	2.10	call-out for major surgery
	Computer (x2)	1200	2400	1200	3.00%	36.00	Used for general administration, caesareans are 3%of total workload
	Printer (x1)	300	300	150	3.00%	4.50	
	2-way radio VHF base	0					HGR has no radio equipment
	handset	0					
	2-way radio HF long distance	0					
	battery	0					
	battery charger (10 amp)	0					
Furniture	beds (24)	150	3600	514.29	16.90%	86.91	all prices are local
	mattress (24)	35	840	120.00	16.90%	20.28	
	tables/desks (2)	40	80	11.43	16.90%	1.93	
	wardrobes (x1)	150	150	21.43	16.90%	3.62	
	chairs (x5)	15	75	10.71	16.90%	1.81	
	bench (x1)	20	20	2.86	16.90%	0.48	

ANNEX 8 HGR (Total and average cost)

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	*Assumptions*
	shelf (x1)	80	80	11.43	16.90%	1.93	
	sink/hand washing basin (x2)	25	50	7.14	21.00%	1.50	
	laboratory table (x1)	50	50	7.14	4.00%	0.29	
Equipment	examination bed (x2)	270	540	77.14	16.90%	9.25	
	operating table (x1)	4560	4560	912.00	21.00%	191.52	caesareans are 21% of theatre workload
	speculum (x1)	8	8	1.60	16.90%	0.27	caesareans are 12% of maternity cases
	stethoscope (x6)	5	30	6.00	16.90%	1.01	
	Sphygmo-manometer (x8)	15	120	24.00	16.90%	4.06	
	dressing pack (2)	25	50	10.00	21.00%	2.10	
	suture set	18.75	18.75	3.75	21.00%	0.79	
	delivery pack (vaginal delivery) (x2)						
	caesarean section pack	1300	5200	1040.00	100%	1040	
	hysterectomy pack	1600					
	instruments evacuation of uterus						
	ultrasound	NA					
	microscope (solar) (X1)	510	510	102	4.00%	4.08	
	centrifuge (x1)	70	70	14	4.00%	0.56	
	vacuum extraction set?						
	sterilisation drum (x4)	13	52	10.4	21.00%	2.18	
	autoclave (x1)	2541	2541	508.2	21.00%	106.72	cost taken from WHO project proposal
	pressure cooker (large) (x2)	470	940	188	21.00%	39.48	
	kitchen stove	0					
	crockery and cutlery	0					
	generator (small)	300	300	42.86	21.00%	9.00	amortization factor same as for refrigerators and coolers
	generator (large) (x1)	1200	1200	171.43	3.00%	5.14	amortization factor same as for refrigerators and coolers
	refrigerator(x1)	350	350	50.00	4.00%	2.00	
Linen	Bed sheets (x24)	11	264	132.00	16.90%	22.31	Bedlinen is provided in maternity ward
	linen for operating theatre (x30x4)	6	720	360.00	21.00%	75.60	Four section packs, each contains 30m of linen
	blankets	0					If provided, the cost is included in bedsheets
	mosquito net (x24)	4	96	48.00	16.90%	8.11	

ANNEX 8 HGR (Total and average cost)

RECURRENT	INPUT	UNIT COST (USD)	NUMBER OF UNITS	TOTAL COST	Proportion EMOCS	TOTAL	HGR
Medicine	Blood transfusion	10		25		25.00	Based on 3% cases being transfused
	Antibiotics						
	Oxytocics						
	IV fluids						
	Anaesthetics						
	Analgesics						
Medical supplies	syringes						
	needles						
	Cotton swabs						
	Dressings (sterile)						
	Adhesive tape						
	Disinfectant						
	Soap	28.5	82	2337	100.00%	2337	Cost based on 2007 prices from UNFPA kit 11
Salaries	Medical doctor specialist	0					
	Medical Doctor general	6					
	Nurse specialist (anaesthesia)	1					
	Nurse general A3	24					
	Nurse general A2	18					
	Nurse general A0	1					
	Midwife trained						
	nurse assistant						
	Laboratory technician	2					
	laboratory assistants						
	administrator	1					
	administration assistants						
	hygienists (cleaning)						
	guards						
			63343 (salaries+bonus)	63348	11.00%	**6968.28**	Salaries taken from annual report

ANNEX 8 HGR (Total and average cost)

RECURRENT	INPUT	UNIT COST (USD)	NUMBER OF UNITS	TOTAL COST	Proportion EMOCS	TOTAL	HGR
Maintenance				5678.2	3.00%	170.35	Taken from annual report
Stationery	paper						
	registers and forms						
	pens etc.						
Water	m^3/day about m^3/month		200				
electricity	USD/month		350				
Fuel	Generator=L/month						
	cars =L/month						
			24724 (fuel& electricity)	24724	3.00%	741.72	
Land Rent	USD/month						
	4000m^2 surface	200		2400	3.00%	72	
						14069.97	***Divide total by annual caesareans (82 sections)***
							171.58
NOTE (2007 report)							
161/350 beds in use							
Medicine USD 21090							
NOTE 1 (amortization)							
Facility	20						
Furniture and beds	7						
Refrigerators, coolers	7						
Medical equipment	5						
Comm. Equipment	2						
Vehicles	7						
Other	2						

ANNEX 8 CME Incremental

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	
Buildings	Maternity (15 beds)=90sqm	250	22500	1125.00	55.70%	626.63	
	gynaecology+intensive care	250	15000	750.00	5.00%	37.50	
	operating theatre=165sqm	300	49500	2475.00	28.00%	693.00	
	laundry/sterilization=25sqm	250	6250	312.50	10.00%	31.25	
	laboratory=36sqm	250	9000	450.00	12.00%	54.00	
	OPD						
	kitchen	0		0.00			
Vehicles	ambulance		0				
	cars (4x4) (x2)	30000	30000	4285.71	25.00%	1071.43	
	Motorbikes (125 cc)(x1)	600	600	85.71	12.00%	10.29	
	bicycles	90	0				
Communications	telephones (mobile)(X5)	20	100	50.00	12.00%	6.00	
Equipment	computers(X3)	1200	3600	1800.00	12.00%	216.00	
	2-way radio	0		0.00			
	printer (X1)	300	300	150.00	12.00%	18.00	
Furniture	beds (X15)	150	2250	321.43	55.70%	179.04	
	mattress (X15)	35	525	75.00	55.70%	41.78	
	tables/desks (X1)	40	40	5.71	55.70%	3.18	
	wardrobes (X1)	150	150	21.43	55.70%	11.94	
	chairs (X3)	15	45	6.43	55.70%	3.58	
	bench (X1)	20	20	21.43	55.70%	11.94	
	shelf (X1)	80	80	11.43	55.70%	6.37	
	sink/hand washing basin (X2)	25	50	7.14	28.00%	2.00	
	laboratory table (X1)	50	50	7.14	12.00%	0.86	
Equipment	examination bed (X1)	270	270	54.00	55.70%	30.08	
	operating table (X1)	4560	4560	912.00	28.00%	255.36	
	speculum (X6)	8	48	9.60	55.70%	5.35	

ANNEX 8 CME Incremental

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	
	stethoscope (X10)	5	50	10.00	55.70%	5.57	
	Sphygmo-manometer (X2)	15	30	6.00	55.70%	3.34	
	caesarean section pack(X3)	1300	3900	780.00	100.00%	780.00	
	hysterectomy pack (X2)	1600	3200	640.00	2.00%	12.80	
	instruments evacuation of uterus(X2)	545	1090	218.00	0		
	ultrasound (X1)	4000	4000	800.00	19.00%	12.24	
	microscope (solar)(x1)	510	510	102.00	12.00%	12.24	
	centrifuge (x1)	70	70	14.00	12.00%	1.68	
	dressing pack (x2)	25	50	10.00	28.00%	2.80	
	sterilisation drum (x5)	13	65	13.00	28.00%	3.64	
	pressure cooker (large)(x1)	470	470	94.00	28.00%	26.32	
	pressure cooker (small)(x2)	150	300	60.00	28.00%	16.80	
	suture set	18.75	18.75	3.75	28.00%	1.05	
	generator (small)(x1)	300	300	42.86	28.00%	12.00	
	refrigerator (x1)	350	350	50.00	12.00%	6.00	
Linen	Bed sheets (x12)	11	132	66.00	55.70%	36.76	
	linen for operating theatre/m (x3)(x30)	6	540	270.00	28.00%	75.60	
	blankets			0.00			
	mosquito net (x12)	4	48	24.00	55.70%	13.37	
RECURRENT	**INPUT**	**UNIT COST (USD)**	**EXPENDITURE (USD)**	**TOTAL COST / annum**	**Proportion EMOCS**	**TOTAL**	
Blood Transfusion	Blood Transfusion	10/case	50			50.00	
Medicine	Antibiotics						
	Oxytocics						
	IV fluids						
	Anaesthetics						
	Analgesics						
Medical supplies	syringes						
	needles						
	Cotton swabs						

ANNEX 8 CME Incremental

RECURRENT	INPUT	UNIT COST (USD)	Number of Units	TOTAL COST / annum	Proportion EMOCS	TOTAL	
	Dressings (sterile)						
	Adhesive tape						
	Disinfectant						
	Soap	28.5	x156	4446.00	100.00%	4446.00	
Food	N/A						
Salaries	Medical doctor specialist (expat.)(x1)	1020		12240.00	12.00%	1468.80	
	Medical Doctor general (expat)(x1)	1020		12240.00	15.00%	1836.00	
	Medical doctor specialist (x1)	500		6000.00	12.00%	720.00	
	Medical Doctor general (x4)	250		12000.00	15.00%	1800.00	
	Nurse specialist (x1)	229		2748.00	12.00%	329.76	
	Nurse general	120	x13	18720.00	15.00%	2808.00	
	Midwife trained	161	x4	7728.00	55.70%	4304.50	
	nurse assistant	83	x5	4980.00	12.00%	597.60	
	Laboratory technician	154	x3	5544.00	12.00%	665.28	
	laboratory assistants	0					
	administrator	230	x2	5520.00	12.00%	662.40	
	administration assistants	154	x2	3696.00	12.00%	443.52	
	pharmacist	196	x1	2352.00	12.00%	282.24	
	hygienists (cleaning)	75	x2	1800.00	15.00%	270.00	
	guards	71	x1	852.00	10.00%	85.20	**16273.30**
	kitchen staff	0		0.00			
	WATSAN (chlorine & distribution)						
	carpenters						
	drivers	85	x1	1020.00	10.00%	102.00	
Maintenance							
Stationery	paper	56		672.00	12.00%	80.64	
	registers and forms						
	pens etc.	5		60.00	12.00%	7.20	

ANNEX 8 CME Incremental

RECURRENT	INPUT	UNIT COST (USD)	Number of Units	TOTAL COST / annum	Proportion EMOCS	TOTAL	
Water	$m^{3/}$/day about m^3/month	35		420.00	12.00%	50.40	
electricity	USD/month	45		540.00	12.00%	64.80	
Fuel	Generator=L/month	350		4200.00	12.00%	504.00	
	cars =L/month						
Telephone calls	monthly call charges	30		360.00	12.00%	43.20	
						25959.29	
						Divide by 156=1CS	
							166.41
NOTE 1 (amortization)							
Facility	20						
Furniture and beds	7						
Refrigerators, coolers	7						
Medical equipment	5						
Comm. Equipment	2						
Vehicles	7						
Other	2						

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	COST / annum	Proportion EMOCS	TOTAL	Assumptions
Buildings	Maternity (28 beds) 168sqm	250	42000	2100	29.00%	609.00	estimated workload based on same total number deliveries
	Gynaecology (beds)= 0sqm						
	operating theatre=326sqm	250	81500	4075	40.30%	1642.225	
	laundry/sterilization= 261.5sqm	250	65375	3268.75	10.00%	326.88	
	laboratory=28sqm	250	7000	350	8.00%	28.00	
	OPD	0					
Vehicles	ambulance (x1)	40000	40000	5714.29	29.00%	1657.14	
	cars 4x4 (x1)	30000	30000	4285.71	8.00%	342.86	
	Motorbikes 125 cc	0					
	bicycles	0					
Communications	telephone (mobile)(x1)	20	20	10	40.30%	4.03	
	Computer (x2)	1200	2400	1200	8.00%	96.00	
	Printer (x1)	300	300	150	8.00%	12.00	
	2-way radio VHF base	0					
	handset	0					
	2-way radio HF long distance	0					
	battery	0					
	battery charger (10 amp)	0					
Furniture	beds (28)	150	3600	514.29	29.00%	149.14	
	mattress (28)	35	840	120.00	29.00%	34.80	
	tables/desks (2)	40	80	11.43	29.00%	3.31	
	wardrobes (x1)	150	150	21.43	29.00%	6.21	
	chairs (x5)	15	75	10.71	29.00%	3.11	
	bench (x1)	20	20	2.86	29.00%	0.83	
	shelf (x1)	80	80	11.43	29.00%	3.31	
	sink/hand washing basin (x2)	25	50	7.14	40.30%	2.88	
	laboratory table (x1)	50	50	7.14	8.00%	0.57	

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	COST / annum	Proportion EMOCS	TOTAL	Assumptions
Equipment	examination bed (x2)	270	540	77.14	29.00%	9.25	
	operating table (x1)	4560	4560	912.00	40.30%	367.54	
	speculum (x1)	8	8	1.60	29.00%	0.46	
	stethoscope (x6)	5	30	6.00	29.00%	1.74	
	Sphygmo-manometer (x8)	15	120	24.00	29.00%	6.96	
	dressing pack (2)	25	50	10.00	40.30%	4.03	
	suture set	18.75	18.75	3.75	40.30%	1.51	
	delivery pack (vaginal delivery) (x2)						
	caesarean section pack	1300	5200	1040.00	100%	1040	
	hysterectomy pack	1600					
	instruments evacuation of uterus						
	ultrasound	NA					
	microscope (solar) (X1)	510	510	102	8.00%	8.16	
	centrifuge (x1)	70	70	14	8.00%	1.12	
	vacuum extraction set	0					
	sterilisation drum (x4)	13	52	10.4	29.00%	3.02	
	autoclave (x1)	2541	2541	508.2	40.30%	204.80	
	pressure cooker (large) (x2)	470	940	188	40.30%	75.764	
	kitchen stove	0					
	crockery and cutlery	0					
	generator (small)	300	300	42.86	40.30%	17.27	
	generator (large) (x1)	1200	1200	171.43	29.00%	49.71	
	refrigerator(x1)	350	350	50.00	8.00%	4.00	
Linen	Bed sheets (x24)	11	264	132.00	29.00%	38.28	
	linen for operating theatre (x30x4)	6	720	360.00	40.30%	145.08	
	blankets	0					
	mosquito net (x24)	4	96	48.00	29.00%	13.92	

RECURRENT	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	COST / annum	Proportion EMOCS	TOTAL	
Medicine	Blood transfusion	10		60		40.00	3% receive transfusion
	Antibiotics						
	Oxytocics						
	IV fluids						
	Anaesthetics						
	Analgesics						
Medical supplies	syringes						
	needles						
	Cotton swabs						
	Dressings (sterile)						
	Adhesive tape						
	Disinfectant						
	Soap	28.5	208	5928	100.00%	5928	
		Number of units					
Salaries	Medical doctor specialist	0					
	Medical Doctor general	6					
	Nurse specialist (anaesthesia)	1					
	Nurse general A3	24					
	Nurse general A2	20					
	Nurse general A0	1					
	Midwife trained						
	nurse assistant						
	Laboratory technician	2					
	laboratory assistants						
	administrator	1					
	administration assistants						
	hygienists (cleaning)						
	guards						
		(salaries+bonus)	66228	66228	15.00%	9934.20	

RECURRENT	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	COST / annum	Proportion EMOCS	TOTAL	RECURRENT
Maintenance				5678.2	8.00%	454.26	
Stationery	paper						
	registers and forms						
	pens etc.						
Water	m^3/day about m^3/month		200				
electricity	USD/month		350				
Fuel	Generator=L/month						
	cars =L/month						
			24724 (fuel& electricity)	24724	8.00%	1977.92	
Land Rent	USD/month						
	4000m^2 surface	200		2400	8.00%	192	
						25441.30	***(divide by 208 for 1C/S)***
							122.31
NOTE (2007 report)							
161/350 beds in use							
Medicine USD 21090							
NOTE 1 (amortization)							
Facility							
Furniture and beds	20						
Refrigerators, coolers	7						
Medical equipment	7						
Comm. Equipment	5						
Vehicles	2						
Other	7						
	2						

Annex 9: BM (Sensitivity)

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	
Buildings	Maternity (28 beds)= 178sqm	250	44500	2225	47.00%	1045.75	
	Gynaecology+intensive care=178sqm	250	44500	2225	5.00%	111.25	
	operating theatre=256sqm	300	76800	3840	67.00%	2572.80	
	laundry/sterilization =120sqm	250	30000	1500	10.00%	150.00	
	laboratory=25sqm	250	6250	312.5	8.00%	25.00	
	kitchen =40sqm	250	10000	500	5.00%	25.00	
	OPD (benches/plastic sheeting)		0				
Vehicles	ambulance (x2)	40000	80000	11428.57	10.00%	1142.86	
	cars (4x4)(x5)	30000	150000	21428.57	5.00%	1071.43	
	Motorbikes (125 cc)	600	0				
	bicycles	90	0				
Communications	telephone	0					
	computer (x6)	1200	7200	3600	5.00%	180.00	
	Printer (x1)	300	300	150	5.00%	7.50	
	2-way radio VHF base	1500	1500	750	20.00%	150.00	
	handset (x15)	750	2250	1125	5.00%	56.25	
	2-way radio HF long distance	5000	5000	2500	20.00%	500.00	
	battery	180	180	90	20.00%	18.00	
	battery charger (10 amp)	250	250	125	20.00%	25.00	
Furniture	beds (x17)	60	1020	145.71	100.00%	145.71	
	tables/desks (x2)	40	80	11.43	100.00%	11.43	
	wardrobes (x2)	150	300	42.86	100.00%	42.86	
	chairs (x6)	15	90	12.86	100.00%	12.86	
	bench (x2)	20	40	5.71	100.00%	5.71	
	shelf (x2)	80	160	22.86	100.00%	22.86	

Annex 9: BM (Sensitivity)

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	
	sink/hand washing basin (x3)	25	75	10.71	100.00%	10.71	
	laboratory table	50	50	7.14	8.00%	0.57	
Equipment	examination bed (x2)	270	540	108	100.00%	108.00	
	operating table (x1)	4560	9120	1824	67.00%	1222.08	
	speculum (x10)	8	80	16	20.00%	3.20	
	stethoscope (x15)	5	75	15	47.00%	7.05	
	Sphygmo-manometer (x3)	15	45	9	47.00%	4.23	
	dressing pack (x4)	25	100	20	85%	17.00	
	suture set (x5)	18.75	92.5	18.5	67.00%	12.40	
	delivery pack (vaginal delivery)		0		0		
	caesarean section pack (x4)	1300	5200	1040	100.00%	1040.00	
	hysterectomy pack	1600	1600	320	2%	6.40	
	instruments evacuation of uterus (x4)	545	2180	436	0		
	ultrasound (x1)	4000	4000	800	10.00%	80.00	
	microscope (solar)	510	510	102	8.00%	8.16	
	centrifuge	70	70	14	8.00%	1.12	
	vacuum extraction set	90			0		
	sterilisation drum (x4)	13	52	10.4	100.00%	10.40	
	autoclave	2541	2541	508.2	67.00%	340.49	
	pressure cooker (large)	470	470	94	67.00%	62.98	
	kitchen stove	cost not included					
	crockery and cutlery	cost not included					
	generator (small)	350	350	50	67.00%	33.5	
	generator (large)	1200	1200	171.43	5.00%	8.57	
	refrigerator	350	350	50	8.00%	4	

Annex 9: BM (Sensitivity)

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	
Linen	Bed sheets (34)	6	204	102	100.00%	102	
	operating theatre linen/meter (x30)(x4)	6	720	360	100.00%	360	
	blankets (x17)	3	51	25.5	100.00%	25.5	
	mosquito net (x17)	4	68	34	100.00%	34	
RECURRENT	**INPUT**	**UNIT COST (USD)**	**EXPENDITURE (USD)**	**TOTAL COST / annum**	**Proportion EMOCS**	**TOTAL**	
Medicine	blood transfusion	10/case	210			210	
	Antibiotics						
	Oxytocics						
	IV fluids						
	Anaesthetics						
	Analgesics						
Medical supplies	syringes						
	needles						
	Cotton swabs						
	Dressings (sterile)						
	Adhesive tape						
	Disinfectant						
	Soap		recurrent supplies/ section				
	718 sections/year	28.5/case		20463	100.00%	20463	
Food	Rice	1.1/kg	50gm/person/meal	1615.5	100.00%	1615.5	
	Beans	0.5/kg	300gm/person/meal				
	Gruel (maize flour)	0.5/kg	80gm/person/meal				

Annex 9: BM (Sensitivity)

RECURRENT	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	
Salaries	Medical doctor (specialist exp)(x1)	2763	2763	33156	47.00%	15583.32	
	Medical Doctor general (x1)	450	450	5400	10.00%	540	
	Nurse general (A1)(x13)	160	2080	24960	47.00%	11731.2	
	Midwife trained (exp)(x1)	2431	2431	29172	47.00%	13710.84	
	nurse assistant (x4)	104	416	4992	47.00%	2346.24	
	pharmacist (exp)(x1)	2944	2944	35328	5.00%	1766.4	
	Pharmacist (x8)	192	1536	18432	5.00%	921.6	
	pharmacy technician (x2)	125	250	3000	5.00%	150	
	Laboratory technician (x1)	192	192	2304	8.00%	184.32	
	laboratory assistants (x8)	160	1280	15360	8.00%	1228.8	
	administrator expatriate (x1)	2974	2974	35688	5.00%	1784.4	
	administration assistants (x2)	192	384	4608	5.00%	230.4	
	hygienists (cleaning)(x13)	86	1118	13416	10.00%	1341.6	
	guards (x26)	72	1872	22464	5.00%	1123.2	
	kitchen staff (x13)	86	1118	13416	5.00%	670.8	
	WATSAN (chlorine & distribution) (x5)	104	520	6240	5.00%	312	
	carpenters (x3)	104	312	3744	5.00%	187.2	
Maintenance				80000	5.00%	4000	
Stationery	paper						
	registers and forms					**90925.45**	
	pens etc.						
telephone (mobile)	50 USD/month						
Water	20m$^{3/}$/day about 700m^3/month						
electricity	350USD/month						

Annex 9: BM (Sensitivity)

RECURRENT	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	
Fuel	Generator=150L/month						
	cars =300-500L/month						
Land Rent	500 USD/month	500		6000	5.00%	300	
						91225.45	
						Divide total by annual CSs (718)	**127.05**
NOTE 1 (amortization in years)		**NOTE 2 (exchange rate)**					
Facility	20	1000 USD= 1149.10 SWF					
Furniture and beds	7	1000 SWF= 870.25 USD					
Refrigerators, coolers	7						
Medical equipment	5						
Comm. Equipment	2						
Vehicles	7						
Other	2						

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	
Buildings	Maternity (17beds) = 102 sqm	250	25500	1275	31.80%	405.45	
	Intensive care (10 beds)	250	15000	750	5.00%	37.5	
	Gynaecology( )= sqm	N/A					
	operating theatre (30sqm)	250	7500	375	23.00%	86.25	
	laundry/sterilization =25sqm	250	6250	312.5	10.00%	31.25	
	Laboratory (12sqm)	250	3000	150	2.00%	3	
	OPD	0					
Vehicles	ambulance	0					
	cars (4x4)	0					
	Motorbikes (125 cc)	0					
	bicycles (x2)	90	180	25.71	5.00%	1.29	
Communications	telephones		0				
	computers (X1)	1200	1200	600	5.00%	30	
	2-way radio		0				
	printer(X1)	300	300	150	5.00%	9	
Furniture	beds (X17)	60	1020	145.71	31.80%	46.34	
	mattress (x17)	35	595	85	31.80%	27.03	
	tables/desks (x2)	40	80	11.43	31.80%	3.63	
	wardrobes (x1)	150	150	21.43	31.80%	6.81	
	chairs (x4)	15	60	8.57	31.80%	2.73	
	bench (x1)	20	20	2.86	31.80%	0.91	
	shelf (x1)	80	80	11.43	31.80%	3.63	
	sink/hand washing basin (x2)	25	50	7.14	23.00%	1.64	
	laboratory table (x1)	50	50	7.14	2.00%	0.14	

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	
Equipment	examination bed (x1)	270	270	54	31.80%	17.172	
	operating table (x1)	4560	4560	912	23.00%	209.76	
	speculum (x6)	8	48	9.6	31.80%	3.0528	
	Stethoscope (x10)	5	50	10	31.80%	3.18	
	Sphygmo-manometer (x2)	15	30	6	31.80%	1.908	
	caesarean section pack (x2)	1300	2600	520	100.00%	520	
	hysterectomy pack	1600	1600	320	2.00%	6.4	
	dressing pack (x1)	25	25	5	23.00%	1.15	
	ultrasound	4000	0				
	microscope (solar)(x1)	510	510	102	2.00%	2.04	
	centrifuge	70	70	14	2.00%	0.28	
	suture set	18.75	18.75	3.75	23.00%	0.8625	
	sterilisation drum (x5)	13	65	13	23.00%	2.99	
	pressure cooker (large)(x1)	470	470	94	23.00%	21.62	
	kitchen stove	0					
	crockery and cutlery	0					
	generator (small)(x1)	300	300	42.86	5.00%	2.14	
	generator (large)	0					
	Refrigerator (x1)	350	350	50	2.00%	1	
	Solar panel (x2)	750	1500	150	14.00%	21	
Linen	Bed sheets (x17)	11	187	93.5	31.80%	29.73	
	linen for operating theatre (x30)(x2)	6	360	180	23.00%	41.4	
	blankets		0				
	mosquito net (x17)	4	68	34	31.80%	10.812	

RECURRENT	**INPUT**	**UNIT COST (USD)**	**EXPENDITURE (USD)**	**TOTAL COST / annum**	**Proportion EMOCS**	**TOTAL**	
Medicine	Antibiotics						
	Oxytocics						
	IV fluids						
	Anaesthetics						
	Analgesics						
Medical supplies	syringes						
	needles						
	Cotton swabs						
	Dressings (sterile)						
	Adhesive tape						
	Disinfectant						
	Soap						
	x56 caesareans/year	28.5	1596		100.00%	1596	
Food					0		
Salaries	Medical Director (x1)	202	202	2424	5.00%	121.2	
	Medical Doctor general (x2)	120	240	2880	10.00%	288	
	Nurse Director (x1)	104	104	1248	5.00%	62.4	
	Nurse generalA2 (x3)	101	303	3636	31.80%	1156.2	
	Nurse A3 (x5)	77	385	4620	31.80%	1469.2	
	Midwife trained (x1)	98	98	1176	31.80%	373.97	
	pharmacy assistant(x1)	88	88	1056	5.00%	52.8	
	Laboratory technician (x2)	88	176	2112	2.00%	42.24	
	administrator (x1)	104	104	1248	5.00%	62.4	

RECURRENT	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	
	administration assistants (x1)	88	88	1056	5.00%	52.8	
	hygienists (cleaning) (x3)	66	198	2376	10.00%	237.6	
	guards (x2)	66	132	1584	5.00%	79.2	
	chaplain (x1)	88	88	1056	5.00%	52.8	
Maintenance							
Stationery	paper	56		672	5.00%	33.6	
	registers and forms						
	pens /printer cartridges						
	telephone credit (monthly)	10		120	5.00%	6	
Water	$m^{3/}$/day about m^3/month	40		480	5.00%	24	
electricity	USD/month	40		480	5.00%	24	
Fuel	Generator=10L/month	20		240	5.00%	12	
	cars =L/month	0					
						7339.52	
						Divide total by annual CSs (56)	**131.06**

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	
Buildings	Maternity (12 beds)=72sqm	250	18000	900.00	41.20%	370.80	
	gynaecology+intensive care	250	15000	750.00	5.00%	37.50	
	operating theatre=165sqm	300	49500	2475.00	12.00%	297.00	
	laundry/sterilization=25sqm	250	6250	312.50	10.00%	31.25	
	laboratory=36sqm	250	9000	450.00	5.00%	22.50	
	OPD	0					
	kitchen	0		0.00			
Vehicles	ambulance		0				
	cars (4x4) (x2)	30000	30000	4285.71	10.00%	428.57	
	Motorbikes (125 cc)(x1)	600	600	85.71	4.00%	3.43	
	bicycles	90	0				
Communications	telephones (mobile)(X5)	20	100	50.00	4.00%	2.00	
Equipment	computers(X3)	1200	3600	1800.00	4.00%	72.00	
	2-way radio	0		0.00			
	printer (X1)	300	300	150.00	4.00%	6.00	
Furniture	beds (X12)	150	1800	257.14	41.20%	105.94	
	mattress (X12)	35	420	60.00	41.20%	24.72	
	tables/desks (X1)	40	40	5.71	41.20%	2.35	
	wardrobes (X1)	150	150	21.43	41.20%	8.83	
	chairs (X3)	15	45	6.43	41.20%	2.65	
	bench (X1)	20	20	21.43	41.20%	8.83	
	shelf (X1)	80	80	11.43	41.20%	4.71	
	sink/hand washing basin (X2)	25	50	7.14	12.00%	0.86	
	laboratory table (X1)	50	50	7.14	5.00%	0.36	

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	
Equipment	examination bed (X1)	270	270	54.00	41.20%	22.25	
	operating table (X1)	4560	4560	912.00	12.00%	109.44	
	speculum (X6)	8	48	9.60	41.20%	3.96	
	stethoscope (X10)	5	50	10.00	41.20%	4.12	
	Sphygmo-manometer (X2)	15	30	6.00	41.20%	2.47	
	caesarean section pack(X3)	1300	3900	780.00	100.00%	780.00	
	hysterectomy pack (X2)	1600	3200	640.00	2.00%	12.80	
	instruments evacuation of uterus(X2)	545	1090	218.00	0		
	ultrasound (X1)	4000	4000	800.00	19.00%	5.10	
	microscope (solar)(x1)	510	510	102.00	5.00%	5.10	
	centrifuge (x1)	70	70	14.00	5.00%	0.70	
	dressing pack (x2)	25	50	10.00	12.00%	1.20	
	sterilisation drum (x5)	13	65	13.00	12.00%	1.56	
	pressure cooker (large)(x1)	470	470	94.00	12.00%	11.28	
	pressure cooker (small)(x2)	150	300	60.00	12.00%	7.20	
	suture set	18.75	18.75	3.75	12.00%	0.45	
	generator (small)(x1)	300	300	42.86	12.00%	5.14	
	refrigerator (x1)	350	350	50.00	5.00%	2.50	
Linen	Bed sheets (x12)	11	132	66.00	41.20%	27.19	
	linen for operating theatre/m (x3)(x30)	6	540	270.00	12.00%	32.40	
	blankets			0.00			
	mosquito net (x12)	4	48	24.00	41.20%	9.89	

RECURRENT	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	
Blood Transfusion	Blood Transfusion	10/case	20			20.00	
Medicine	Antibiotics						
	Oxytocics						
	IV fluids						
	Anaesthetics						
	Analgesics						
Medical supplies	syringes						
	needles						
	Cotton swabs						
	Dressings (sterile)						
	Adhesive tape						
	Disinfectant		Number of units				
	Soap	28.5	x58	1653.00	100.00%	1653.00	
Food	N/A						
Salaries	Medical doctor specialist (expat.)(x1)	1020		12240.00	4.00%	489.60	
	Medical Doctor general (expat)(x1)	1020		12240.00	8.00%	979.20	
	Medical doctor specialist (x1)	500		6000.00	4.00%	240.00	
	Medical Doctor general (x4)	250		12000.00	8.00%	960.00	
	Nurse specialist (x1)	229		2748.00	4.00%	109.92	
	Nurse general	120	x13	18720.00	8.00%	1497.60	
	Midwife trained	161	x3	5796.00	41.20%	2387.95	
	nurse assistant	83	x5	4980.00	4.00%	199.20	
	Laboratory technician	154	x3	5544.00	5.00%	277.20	

RECURRENT	INPUT	UNIT COST (USD)	Number of Units	TOTAL COST / annum	Proportion EMOCS	TOTAL	
	laboratory assistants	0					
	administrator	230	x2	5520.00	4.00%	220.80	
	administration assistants	154	x2	3696.00	4.00%	147.84	
	pharmacist	196	x1	2352.00	4.00%	94.08	
	hygienists (cleaning)	75	x2	1800.00	8.00%	144.00	
	guards	71	x1	852.00	4.00%	34.08	
	kitchen staff	0		0.00			
	WATSAN (chlorine & distribution)						
	carpenters						
	drivers	85	x1	1020.00	8.00%	102.00	
Maintenance							
Stationery	paper	56		672.00	4.00%	26.88	
	registers and forms						
	pens etc.	5		60.00	4.00%	2.40	
Water	$m^{3/}$/day about m^3/month	35		420.00	4.00%	16.80	
electricity	USD/month	45		540.00	4.00%	21.60	
Fuel	Generator=L/month	350		4200.00	4.00%	168.00	
	cars =L/month						
Telephone calls	monthly call charges	30		360.00	4.00%	14.40	
						12281.60	
						Divide total by annual CSs (58)	**211.75**

ANNEX 9: HGR (Sensitivity)

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	
Buildings	Maternity (24beds)= 144 sqm	250	36000	1800	23.30%	419.40	
	Gynaecology (beds)= 0sqm						
	operating theatre=326sqm	250	81500	4075	21.00%	855.75	
	laundry/sterilization= 261.5sqm	250	65375	3268.75	6.00%	196.13	
	laboratory=28sqm	250	7000	350	4.00%	14.00	
	OPD	0					
Vehicles	ambulance (x1)	40000	40000	5714.29	10.00%	571.43	
	cars 4x4 (x1)	30000	30000	4285.71	3.00%	128.57	
	Motorbikes 125 cc	0					
	bicycles	0					
Communications	telephone (mobile)(x1)	20	20	10	21.00%	2.10	
	Computer (x2)	1200	2400	1200	3.00%	36.00	
	Printer (x1)	300	300	150	3.00%	4.50	
	2-way radio VHF base	0					
	handset	0					
	2-way radio HF long distance	0					
	battery	0					
	battery charger (10 amp)	0					
Furniture	beds (24)	150	3600	514.29	23.30%	119.83	
	mattress (24)	35	840	120.00	23.30%	27.96	
	tables/desks (2)	40	80	11.43	23.30%	2.66	
	wardrobes (x1)	150	150	21.43	23.30%	4.99	

ANNEX 9: HGR (Sensitivity)

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	
	chairs (x5)	15	75	10.71	23.30%	2.50	
	bench (x1)	20	20	2.86	23.30%	0.67	
	shelf (x1)	80	80	11.43	23.30%	2.66	
	sink/hand washing basin (x2)	25	50	7.14	21.00%	1.50	
	laboratory table (x1)	50	50	7.14	4.00%	0.29	
Equipment	examination bed (x2)	270	540	77.14	23.30%	9.25	
	operating table (x1)	4560	4560	912.00	21.00%	191.52	
	speculum (x1)	8	8	1.60	23.30%	0.37	
	stethoscope (x6)	5	30	6.00	23.30%	1.40	
	Sphygmo-manometer (x8)	15	120	24.00	23.30%	5.59	
	dressing pack (2)	25	50	10.00	21.00%	2.10	
	suture set	18.75	18.75	3.75	21.00%	0.79	
	delivery pack (vaginal delivery)						
	caesarean section pack	1300	5200	1040.00	100%	1040	
	hysterectomy pack	1600					
	instruments evacuation of uterus						
	ultrasound	NA					
	microscope (solar) (X1)	510	510	102	4.00%	4.08	
	centrifuge (x1)	70	70	14	4.00%	0.56	
	vacuum extraction set?						
	sterilisation drum (x4)	13	52	10.4	21.00%	2.18	
	autoclave (x1)	2541	2541	508.2	21.00%	106.72	
	pressure cooker (large) (x2)	470	940	188	21.00%	39.48	
	kitchen stove	0					
	generator (small)	300	300	42.86	21.00%	9.00	

ANNEX 9: HGR (Sensitivity)

CAPITAL	INPUT	UNIT COST (USD)	EXPENDITURE (USD)	TOTAL COST / annum	Proportion EMOCS	TOTAL	
	generator (large) (x1)	1200	1200	171.43	3.00%	5.14	
	refrigerator(x1)	350	350	50.00	4.00%	2.00	
Linen	Bed sheets (x24)	11	264	132.00	23.30%	30.76	
	linen for operating theatre (x30x4)	6	720	360.00	21.00%	75.60	
	blankets	0					
	mosquito net (x24)	4	96	48.00	23.30%	11.18	
RECURRENT	**INPUT**	**UNIT COST (USD)**	**Number of Units**	**TOTAL COST / annum**	**Proportion EMOCS**	**TOTAL**	
Medicine	Blood transfusion	10		25		25.00	
	Antibiotics						
	Oxytocics						
	IV fluids						
	Anaesthetics						
	Analgesics						
Medical supplies	syringes						
	needles						
	Cotton swabs						
	Dressings (sterile)						
	Adhesive tape						
	Disinfectant						
	Soap	28.5	82	2337	100.00%	2337	
Salaries	Medical doctor specialist		0				
	Medical Doctor general (6)		6				

ANNEX 9: HGR (Sensitivity)

RECURRENT	INPUT	UNIT COST (USD)	Number of Units	TOTAL COST / annum	Proportion EMOCS	TOTAL	
	Nurse specialist (anaesthesia)		1				
	Nurse general A3		24				
	Nurse general A2		18				
	Nurse general A0		1				
	Midwife trained						
	nurse assistant						
	Laboratory technician		2				
	laboratory assistants						
	administrator		1				
	administration assistants						
	hygienists (cleaning)						
	guards						
		63343 (salaries+bonus)		63348	11.00%	6968.28	
Maintenance				5678.2	3.00%	170.35	
Stationery	paper						
	registers and forms						
	pens etc.						
Water	m^3/day about m^3/month	200					
electricity	USD/month	350					

ANNEX 9: HGR (Sensitivity)

RECURRENT	INPUT	UNIT COST (USD)	Number of Units	TOTAL COST / annum	Proportion EMOCS	TOTAL	
Fuel	Generator=L/month						
	cars =L/month						
				(fuel& electricity) 24724	3.00%	741.72	
Land Rent	USD/month						
	4000m^2 surface	200 (monthly)		2400	3.00%	72	
						14243.01	
						Divide total by annual CSs (82)	**173.70**
NOTE (2007 report)							
161/350 beds in use							
Medicine USD 21090							

ANNEX 10 HOSPITAL ACTIVITIES

RWANKOLE	**December**	**January**	**February**	**March**	**April**	**May**	**Total**
Total deliveries	*25*	30	37	47	40	29	208
Multiple deliveries	0	0	0	0	0	0	
Breech	0	0	0	0	0	0	
Transverse	0	0	0	0	0	0	
Other abnormal foetal positions	0	0	0	0	0	0	
Stillbirths	0	1	0	0	0	1	2
Early neonatal deaths (<7days)	0	1	0	0	0	1	2
Bleeding related to pregnancy	1	0	1	0	0	0	2
Treatment for septicemia	0	0	0	0	0	0	
Eclampsia	0	0	0	0	0	1	1
Maternal deaths	0	0	0	0	0	0	
Vacuum extractions	0	0	0	0	0	0	
Forceps deliveries	0	0	0	0	0	0	
Episiotomies	0	3	7	2	2	4	18
Caesarean sections	6	1	6	3	9	3	28
Ruptured uterus	0	0	0	0	0	0	
Ectopic pregnancies	0	0	0	0	0	0	
Abortion complications	0	1	3	0	0	3	7

ANNEX 10 HOSPITAL ACTIVITIES

GENERAL HOSPITAL BUNIA	December	January	February	March	April	May	Total
Total deliveries	92	55	92	64	77	65	445
Multiple deliveries	1TW	0	1TW	2TW	1TW	0	
Breech	2	0	2	0	0	0	
Transverse	0	0	0	0	0	0	
Other abnormal foetal positions	9	0	9	9	0	5	
Stillbirths	2M	4	2M	5/M1	1	0	
Early neonatal deaths (<7days)	1	0	1	0	1	1	4
Bleeding related to pregnancy	0	0	0	0	0	0	
Treatment for septicemia	0	0	0	0	0	0	
Eclampsia	0	0	0	0	0	0	
Maternal deaths	0	0	0	0	0	0	
Vacuum extractions	0	0	0	1	1	0	
Forceps deliveries	0	0	0	0	0	0	
Episiotomies	2	0	2	10	1	0	
Caesarean sections	9	5	9	6	7	5	41
Ruptured uterus	0	0	0	0	0	0	
Ectopic pregnancies	0	0	0	0	0	0	
Abortion complications	0	2	6	5	2	5	20

ANNEX 10 HOSPITAL ACTIVITIES

CENTRE MEDICAL EVANGELIQUE	December	January	February	March	April	May	Total
Total deliveries	33	15	31	24	25	25	153
Multiple deliveries	0	0	0	0	0	0	
Breech	0	1	1	1	0	0	
Transverse	0	0	0	0	0	0	
Other abnormal foetal positions	0	0	0	1	1	0	
Stillbirths	0	1M	1	1M	4	0	
Early neonatal deaths (<7days)	0	0	1	0	0	0	
Bleeding related to pregnancy	0	2	2	1	0	1	
Treatment for septicemia	0	0	0	0	0	0	
Eclampsia	0	1	0	0	0	0	
Maternal deaths	0	0	0	0	0	1	1
Vacuum extractions	0	0	0	0	0	0	
Forceps deliveries	0	0	0	0	0	0	
Episiotomies	2	0	2	1	0	1	
Caesarean sections	4	4	6	6	6	3	29
Ruptured uterus	0	0	0	0	0	0	
Ectopic pregnancies	0	0	0	0	0	0	
Abortion complications	2	2	2	4	0	1	11

ANNEX 10 HOSPITAL ACTIVITIES

BON MARCHE	December	January	February	March	April	May	Total
Total deliveries	217	244	237	306	275	294	1573
Multiple deliveries	8TW	4TW	4TW	0	7TW	7TW	
Breech	9	7	3	5	4	11	
Transverse	2	1	1	0	2	2	
Other abnormal foetal positions	3	5	5	2	5	9	
Stillbirths	14M8	8M4	20M15	4	6M3	13M5	
Early neonatal deaths (<7days)	0	8	6	0	1	7	
Bleeding related to pregnancy	2	6	10	4	5	8	
Treatment for septicemia	0	0	2	0	0	6	
Eclampsia	2	2	3	1	3	7	
Maternal deaths	1	1	0	0	0	3	
Vacuum extractions	9	11	8	7	13	13	
Forceps deliveries	0	0	0	0	0	0	
Episiotomies	25	27	22	9	8	20	
Caesarean sections	42	45	64	74	61	73	359
Ruptured uterus	0	2	6	1	2	1	12
Ectopic pregnancies	6	1	3	0	5	2	
Abortion complications	36	42	45		39	27	189

ANNEX 10 HOSPITAL ACTIVITIES

BUNIA CITE	December	January					
Total deliveries	52	59					
Multiple deliveries	1TW	0					
Breech	2	0					
Transverse	0	0					
Other abnormal foetal positions	0	0					
Stillbirths	0	0					
Early neonatal deaths (<7days)	1	0					
Bleeding related to pregnancy	0	0					
Treatment for septicemia	0	0					
Eclampsia	0	0					
Maternal deaths	0	0					
Vacuum extractions	2	0					
Forceps deliveries	0	0					
Episiotomies	10	3					
Caesarean sections	1	3					
Ruptured uterus	0	0					
Ectopic pregnancies	0	0					
Abortion complications	2	2					

Rwampara	(outside Bunia HZ)						**Total**
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y			Fansidar Vermox Fefol	300FC		
1st visit		41	51				
repeat visit		60	63				
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	Y	all	all	albumin, sediment, glucose	400FC		
d) Haemoglobin	Y	all	all		400FC		
e) Syphilis	Y	1+6-	6+7-	extencillin 50MU/kg	1500FC	1vial/week/4weeks	
f)Other STI	Y			Symptomatic			
Normal delivery	Y	39	34		1500FC		
Care of newborn							
a)resuscitation	Y	0	0	Mouth-to-mouth			
b)treatment infection	Y	0	0	ampicillin and gentamycin			
Severe anaemia	Y			transfusion			
Eclampsia	R						
Haemorrhage	R						
Septicemia	R						
Caesarean section	R						
Family planning	N			education during antenatal			
Abortion complications	R						
Adventist							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y			Fefol,			
1st visit		4	10				
repeat visit		12	15				
a) weight	Y						
b)BP	Y						
c) urine	Y	few			200FC		
d) Haemoglobin		few			200FC		
e) Syphilis	Y		1		2USD		
f)Other STI	Y			no HIV testing yet			

Adventist (ctd)							
Normal delivery		5	2				**7**
Care of newborn							
a)resuscitation	N			Mouth-to-mouth			
b)treatment infection	N						
Severe anaemia	R			no transfusion			
Eclampsia	R						
Haemorrhage	R			no transfusion			
Septicemia	R						
Caesarean section	R						
Family planning	N			refer for contraception			
Abortion complications	R						
Bankoko							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y						
1st visit		29	23		500FC	FICHE	
repeat visit		68	84				
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	N						
d) Haemoglobin	N						
e) Syphilis	N						
f)Other STI	Y			syndromic	250CF		
Normal delivery	Y	17	10		1500FC		**27**
Care of newborn							
a)resuscitation	N						
b)treatment infection	N						
Severe anaemia	N						
Eclampsia	N						
Haemorrhage	N			IV fluids available			
Septicemia	N						
Caesarean section	R			no cases			
Family planning	N			no cases			

Bankoko (ctd)							
Abortion complications	R						
Bigo							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y				250CF	FICHE	
1st visit		70	139				
repeat visit		185	217				
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	R						
d) Haemoglobin	R						
e) Syphilis	N			except survey			
f)Other STI	Y			syndromic			
Normal delivery	Y	16	15		3120CF	6USD	**31**
Care of newborn							
a)resuscitation	N			no cases			
b)treatment infection	N			no cases			
Severe anaemia	N			no cases			
Eclampsia	N			no cases			
Haemorrhage	N			no cases			
Septicemia	N			no cases			
Caesarean section	R	4	3	refer to General Hospital (near)			
Family planning	R						
Abortion complications	N			no cases			
Bora Uzima							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y						
1st visit		55	66		500FC	FICHE	
repeat visit		64	93				
a) weight	Y	all	all				
b)BP	Y	all		no sphygmomanometer in Jan.			
c) urine	Y			proteins, sediment, glucose	400FC		
d) Haemoglobin	Y	most	most				

Bora Uzima (ctd)							
e) Syphilis	No						
f)Other STI	Y			syndromic		cost depends on treatment	
Normal delivery	Y	35	30		1500FC		**65**
Care of newborn							
a)resuscitation	Y			mouth to mouth			
b)treatment infection	R						
Severe anaemia	N						
Eclampsia	N			no treatment available			
Haemorrhage	N			no cases			
Septicemia	R			refer to General Hospital			
Caesarean section	R	6	4				
Family planning	N						
Abortion complications	N			no cases			
Centrale							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y				200FC		
1st visit		25	33		50FC		
repeat visit		43	34		50FC		
a) weight	Y	all	all				
b)BP	Y	all	all	refer to MSF if hypertension			
c) urine	Y				100FC		
d) Haemoglobin	N						
e) Syphilis	N						
f)Other STI	N						
Normal delivery	Y	28	26		1500FC		**54**
Care of newborn							
a)resuscitation	N						
b)treatment infection	N						
Severe anaemia	N			no cases			
Eclampsia	N			no cases			
Haemorrhage	N			no cases			
Septicemia	N			no cases			

Centrale (ctd)							
Caesarean section	R	3					
Family planning	Y			Depo-Provera			
Abortion complications	R						
Bunia Cite							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y			Fansidar Vermox Fefol			
1st visit		56	62	mosquito net	500FC	15 minutes	
repeat visit					300FC		
a) weight	Y	all	all				
b)BP	Y						
c) urine	Y	25	42		180FC	10 minutes	
d) Haemoglobin	Y				180FC		
e) Syphilis	Y	30	36	survey in December-Jan.	3USD	45 minutes	RPR
f)Other STI	Y	13	11				
Normal delivery	Y	53	54				
Care of newborn	Y						
a)resuscitation	N						
b)treatment infection	Y	7	6	amoxycillin, ampi-, gentamycin			
Severe anaemia	N						
Eclampsia	N						
Haemorrhage	Y	2	1	no transfusion			
Septicemia	N						
Caesarean section	Y	2	1			45 minutes	
Family planning	Y	1	4	implant		5 minutes	
Abortion complications	N						
Clinique Bomoi							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y				25 USD	includes normal delivery	
1st visit		22	37				
repeat visit							
a) weight	Y	all	all	weight and height			
b)BP	Y	all	all				

Bomoi (ctd)							
c) urine	Y	all	all				
d) Haemoglobin	Y	all	all				
e) Syphilis	N						
f)Other STI	N			few pregnant cases			
Normal delivery	Y	18	21				**39**
Care of newborn							
a)resuscitation	Y			5 cases in 2 months?			
b)treatment infection	Y						
Severe anaemia	Y						
Eclampsia	Y	1	3	refer to MSF after stabilizing			
Haemorrhage	Y			1 placenta praevia			
Septicemia	Y						
Caesarean section	Y	2	3		80USD	excludes stay in hospital	
Family planning	Y						
Abortion complications	Y	5	2	curretage			
Clinique Davenport							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y				200FC	FICHE	
1st visit		7	9				
repeat visit		14	17				
a) weight	Y						
b)BP	Y						
c) urine	Y			proteins, sediment,	200FC		
d) Haemoglobin	Y				200FC		
e) Syphilis	Y				2USD		
f)Other STI	Y	0	5	ceftriazone for gonorrhoea			
Normal delivery	Y	11	17		5USD		**28**
Care of newborn							
a)resuscitation	Y	1	0	Ambu-bag available			
b)treatment infection	Y			no cases			
Severe anaemia	Y			transfusion	10USD		
Eclampsia	Y			Mg Sulfate and hydralazine			

Davenport (ctd)							
Haemorrhage	Y			Ringers Lactate			
Septicemia	Y			IV antibiotics, referral from Nov.			
Caesarean section	Y	1		not supported after November	50USD		
Family planning	Y			out of stock			
Abortion complications	Y	2	3	curretage	10USD	<30 minutes	
	Still births	1	2	twins in January			
Clinique Freedom							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y				500FC	FICHE	
1st visit		14	21				
repeat visit		11	6				
a) weight	Y						
b)BP	Y						
c) urine	Y	18		sediment, proteins	0.5USD	2USD for Gram stain	
d) Haemoglobin	Y	0	10	vitamin K and Fefol	0.5USD		
e) Syphilis	Y	1		if clinical signs		supported by	
f)Other STI	Y			Cefotaxin for gonorrhoea		OXFAM Quebec	
Normal delivery	Y	5	2		10USD		**7**
Care of newborn	Y						
a)resuscitation	Y			mouth to mouth			
b)treatment infection	Y	1		ampicillin and cefotaxin			
Severe anaemia	N						
Eclampsia	N						
Haemorrhage	Y		1	vit K and Fefol			
Septicemia	N			no cases			
Caesarean section	N			no cases, recently opened			
Family planning	N						
Abortion complications	Y			up to 5 cases/week			
Still births							
Early neonatal death							

Kindia HC							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y				300FC		
1st visit		12	15				
repeat visit		38	27				
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	Y	all	all	proteins, sediment, glucose		FREE supported by	
d) Haemoglobin	Y	all	all			Anglican community	
e) Syphilis	N			no reagents			
f)Other STI	Y	3	1	includes HIV, refer to HGR			
Normal delivery	Y	11	14		1500FC		**25**
Care of newborn	Y						
a)resuscitation	Y			mouth to mouth			
b)treatment infection	Y			amoxycillin, kanamycin			
Severe anaemia	R			no cases			
Eclampsia	R						
Haemorrhage	R						
Septicemia	Y			ampicillin, penicillin G			
Caesarean section	R						
Family planning	N			education during antenatal			
Abortion complications	R						
Still births							
Early neonatal death							
Lembabo							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y				200FC	FICHE	
1st visit		41	67		50FC	medicine	
repeat visit		67	46				
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	N			no laboratory			
d) Haemoglobin	N						

Lembabo (ctd)							
e) Syphilis	N						
f)Other STI	Y			penicillin for gonorrhoea			
Normal delivery	Y	30	25				**55**
Care of newborn							
a)resuscitation	N						
b)treatment infection	Y	3	0	ampicillin and gentamycin			
Severe anaemia	R			no IV fluids			
Eclampsia	R						
Haemorrhage	R						
Septicemia	R						
Caesarean section	R	0	0				
Family planning	N						
Abortion complications	R						
Still births							
Early neonatal death							
Mudzi Pela							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y				200FC		
1st visit		89	113	refer at risk pregnancies			
repeat visit		39	204				
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	Y			as indicated			
d) Haemoglobin	Y			if problems			
e) Syphilis	Y			survey in December-Jan.			
f)Other STI	Y			gonorrhoea, oral treatment			
Normal delivery	Y	0	8	1 breech referred with clavicula #			**8**
Care of newborn							
a)resuscitation	N						
b)treatment infection	R						
Severe anaemia	N			no cases			
Eclampsia	N						

Mudzi Pela							
Haemorrhage	N			oxytocin out of stock			
Septicaemia	R						
Caesarean section	R			9 referrals but no feedback			
Family planning	Y			only natural methods			
Abortion complications	N			no cases			
Still births		0	0				
Early neonatal death		0	0				

Mwito (mission)							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y						
1st visit		40	37				
repeat visit		88	88				
a) weight	Y						
b)BP	Y			Salt-free diet and transfer to HGR			
c) urine	Y				300FC	for Hb, urine, stool	
d) Haemoglobin	Y						
e) Syphilis	N						
f)Other STI	Y						
Normal delivery	Y	19	24		1500FC		**43**
Care of newborn							
a)resuscitation				mouth to mouth			
b)treatment infection	No						
Severe anaemia	Y			refer for transfusion			
Eclampsia	N			no cases			
Haemorrhage	N						
Septicaemia	N						
Caesarean section	R			refer to HGR			
Family planning	N						
Abortion complications	R						
Still births		1				there are many home	
Early neonatal death						deliveries in the area	
Nyakasanza							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y				0		
1st visit		20	54				
repeat visit		49	37				
a) weight	Y						
b)BP	Y						
c) urine	N						
d) Haemoglobin	N						

Nyakasanza (ctd.)							
e) Syphilis	N						
f)Other STI	Y			syndromic			
Normal delivery	Y	10	12		1500FC		**22**
Care of newborn							
a)resuscitation	Y			mouth to mouth			
b)treatment infection	Y						
Severe anaemia	R	0	0				
Eclampsia	R	0	0				
Haemorrhage	R			IV fluids and refer			
Septicaemia	R						
Caesarean section	R	2	1	Refer to MSF			
Family planning	N						
Abortion complications	R						
Still births							
Early neonatal death							
Nzere							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y				0		
1st visit		0	4				
repeat visit		0	5				
a) weight	Y						
b)BP	Y	all	all				
c) urine	N						
d) Haemoglobin	N						
e) Syphilis	N						
f)Other STI	Y			syndromic		consultation and market price of drugs	
Normal delivery	Y	0	0	started recently	1500FC		0
Care of newborn							
a)resuscitation	N						
b)treatment infection	N						
Severe anaemia	N						
Eclampsia	N						

Nzere (ctd)							
Haemorrhage	N						
Septicaemia	N						
Caesarean section	R						
Family planning	N						
Abortion complications	R						
Still births							
Early neonatal death							
Rwankole							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y						
1st visit		43	65				
repeat visit							
a) weight	Y						
b)BP	Y	all	all				
c) urine	Y						
d) Haemoglobin	Y						
e) Syphilis	Y						
f)Other STI	Y						
Normal delivery	Y	19	29				
Care of newborn							
a)resuscitation	Y	0	2				
b)treatment infection	Y						
Severe anaemia	Y						
Eclampsia	Y						
Haemorrhage	Y						
Septicaemia	Y						
Caesarean section	Y	6	1				
Family planning	Y						
Abortion complications	Y						
Still births							
Early neonatal death							

Simbiliyabo							
Examination	*Y/N/R*	*December*	*January*	*Action*	*Price*		
Antenatal	Y				300FC		
1st visit		11	9				
repeat visit		24	18				
a) weight	Y			and height			
b)BP	Y						
c) urine	Y	few	few	proteins and glucose	200FC		
d) Haemoglobin	Y	few	few		50FC		
e) Syphilis	N						
f)Other STI	N						
Normal delivery	Y	7	5	performs episiotomies, no vacuum	5USD		**12**
Care of newborn							
a)resuscitation	Y			Mouth-to-mouth			
b)treatment infection	Y			ampicillin IM			
Severe anaemia	N			no cases			
Eclampsia	N			no cases			
Haemorrhage	Y	1	0	IV fluids, oxytocics			
Septicaemia	N			no cases			
Caesarean section	R	2	0	to HGR			
Family planning	N			drugs available, no cases			
Abortion complications	R	1		to Rwankole			
Still births							
Early neonatal death							
MATERNAL DEATH IN DECEMBER DUE TO SEVERE HAEMORRHAGE 45 MIN AFTER DELIVERY, 4TH CHILD							
MOTHER FROM MAYEMBA, CHILD IN ORPHANAGE MUDZIPELA							**423**

Umoja							
Examination	*Y/N/R*	*February*	*March*	*Action*	*Price*		**Total**
Antenatal	Y			Fefol, Fansidar,Vermox, VAT	250FC		
1st visit		47	35				
repeat visit		72	77				
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	N			no laboratory technician			
d) Haemoglobin	N						
e) Syphilis	N						
f)Other STI	Y			procaine Peni for gonorrhoea	300FC		
Normal delivery	Y	37	59				**96**
Care of newborn							
a)resuscitation	Y	4	8	hydrocortisone			
b)treatment infection	Y						
Severe anaemia	R						
Eclampsia	R						
Haemorrhage	R	1	0				
Septicemia	R						
Caesarean section	R	1	1				
Family planning	N						
Abortion complications	R	1	1				
Still birth				4 cases			
Early neonatal death							

Adventist							
Examination	*Y/N/R*	*February*	*March*	*Action*	*Price*		
Antenatal	Y			Fefol, Fansidar,Vermox, VAT	200FC	FICHE	
1st visit		4	14				
repeat visit		19	3				
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	Y			if required sediment, proteins	400FC	4 tests (urine, Hb,	
d) Haemoglobin	Y			if required		malaria, stool)	
e) Syphilis	Y			if required	3USD		
f)Other STI	Y			syndromic			
Normal delivery	Y	1	3		1500FC		**4**
Care of newborn							
a)resuscitation	Y			Mouth-to-mouth, cardiac massage, hydrocortisone			
b)treatment infection	Y	Y					
Severe anaemia	R						
Eclampsia	R						
Haemorrhage	Y			ergometrin, Fefol			
Septicemia	Y			no cases			
Caesarean section	R	0	1				
Family planning	Y	0	0	Norplant			
Abortion complications	R	0	1				
Still birth							
Early neonatal death							

Bankoko							
Examination	*Y/N/R*	*February*	*March*	*Action*	*Price*		
Antenatal	Y			Fansidar, Fefol, Vermox	500FC	all ANC	
1st visit		21	18				
repeat visit		67	71				
a) weight	Y						
b)BP	Y						
c) urine	N						
d) Haemoglobin	N						
e) Syphilis	N						
f)Other STI	N						
Normal delivery	Y	6	18	vitamin A, ergometrin	1500FC		**24**
Care of newborn							
a)resuscitation	N			refer to HGR			
b)treatment infection	Y	1		ampicillin, gentamycin	500FC		
Severe anaemia	R			to HGR			
Eclampsia	R			to HGR			
Haemorrhage	R			to HGR			
Septicemia	R						
Caesarean section	R	0	2				
Family planning	N						
Abortion complications	R			no cases			
Still birth							
Early neonatal death			1	age 2 days			

Bigo							
Examination	*Y/N/R*	*February*	*March*	*Action*	*Price*		
Antenatal	Y			Fefol, Fansidar,Vermox,	250FC	VISIT	
1st visit		64	87				
repeat visit		186	121				
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	R	few	few	HGR			
d) Haemoglobin	R			HGR			
e) Syphilis	R			HGR			
f)Other STI	Y	7	12	metronidazole,erythromycin,CTX	6USD		
Normal delivery	Y	6	8				**14**
Care of newborn							
a)resuscitation	Y						
b)treatment infection	Y						
Severe anaemia	R						
Eclampsia	R						
Haemorrhage	Y			no cases			
Septicaemia	Y			no cases			
Caesarean section	R	0	0				
Family planning	N						
Abortion complications	Y	2	7				
Still birth							
Early neonatal death							

Bunia Cite							
Examination	*Y/N/R*	*February*	*March*	*Action*	*Price*		
Antenatal	Y			Fansidar, Fefol, Vermox, VAT			
1st visit		47	74		500FC		
repeat visit		161	129		150FC		
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	Y			voluntary			
d) Haemoglobin	Y			voluntary			
e) Syphilis	Y			voluntary			
f)Other STI	Y			ceftriaxone, erythromycin			
Normal delivery	Y	62	65		4700FC		**127**
Care of newborn							
a)resuscitation	Y	1	2				
b)treatment infection	Y	1	2	amoxycillin, ampicillin,gentamycin			
Severe anaemia	R						
Eclampsia	R						
Haemorrhage	Y		2				
Septicaemia	Y			amoxycillin			
Caesarean section	R	3	9				
Family planning	N						
Abortion complications	Y		2				
Still birth							
Early neonatal death		1	2				

Bora Uzima							
Examination	*Y/N/R*	*February*	*March*	*Action*	*Price*		
Antenatal	Y			Fansidar, Fefol, Vermox,VAT	500FC	FICHE	
1st visit		29	47				
repeat visit		70	63				
a) weight	Y	all	all				
b)BP	Y						
c) urine	Y			new cases: sed., proteins, glucose	200FC		
d) Haemoglobin	Y			new cases	200FC		
e) Syphilis	Y						
f)Other STI	Y			Benzathin Penicillin 2.4MU/wx4	500FC		
Normal delivery	Y	32	46		1500FC		**78**
Care of newborn							
a)resuscitation	Y	1	2	mouth-to-mouth,			
b)treatment infection	Y	0	0	ampicillin, gentamycin		50 or 400 FC/vial	
Severe anaemia	N			HGR			
Eclampsia	R	1		HGR			
Haemorrhage	Y	0	2	erythromycin, oxytocin	100FC	per vial oxytocin	
Septicaemia	R						
Caesarean section	R	2	2				
Family planning	N						
Abortion complications	R	0	1				
Still birth							
Early neonatal death			1				

Clinique Bomoi							
Examination	*Y/N/R*	*February*	*March*	*Action*	*Price*		
Antenatal	Y			Fefol, Fansidar,Vermox,	600FC	FICHE	
1st visit		21	23		15USD	3X echography	
repeat visit			44				
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	Y	all	all	sediment, proteins	0	treatment to be paid	
d) Haemoglobin	Y	all			0		
e) Syphilis	N			unless suspect +ve			
f)Other STI	Y			syndromic			
Normal delivery	Y	17	27				**44**
Care of newborn							
a)resuscitation	Y	5	7	bicarbonate, glucose 50%, Ambu			
b)treatment infection	Y	0	0				
Severe anaemia	Y	0	0				
Eclampsia	Y	0					
Haemorrhage	Y	1	0	placenta retention (referred)			
Septicaemia	Y	0	0				
Caesarean section	Y	1	2	also referred 2 cases	80USD		
Family planning							
Abortion complications	Y	2	0				
Still birth							
Early neonatal death			2				

Centrale							
Examination	*Y/N/R*	*February*	*March*	*Action*	*Price*		
Antenatal	Y						
1st visit		24	37				
repeat visit		45	49				
a) weight	Y	all	all				
b)BP	Y						
c) urine	Y			sediment	100FC		
d) Haemoglobin	Y				100FC		
e) Syphilis	N						
f)Other STI	N						
Normal delivery	Y	26	31				**57**
Care of newborn							
a)resuscitation	Y			Mouth-to-mouth,			
b)treatment infection	Y			gentamycin, ampicillin	100FC		
Severe anaemia	N						
Eclampsia	N						
Haemorrhage	Y			folic acid, Fe, RL IV, oxytocics	750FC		
Septicaemia	N						
Caesarean section	N						
Family planning	Y			oral contraceptives, condoms, Depo Provera			
Abortion complications	N						
Still birth							
Early neonatal death							

Clinique Davenport							
Examination	*Y/N/R*	*February*	*March*	*Action*	*Price*		
Antenatal	Y			at risk pregnancies: F5 M3	600FC		
1st visit		5	7				
repeat visit		19	21				
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	Y			only if paying	300FC		
d) Haemoglobin	Y			only if paying	300FC		
e) Syphilis	Y			only if paying	1800FC		
f)Other STI	Y			syndromic, HIV	0		
Normal delivery	Y	11	22		8USD		**33**
Care of newborn							
a)resuscitation	Y	1	1	Ambu, canule de Guedel			
b)treatment infection	Y	0		ampicillin, gentamycin, quinine			
Severe anaemia	Y	0		transfusion	5USD		
Eclampsia	Y	0		MgSulfate			
Haemorrhage	Y	0					
Septicaemia	Y						
Caesarean section	Y			no figures			
Family planning	N						
Abortion complications	Y	0					
Still birth							
Early neonatal death	Y		1	died after 24 hours			

Kindia							
Examination	*Y/N/R*	*February*	*March*	*Action*	*Price*		
Antenatal	Y			Fansidar, Fefol, Vermox,VAT	300FC		
1st visit		5	5				
repeat visit		24	31				
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	N			no reagents			
d) Haemoglobin	Y			only if paying	200FC		
e) Syphilis	N						
f)Other STI	Y	3	0	Benzathine Peni 2.4MU/wk x4	300FC	VIAL	
Normal delivery	Y	11	5		1500FC		**16**
Care of newborn							
a)resuscitation	Y	0	0				
b)treatment infection	Y	0		gentamycin			
Severe anaemia	R						
Eclampsia	R						
Haemorrhage	R						
Septicaemia	Y			no cases			
Caesarean section	R						
Family planning	N						
Abortion complications	R						
Still birth							
Early neonatal death							

Mwito							
Examination	*Y/N/R*	*February*	*March*	*Action*	*Price*		
Antenatal	Y			Fefol, Fansidar,	300FC	FICHE	
1st visit		35	42				
repeat visit		91	95				
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	Y				100FC	stool=100FC as well	
d) Haemoglobin	Y						
e) Syphilis	N						
f)Other STI	N			amoxycillin			
Normal delivery	Y	19	19		1500FC		**38**
Care of newborn							
a)resuscitation	Y	0	0	Mouth-to-mouth,			
b)treatment infection	Y			amoxycillin, ampicillin,quinine	1USD	quinine 2USD	
Severe anaemia	R	1					
Eclampsia	N						
Haemorrhage	Y			oxytocics			
Septicaemia	N						
Caesarean section	N						
Family planning	N			only natural methods			
Abortion complications	R						
Still birth							
Early neonatal death							

Nyakasanza							
Examination	*Y/N/R*	*February*	*March*	*Action*	*Price*		
Antenatal	Y			Fansidar, Fefol, VAT	300FC	FICHE	
1st visit		50	17				
repeat visit		60	65				
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	N			no laboratory			
d) Haemoglobin	N						
e) Syphilis	N						
f)Other STI	Y			Procain Peni and amoxycillin	750FC	treatment of couple	
Normal delivery	Y	17	23				**40**
Care of newborn							
a)resuscitation	Y						
b)treatment infection	Y	0	0	ampicillin and gentamycin			
Severe anaemia	R	0	1				
Eclampsia	R	0	0				
Haemorrhage	R	0	1				
Septicaemia	R						
Caesarean section	R	0	1				
Family planning	N						
Abortion complications	R						
Still birth		1		from outside health area			
Early neonatal death							

Nzere							
Examination	*Y/N/R*	*February*	*March*	*Action*	*Price*		
Antenatal	Y			Fansidar, Fefol, Vermox, VAT	100FC		
1st visit		3	7				
repeat visit		7	8				
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	N			no laboratory			
d) Haemoglobin	N						
e) Syphilis	N						
f)Other STI	N						
Normal delivery	Y	6	11		1500FC		**17**
Care of newborn							
a)resuscitation	Y			Mouth-to-mouth,			
b)treatment infection	R						
Severe anaemia	R						
Eclampsia	R						
Haemorrhage	R						
Septicaemia	R						
Caesarean section	R	2	2				
Family planning	N			no products			
Abortion complications	R						
Still birth							
Early neonatal death							
1 maternal death in February reported in a nearby HC (Bembei) 7km from Bunia							

Simbiliyabo							
Examination	*Y/N/R*	*February*	*March*	*Action*	*Price*		
Antenatal	Y			Fansidar, Fefol, mebendazole	300FC	FICHE	
1st visit		7	10		150FC	medicine	
repeat visit		26	15	Detected 1 high risk pregnancy F			
a) weight	Y	all	all				
b)BP	Y	all	all				
c) urine	N			no microscope			
d) Haemoglobin	N						
e) Syphilis	N						
f)Other STI	N			no cases, HIV testing Y			
Normal delivery	Y	17	4				**21**
Care of newborn							
a)resuscitation	Y			Mouth-to-mouth,			
b)treatment infection	Y	0	0	ampicillin IM (buy on prescription)			
Severe anaemia	R						
Eclampsia	R						
Haemorrhage	R			ergometrin if moderate	150FC	VIAL	
Septicaemia	R						
Caesarean section	R	0	2				
Family planning	Y	3	2	Depo-Provera	150FC		
Abortion complications	R						
Still birth							**609**
Early neonatal death							

Nyankunde CME Bunia								
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal	Y			SP, Mebendazole, Fefol	20USD	5-7min		
1st visit		30	28				cost includes ANC and NVD	
repeat visit		59	49					
a) weight	Y	al	all					
b)BP	Y	all	all					
c) urine	Y	all	all					
d) Haemoglobin	Y	all	all		0.6 USD			
e) Syphilis	Y			if required	4USD			
f)Other STI	Y			HIV if indicated	5USD			
Normal delivery	Y			see hospital files				
Care of newborn								
a)resuscitation	Y			Ambu Bag				
b)treatment infection	Y			Ampicillin & Gentamycin			not included in 20USD	
Severe anaemia	Y			transfusion	10USD			
Eclampsia	Y			aldomet				
Haemorrhage	Y			oxytocics, IV fluids, blood	10USD			
Septicaemia	Y			ampicillin, gentamycin, flagyl				
Caesarean section	Y				60USD			
Family planning	Y			only education				
Abortion complications	Y	1						
Still birth		0						
Early neonatal death		0						
1 maternal death cause severe anaemia in May								

Adventist								
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal	Y			Fefol, SP, Mebendazole	1USD	15 minutes	FICHE	
1st visit		9	12					
repeat visit		17	23					
a) weight	Y							
b)BP	Y							
c) urine	Y				0.5USD		GE0.5USD	
d) Haemoglobin	Y				0.5USD			
e) Syphilis	Y							
f)Other STI	N			only if required				
Normal delivery	Y	6	5		1500FC			**11**
Care of newborn								
a)resuscitation	Y	0	0	Mouth-to-mouth, hydrocortisone,			also alcohol on thorax	
b)treatment infection	N							
Severe anaemia	N			HGR				
Eclampsia	N							
Haemorrhage	N			HGR				
Septicaemia	N							
Caesarean section	N							
Family planning	Y			education, condoms, prescription				
Abortion complications	N							
Still birth		0						
Early neonatal death		1						

Bankoko								
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal	Y				500FC	5min		
1st visit		22	22	Mebendazole, SP, Fefol	FREE			
repeat visit		52	55					
a) weight	Y	all	all					
b)BP	Y	all	all					
c) urine	N							
d) Haemoglobin	N							
e) Syphilis	N							
f)Other STI	N							
Normal delivery	Y	12	8		1500FC			**20**
Care of newborn								
a)resuscitation	Y			Mouth-to-mouth,				
b)treatment infection	Y	0	0	ampicillin & Gentamycin	1000FC		to buy drugs in town centre	
Severe anaemia	N							
Eclampsia	R							
Haemorrhage	Y			ergometrin, RL IV				
Septicaemia	R							
Caesarean section	N							
Family planning	Y			only education				
Abortion complications	N							
Still birth		0	0					
Early neonatal death								

Bigo								
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal	Y			Fefol, SP, Mebendazole	300FC		FICHE	
1st visit		146	112		250 FC	10-12 min	price per consultation	
repeat visit		307	294		150FC		price of medicine	
a) weight	Y							
b)BP	Y							
c) urine	Y							
d) Haemoglobin	R			to HGR (near)				
e) Syphilis	Y	4	5	if complaints				
f)Other STI	Y			all since February HIV				
Normal delivery		0	4					**4**
Care of newborn				umbilical dressing				
a)resuscitation	R							
b)treatment infection	R							
Severe anaemia	R							
Eclampsia	R							
Haemorrhage	R							
Septicaemia	R							
Caesarean section	R							
Family planning	Y			only education				
Abortion complications	R							
Still birth								
Early neonatal death								

Bunia Cite								
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal	Y							
1st visit								
repeat visit								
a) weight	Y							
b)BP	Y							
c) urine	Y	al	all					
d) Haemoglobin	Y	al	all					
e) Syphilis	Y			if needed	3USD			
f)Other STI	Y			HIV	0			
Normal delivery	Y	72	59		4800FC			**131**
Care of newborn								
a)resuscitation	Y			suction, mouth-to-mouth				
b)treatment infection	Y			ampicillin, gentamycin	2000FC			
Severe anaemia	R			HGR				
Eclampsia	R							
Haemorrhage	Y			oxytocics, IV fluids,	3000FC		NaCl or glucose 5%	
Septicaemia	R							
Caesarean section	R							
Family planning	N			education				
Abortion complications	R							
Still birth		2		macerated				
Early neonatal death								

Bora Uzima								
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal	Y			Fefol, SP, Mebendazole	450FC		150FC/visit	
1st visit		34	38					
repeat visit		37	38					
a) weight	Y	all	all					
b)BP	Y	all	all					
c) urine	Y	all	all					
d) Haemoglobin	Y	all	all		400FC		price for routine lab.tests	
e) Syphilis	Y			if needed	3.5USD			
f)Other STI	N			no tests available				
Normal delivery	Y	34	27		1500FC			**61**
Care of newborn								
a)resuscitation	R							
b)treatment infection	Y			ampicillin & Gentamycin	5USD		drugs bought in town	
Severe anaemia	R							
Eclampsia	R							
Haemorrhage	Y			oxytocics	0			
Septicaemia	R							
Caesarean section	R							
Family planning	Y			only education				
Abortion complications	R							
Still birth		0						
Early neonatal death		0						

Centrale (Soleniama)	RURAL							
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal	Y			Fefol, SP, Mebendazole	200FC		FICHE	
1st visit		33	44			30 min		
repeat visit		48	43		200FC	10min	monthly for drugs	
a) weight	Y	all	all					
b)BP	Y	all	all					
c) urine	Y	all	all					
d) Haemoglobin	Y	all	all		400FC		single price all tests	
e) Syphilis	N							
f)Other STI	N							
Normal delivery	Y	42	51		1500FC		add 400FC for paperwork	
Care of newborn								**93**
a)resuscitation	Y			Mouth-to-mouth,				
b)treatment infection	Y			ampicillin & Gentamycin	1USD			
Severe anaemia	Y			refer if <6gmHb				
Eclampsia	R		1	refer				
Haemorrhage	Y			oxytocics and refer	150FC			
Septicaemia	R							
Caesarean section	R							
Family planning	R			education on natural methods				
Abortion complications	R							
Still birth							1stillbirth in January	
Early neonatal death		2						
There have been 3 maternal deaths (when?) in area, delivered by "matrones" cause unknown								

Clinique Bomoi								
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal	Y			Fefol, SP, Mebendazole	1USD		FICHE	
1st visit		47	29			30 min		
repeat visit		66	80			15 minutes		
a) weight	Y							
b)BP	Y							
c) urine	Y			proteins, sediment, vaginal smear				
d) Haemoglobin	Y							
e) Syphilis	N							
f)Other STI	Y			HIV on request				
Normal delivery	Y	29	27		25USD			
Care of newborn								**56**
a)resuscitation	Y			Mouth-to-mouth, bicarbonate, glucose				
b)treatment infection	Y			non cases				
Severe anaemia	Y			Fefol, transfusion if needed				
Eclampsia	R							
Haemorrhage	Y			no cases				
Septicaemia	Y			no cases				
Caesarean section	Y	4	2		80USD			
Family planning	Y			education				
Abortion complications	Y	3	2		25USD			
Still birth							1SB in june	
Early neonatal death								

Kindia								
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal				Fefol, SP, Mebendazole	400FC		FICHE	
1st visit		8	4				drugs free of charge	
repeat visit		32	28					
a) weight	Y							
b)BP	Y							
c) urine	N							
d) Haemoglobin	N				300FC		all tests except stool	
e) Syphilis	N							
f)Other STI	N							
Normal delivery	Y	6	9		1500FC			**15**
Care of newborn								
a)resuscitation	Y			Mouth-to-mouth,				
b)treatment infection	Y			Peni G & Gentamycin	1.5USD			
Severe anaemia	R							
Eclampsia	R							
Haemorrhage	R							
Septicaemia	R							
Caesarean section	R							
Family planning	Y			education, condoms,				
Abortion complications	R							
Still birth		1						
Early neonatal death								

Lembabo								
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal	Y			Fefol, SP, Mebendazole	200FC		FICHE	
1st visit		49	57		50FC			
repeat visit		58	73					
a) weight	Y							
b)BP	Y							
c) urine	N							
d) Haemoglobin	N							
e) Syphilis	N							
f)Other STI	N							
Normal delivery	Y	24	37		1500FC		add 400FC for paperwork	
Care of newborn								**61**
a)resuscitation	N							
b)treatment infection	Y			ampicillin prescription				
Severe anaemia	R				10USD		cost of ambulance	
Eclampsia	R							
Haemorrhage	R			IV fluids available, oxytocics				
Septicaemia	R							
Caesarean section	R							
Family planning	N			needs training first				
Abortion complications	N							
Still birth								
Early neonatal death								

Mwito	RURAL							
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal	Y			Fefol, SP, Mebendazole	300FC		FICHE	
1st visit		57	59			10min	drugs are free	
repeat visit		136	125		100FC		consultation, average 3x	
a) weight	Y							
b)BP	Y							
c) urine	Y							
d) Haemoglobin	Y				300FC		for all tests	
e) Syphilis	N							
f)Other STI	N							
Normal delivery	Y	25	23	ergometrin all women	1500FC			
Care of newborn								
a)resuscitation	Y			Mouth-to-mouth,				**58**
b)treatment infection	Y			ampicillin or amoxycillin syrup				
Severe anaemia	N			no case, prevention				
Eclampsia	N							
Haemorrhage	Y			oxytocics and referral				
Septicaemia	N			no cases				
Caesarean section	R							
Family planning	N							
Abortion complications	N							
Still birth		1	1					
Early neonatal death								

Mudzi Pela								
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal	Y			Fefol, SP, Mebendazole	600FC		FICHE	
1st visit		75	91		300FC	5-10min	drugs	
repeat visit		31	57					
a) weight	Y	all	all					
b)BP	Y							
c) urine	Y	all	all		300FC		1 or 2 checks	
d) Haemoglobin	Y			if required				
e) Syphilis	N			no reagents, refer				
f)Other STI	N							
Normal delivery	Y	18	13		4000FC			**31**
Care of newborn								
a)resuscitation	N			Refer for delivery if foetal distress				
b)treatment infection	N							
Severe anaemia	N							
Eclampsia	R							
Haemorrhage	Y			uterus revision and oxytocics	150FC			
Septicaemia	R							
Caesarean section	R							
Family planning	N			education on natural methods				
Abortion complications	R							
Still birth								
Early neonatal death								
1 maternal death in January reported from nearby private HC (Sauvetage)								

Nyakasanza								
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal	Y			Fefol, SP, Mebendazole	200FC		per consultation	
1st visit		17	30			7-10min		
repeat visit		39	40			5min		
a) weight	Y							
b)BP	Y							
c) urine	N							
d) Haemoglobin	N							
e) Syphilis	N							
f)Other STI	N							
Normal delivery	Y	13	9					**22**
Care of newborn								
a)resuscitation	Y			Mouth-to-mouth,				
b)treatment infection								
Severe anaemia	R							
Eclampsia	R							
Haemorrhage	Y			oxytocics				
Septicaemia	R							
Caesarean section	R							
Family planning	Y			education on natural methods				
Abortion complications	R							
Still birth								
Early neonatal death								

Nzere	RURAL							
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal	Y			Fefol, SP, Mebendazole	100FC		FICHE	
1st visit		8	4		120FC		each consultation	
repeat visit		10	19					
a) weight	Y							
b)BP	Y							
c) urine	N			no strips				
d) Haemoglobin	N			no equipment				
e) Syphilis	N							
f)Other STI	N							
Normal delivery	Y	11	8		1500FC		add 300FC for paperwork	
Care of newborn								**19**
a)resuscitation	N			no cases				
b)treatment infection	N							
Severe anaemia	R							
Eclampsia	N							
Haemorrhage	Y			ergometrin and referral	100FC		only if VIALS	
Septicaemia	N							
Caesarean section	N							
Family planning	N			education on natural methods				
Abortion complications	N							
Still birth								
Early neonatal death								

Rwankole								
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal	Y			Fefol, SP, Mebendazole	500FC		FICHE	
1st visit		40	47			15-20min		
repeat visit		98	93			5-10min		
a) weight	Y	all						
b)BP	Y	all						
c) urine	Y	all			350FC			
d) Haemoglobin	Y	all			350FC			
e) Syphilis	Y	all			3USD			
f)Other STI	N			if necessary	3USD		for HIV test	
Normal delivery	Y	34	26		1500FC			
Care of newborn								
a)resuscitation	Y			ambu Bag,dextrose 50%. hot water bottle, blanket				
b)treatment infection	Y			ampicillin & Gentamycin				
Severe anaemia	Y			transfusion and Fe x 3 months	3USD		50FC for Fe	
Eclampsia	Y		1	Aldomet				
Haemorrhage	N			no cases?				
Septicaemia	N							
Caesarean section	Y	9	3		20USD		only daytime C/S	
Family planning				education, tubal ligation (2)				
Abortion complications	Y	3	3					
Still birth		1						
Early neonatal death		0						

Sayo	**(Clinique Davenport)**							
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal	Y			Fefol, SP, Mebendazole	300FC		FICHE	
1st visit		10	4			10min		
repeat visit		18	13		150FC		drugs	
a) weight	Y							
b)BP	Y							
c) urine	Y							
d) Haemoglobin	Y				200FC		routine lab tests	
e) Syphilis	Y				0			
f)Other STI	Y			HIV	0			
Normal delivery	Y	16	8		1500FC			**24**
Care of newborn								
a)resuscitation	Y			ambu Bag				
b)treatment infection	Y			rare				
Severe anaemia	R							
Eclampsia	R							
Haemorrhage	R							
Septicaemia	R							
Caesarean section	Y	3	0		10USD			
Family planning	Y			education, condoms, refer for implant, oral contraception				
Abortion complications	Y			no cases				
Still birth								
Early neonatal death								

Simbiliyabo								
Examination	*Y/N/R*	*April*	*May*	*Action*	*Price*	*Time/case*		
Antenatal	Y			Fefol, SP, Mebendazole	300FC		FICHE	
1st visit		9	15		200FC		drugs	
repeat visit		19	16		100FC		consultation	
a) weight	Y							
b)BP	Y							
c) urine	N			refer if other tests needed				
d) Haemoglobin	N							
e) Syphilis	N							
f)Other STI	N							
Normal delivery	Y	12	14	1 retained placenta referred	1500FC			**26**
Care of newborn								
a)resuscitation	Y			Mouth-to-mouth,				
b)treatment infection	Y			gentamycin				
Severe anaemia	R			10USD for referral				
Eclampsia	R							
Haemorrhage	R	1		IV RL, ergometrin and refer				
Septicaemia	R							
Caesarean section	R							
Family planning	Y			education, condoms, DepoProvera and oral contraceptives				
Abortion complications	N							
Still birth		1		macerated				
Early neonatal death								

MSF							
247 beds (not including 6 isolation which are not in use at the moment) Gynecology 16 beds Obstetrics 28 beds + 6 waiting (labour)							
Intervention	*December*	*January*	*February*	*March*	*April*	*May*	Total
Cesarean	43	43	57	73	61	73	350
D&C	21	21	21	16	24	34	
Hysterectomy	0	2	1	1	2	2	8
Major operations	5	1	5	5	6	13	35
Maternal Deaths	1	0	0	1	1	3	
Causes	Kaposi Sarcoma			Ruptured uterus	Prolonged labour and septic shock (child alive)	Prolonged labour, VVF, hysterectomy	
						Prolonged labour and septic shock (still birth)	
						Prolonged labour, intra-uterine death and septic shock	
Admissions		Jan	Feb	March	April	May	
		927	871	864	840,	1018	
Laboratory procedures: total 12480 Jan-March							

HGR							
Intervention	*December*	*January*	*February*	*March*	*April*	*May*	
Cesarean			9	6	7	5	27
D&C			6	5	2	5	
Hysterectomy							
Major operations	41	18	16	26	12	21	134
Maternal Deaths	not reported						
CME							
Intervention	*December*	*January*	*February*	*March*	*April*	*May*	
Cesarean	2	4	6	6	6	3	27
D&C	0	3	2	4	4	2	15
Hysterectomy							
Major operations	34	24	19	33	33	43	186
Maternal Deaths						1	
Causes						Hemorrhage and severe anemia (atonic uterus)	

Rwankole							
Intervention	*December*	*January*	*February*	*March*	*April*	*May*	Total
Cesarean	No record	No record	6	3	9	3	21
D&C	No record	No record	3	0	0	3	6
Hysterectomy	No record	No record					
Major operations	No record	No record					
Maternal Deaths	0	0	0	0	0	0	0

ANNEX 13: Bridewealth

Ethnic Group	Focus Group	USD conversion		Other	Notes
		min	max		
Hema	USB	1080	2560		Sometimes one cow will be returned after formal marriage
	Unemployed w	930	2180		Lowest estimate for uneducated girl
	widows	1650	2220		
Hema N	Unemployed m	1545	2070		
	ISPASC w	As above	As above		
Hema S		1440	1920		Part return of dowry when first child has first tooth
Ngiti (Lendu Bindi)	USB	830	1470		
	ISPASC m	655	890	Add blanket, clothes and spear	
Lubgara	USB	960	1280		
	ISPASC w	740	1640	Add clothes and agricultural tools	Level of education is important
Logo	ISPASC w	1295	1850	Add clothes	No payment if pregnant until after delivery
Lese	Widows	varies	varies	Add clothes, hoe and machete	Price expressed in goats
Kakwa	Widows	600	800		
Bira	Widows	465	630		
	ISPASC w	As above	As above	Add clothes	
	ISPASC m	As above	As above		
	Catholic m	585	790	Add clothes	
Nande	ISPASC m	350	600	Add clothes	Price expressed in goats
Lega		420	600		Maniema
Nyanga		465	630		North Kivu
Alur	Catholic w			3 goats, clothes, agricultural tools	Pre-payment for sex before marriage
	Unemployed w	465	630		
	ISPASC w	945	1630	Add clothes	
	ISPASC m	605	830	Add clothes and hoe	
	Widows	640	880	Add hoe	
Budu	Unemployed w	varies	varies		Haut Uele Price in palm oil drums
	Unemployed m	245	600	Prepayment of chickens, goat, cigarettes, bananas. Add alcohol and mbombolia to dowry	
	Muslims*	100	1000		

*Muslims expressed value in USD only. No mention of ethnic differences.

Payment for first marriage of a woman who has not had any children

ANNEX 14

QUESTIONNAIRE

I. Identification

1. Date of interview

2. Date of delivery

3. Case control proxy

4. Identification number

5. Name

6. Place of origin (if different from residency)

7. Groupement

8. Current address

9. Who are you living with now?

Alone With my partner/ husband With my family (partner /no husband)

10. How old are you?

II. About this pregnancy

11. During this pregnancy, did you have any of the following? (tick all applicable boxes)

A Fever B. Bleeding C. Hypertension

D. I did not have any problem

12. If yes for fever, when did it happen? (multiple answers possible)

A. Beginning of pregnancy B. Mid-pregnancy C. Late pregnancy

D. More than once E. I can't remember

13. What did you do about it? (multiple answers possible)

A. Nothing B. I was treated by a traditional healer C. I went to the health centre

D. I received medicine at the health centre E. I bought medicine (market, shop..)

F. I received medicine from a friend/relative G. Something else (explain)

14. What was the result of you action?

A. I got better B. I got worse C. No change

15. If YES for bleeding, when did it happen?

A. Early in pregnancy B. Mid-pregnancy C. Late in pregnancy

D. Several times E. I can't remember

16. What did you do about it? (multiple answers possible)

A. Nothing B. I went to the health centre C. I went to the hospital

D. A traditional healer treated me E. I bought medicine (market, shop..)

F. I asked a friend/relative for advice G. Something else (explain)

17. What was the result of you action?

A. The bleeding stopped B. The bleeding got worse C. There was no change

18. If YES to hypertension, when did it start?

A. Before this pregnancy B. Early in pregnancy C. In the middle of pregnancy

D. At the end of pregnancy E. I don't know

19. What did you do about it?

A. No action B. I went to the health centre C. I went to a hospital

D. I was given medicine at the health centre/hospital

E. I took medicine bought at a shop/market F. I asked the advice of a friend/relative

G. I was treated by a traditional healer H. I saw a community health worker

I. I did something else (elaborate)

20. What was the result of your action?

A. Condition improved B. It got worse C. No difference

21. During this pregnancy, where you vaccinated against tetanus? Yes/No/I don't know

22. If yes, how many injections did you receive?

23. During this pregnancy did you have any laboratory tests? Yes/No

24. If YES, which kind of tests did you have?

A. Blood B. Urine C. Stool D. Other

25. Do you know why these tests were done? (please explain)

26. If you had a urine test, did you have proteinuria? Yes/No/I'm not sure

27. Do you know the results of the tests?

If YES, verify record (CPN card)

28. Did you receive treatment after the test(s)? Yes/No

29. During this pregnancy, did you have any other problem (s)? Yes/No

30. If YES, did you have any of the following?

A. Weight loss (more than 5kg, check record)

B. Abnormal vaginal discharge

C. Cough (more than 2 weeks)

D. Pain when passing urine

E. Convulsions (describe)

If any other complaints, specify

31. Did you take any treatment? Yes/No

32. If YES, did you improve?

33. If NO, did you improve?

III. About previous pregnancies

34. How many times have you been pregnant? (include this pregnancy)

35. How many children have you delivered?

36. How many of your children are alive today?

37. Have you delivered any stillbirths? (a child that never breathed after delivery)

38. If YES, how many?

39. Do you know the reason?

40. Did you have any caesarean sections before? (exclude this delivery)

41. If YES, after which pregnancy (-cies)? 41. (b) which pregnancy? 41. (c) which pregnancy?

41. (d) which pregnancy? 41. (e) which pregnancy?

42. Do you know why the operation was done? (explain)

43. Did you have prolonged labour for a previous delivery?

IV. About this delivery

44. Date and time of delivery

45. Where were you when labour started?

A. At home B. At the hospital C. At the health centre D. At the waiting mother's shelter

E. Somewhere else (specify)

46. Where did you deliver?

A. At my home B. At the hospital C. At the health centre D. Elsewhere (specify)

47. Why did you deliver there?

A. It is the nearest place B. I prefer to go there C. I followed the advice of a health worker

D. I followed the advice of someone else E. I had no other choice

F. Another reason (explain)

48. How long was your labour? (hours)

If the woman does not know the answer in hours

49. Did labour take more than the time between sunrise and sunset? (=12 hours)

A. Not as long B. Longer

50. How did you deliver?

A. Normal vaginal delivery without intervention B. Vaginal delivery with episiotomy

C. Vaginal delivery with vacuum extraction D. Vaginal delivery with symphysiotomy

E. By caesarean section F. Vaginal delivery with forceps

G. Vaginal delivery with oxytocin infusion H. If other, explain

51. For cases (caesarean) can you explain why you had the operation? Yes/No

If yes, please explain:

Indication from register

52. What was the condition of the child after birth?

A. Alive and in good condition B. Alive and not in good condition C. Not alive

V. About the time after delivery

53. How is your condition at present?

A. In good health B. I am ill C. I am not well but getting better

If B. or C. please explain

54. After delivery did you have severe bleeding? Yes/No

55. If YES, what did you do?

A. I asked a health worker for advice B. I took medicine bought at the market/shop

C. I was treated at a health centre D. I was treated at a hospital

E. I had a transfusion F. I did nothing G. I did something else (explain)

56. After delivery did you have fever?

57. If YES what did you do?

A. I asked a health worker what to do B. I took medicine which I bought (market/shop)

C. I was treated at health centre D. I was treated at hospital

E. I did nothing F. I did something else (explain)

VI. Economic information

58. Did you have to travel to the place where you delivered? Yes/No

If the answer is YES

59. How much time did you take to get there?

60. How many km did you travel?

61. How did you get to the place where you delivered?

A. Walking B. By public transport (explain) C. By private transport (specify)

62. How much did you pay to get to the hospital? (local money)

63. How much are you paying for staying at the place where you delivered, including the cost of all treatment? (*for cases still in hospital make an estimate of cost not yet known)*

64. How much will you pay to go back home?

65. What is the monthly disposable income of your family or household?

65.(b) What is your monthly disposable income?

66. For CASES only: did you need consent form someone else before operation? Yes/No

67. If YES, did this procedure delay the operation? Yes/No

At the end of the interview, the interviewer thanks the woman and gives her a contact telephone number.