FACTORS AFFECTING THE LIKELIHOOD OF RECEIVING CESAREAN SECTION AMONG LOW AND HIGH SOCIO-ECONOMIC GROUPS IN PUBLIC HEALTH FACILITIES IN MALI

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ปัจจัยที่มีผลต่อการได้รับบริการผ่าท้องคลอดในกลุ่มหญิงตั้งครรภ์ที่มีเศรษฐสังคมต่ำและสูงในสถานบริการสาธารณสุขประเทศมาลี

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เบเรนนิสซอเรลดับเบิลยูแกนดาโฮ: ปัจจัยที่มีผลต่อโอกาสการได้รับบริการผ่าท้องคลอดในกลุ่มหญิงตั้งครรภ์ที่มีเศรษฐสังคมต่ำและสูงในสถานบริการสาธารณสุข ประเทศมาลี. (FACTORS AFFECTING THE LIKELIHOOD OF RECEIVING CESAREAN SECTION AMONG LOW AND HIGH SOCIO-ECONOMIC GROUP IN PUBLIC HEALTH FACILITIES IN MALI), อ. ที่ปรึกษาวิทยานิพนธ์หลัก : รศ.ดร.ไพฑูรย์ ไกรพรศักดิ์, 129 หน้า.

นโยบายการผ่าท้องคลอดฟรีของมาลีให้ผลประโยชน์สำหรับผู้หญิงที่มีฐานะร่ำรวยมากกว่าผู้มีฐานะยากจน ดังนั้นวัตถุประสงค์ของการศึกษานี้ เพื่อพิจารณาปัจจัยที่อาจมีที่มีผลต่อความเป็นไปได้ของการผ่าท้องคลอดของการเข้าร่วมการผ่าท้องคลอดในกลุ่มหญิงตั้งครรภ์ที่มีเศรษฐสังคมต่ำและสูงในสถานบริการสาธารณสุขในมาลี

การสำรวจ ณ จุดเวลาหนึ่ง จากการดำเนินงานของ USAID จากกุมภาพันธ์ ถึง กันยายน 2010 ถูกนำมาใช้เป็นข้อมูลทุติยภูมิ ในผู้หญิง 3,968 คนที่กำลังจะทำการคลอดในสถานบริการสาธารณสุขที่ถูกสุ่มมา 41 เพื่อเลือกสถานบริการสุขภาพถูกประเมินในเรื่องของเศรษฐสังคม, ประชากรศาสตร์ และปัจจัยที่ไม่ใช่ทางการแพทย์ที่มีผลกระทบต่อความเป็นไปได้ของการผ่าท้องคลอด โดยใช้แบบจำลองโพรบิตแบบไบโนเมียลและมัลติโนเมียลสำหรับคำนวณปัจจัยแรกที่มีผลกระทบต่ออัตราการผ่าท้องคลอดหลังจากนั้นพิจารณาความสัมพันธ์ระหว่างผลลัพธ์ตัวชี้วัดทางการแพทย์กับปัจจัยที่ไม่ใช่ทางการแพทย์ของหญิงตั้งครรภ์

อุบัติการณ์ของการผ่าท้องคลอด คือ 62.4% จากผู้ที่มีสิทธิเลือกผ่าท้องคลอด โดยส่วนใหญ่แล้วเป็นหญิงอายุ 25 ปีกับ 3 ความเท่าเทียมกัน คือ ไร้การศึกษา, ว่างงาน และที่ไม่ได้เป็นสมาชิกของครอบครัวที่รวย ส่วนใหญ่หญิงตั้งครรภ์ที่เดินทางมาด้วยตนเองด้วยการเดิน (31.5%) คลอดปกติ, 15.7% เดินทางมาด้วยตนเองโดยการนั่งแท็กซี่ มีสิทธิ์ในการเลือกผ่าท้องคลอด และทั้งหมดของผู้ที่ถูกนำส่งโรงพยาบาลด้วยรถพยาบาล (23.7%) มีการผ่าท้องคลอดฉุกเฉินยกเว้นมอพที อัตราส่วนที่สูงที่สุดของการผ่าท้องคลอดอยู่ในกลุ่มคนรวยเสียส่วนใหญ่ในบามาโคและไกดาล ภูมิภาค, อายุของแม่, อาชีพ และการศึกษา ไปจนถึงจำนวนสูตินรีแพทย์และวิธีการเข้ารับการรักษาคือปัจจัยที่มีผลกระทบต่อการผ่าท้องคลอด โดยที่ความเท่าเทียมกันและอาชีพของพ่อไม่มีผล คนยากจน (ว่างงาน, รับจ้าง, ไร้การศึกษาหรือการศึกษาต่ำ, ผู้หญิงจนหรือจนมาก)ชอบที่จะคลอดเองตามปกติหรือไม่ก็เป็นการผ่าท้องคลอดแบบฉุกเฉิน โดยเฉพาะอย่างยิ่งในเขตภาคเหนือ นอกจากนี้ความเป็นไปได้ของการผ่าท้องคลอดเพิ่มขึ้นอย่างต่อเนื่องหลังจากอายุ 25 ปี และการเพิ่มขึ้นของสูตินรีแพทย์ก็เช่นกัน เปรียบเทียบการส่งต่อหญิง การนำส่งเป็นการเปิดโอกาสให้มีการผ่าตัดคลอดและมีโอกาสน้อยของการคลอดเอง

สวัสดิการสังคมเบอร์จสันเป็นสิ่งจำเป็นของนโยบายที่ช่วยสนับสนุนความต้องการของผู้หญิงตั้งครรภ์เพื่อเป็นการส่งเสริมความต้องการสูงสุดสำหรับการเข้าถึงการบริการสาธารณสุขที่ดีกว่าของผู้หญิง การศึกษาของผู้หญิงและความปลอดภัยของการคลอดเป็ฯสิ่งที่สถานบริการสาธารณสุขควรจะสนับสนุน สำหรับผู้หญิงและปรับปรุงระบบส่งต่อแม่สามารถปรับปรุงสภาวะสุขภาพแม่และทารก โดยการจัดหาการเข้าร่วมการคลอดที่ดีกว่าและปลอดภัยกว่าสำหรับแม่

สาขาวิชา เศรษฐศาสตร์สาธารณสุขและการจัดการบริการสุขภาพ ลายมือชื่อนิสิต .....

ปีการศึกษา 2555 ลายมือชื่อ อ. ที่ปรึกษาวิทยานิพนธ์หลัก .....

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Mali free cesarean policy benefits more to the rich women than to the poor ones. Thus the purpose of the study is to determine the non-medical factors affecting the likelihood of receiving cesarean among low and high socio-economic groups in public health facilities in Mali; and to draw some recommendations which will favor more indigent women for a safe motherhood.

Data from a cross sectional survey by USAID funded program ATN plus conducted from February to September 2010 was used as secondary data. Three thousand nine hundred and sixty eight women delivering in forty one randomly selected health facilities were evaluated on their socio-economic, demographic and medical factors affecting the cesarean probability. A binomial probit and multinomial probit models were used to figure out first the factors affecting the C-section rate; then to determine the relationship between the medical and the non-medical factors of women.

The proportion of C-section is 62.4 % with a predominance of elective cesarean. Most of women were 25 years old with 3 parities, uneducated, unemployed and belonging to a rich household. The majority of women coming themselves by foot (31.5 %) delivered normally, 15.7 % arriving themselves by taxi had elective cesarean and those who were evacuated by ambulance (23.7 %) had emergency cesarean Except Mopti, the highest proportion of C-section was done among the rich group mainly in Bamako and Kidal. Region, mother age, occupation and education, quintile, number of obstetricians and admission mode are the factors affecting cesarean. The mother's parity and father's occupation do not matter. The indigent people (unemployed, self-employed, uneducated or low education, poor and poorest women) are either more likely to deliver normally or to have emergency cesarean, especially in the northern regions and benefit less from the free cesarean policy. Further, the cesarean probability increases steadily after the age of 25 years and with a rise of number of obstetricians in the facilities. Compare to the referred women, the evacuated ones are more exposed to emergency cesarean and have a lowest chance to deliver normally.

Bergson social welfare is needed through some policies to favor more the neediest women for a better access to health care services. Girls' education, and safe delivery in health facilities should be promoted. The amelioration of transportation system and maternal referral system can also improve delivery outcomes and provide a safer motherhood.

Field of Study: Health Economics and Health care Management Student's Signature….

Academic Year: 2012 ..... Advisor's Signature….

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First of all, I wouldliketothank the Almighty God forallhisblessings in my life.Iam thankful to him for his kindness and his infinite mercy upon myfamily. Guide me and enlighten me on my road. Keep my family in your peace and your love. And May your peace and joy flood the humanity.

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LIST OF ABBREVIATIONS

ATN plus	National Technical Assistance plus
ATR	In French :Accoucheusetraditionnellerecyclée In English: Trained birth attendant women
CDC	Centers for Disease Control and Prevention
CHU	Centre HospitalierUniversitaire (University Hospitals)
CPD	Cephalopelvic disproportion
CSCom	Centres de Santé Communautaire (CommunityHealthCenters)
C-section	Cesarean section
CSRef	Centres de Santé de Référence (ReferralHealthCenters)
DHS	Demographic and Health Survey
DHHS	Department of Health and Human Services USA
EPH	Etablissement Public Hospitalier (Public Hospital)
GDP	Gross Domestic Product
HMIS	Health Management Information System
MDG	Millennium Development Goals
MoH	Ministry of Health
MMR	Maternal Mortality Ratio
PR	Probability

Sd	Syndrome
SES	Socio-Economic Status
UNFPA	United Nations Population Fund
USAID	United States Agency for International Development
WB	World Bank
WHO	World Health Organization

CHAPTER I
INTRODUCTION

1.1. Introduction

Mali is a landlocked country in western Africa. It is bordered on the North by Algeria; on the East by Niger; Burkina Faso to the Southeast; Ivory Coast from the South; then Senegal and Mauritania are laid on the west. It became independent in 1960 and its first democratic presidential election was held in 1992. It has 14,517,176 of inhabitants and its size is over 1.240.192 square kilometers (Factbook, 2013). The three main cities are: the capital Bamako (1 million habitants), Segou (230,000 habitants) and Mopti (129,000 habitants). The others cities are Sikasso, Tombouctou, Kayes, Koulikoro, Gao and Kida (Annex A).

Mali is among the poorest country in the world with a predominant economic activity in the irrigated floodplain of the River of Niger. The country economics' structure is centered by fishing and agriculture. The annual population growth rate is increasing rapidly from 2.74 % in 2005 to 2.61% in 2011 and the real GDP growth was 2.74% in 2011.

Despite more than a decade of health sector reforms, Mali's maternal health indicators remain of concern. Maternal Mortality Ratio (MMR) is high with 464 maternal deaths per 100,000 live births (DHS, 2006), and the burden of maternal mortality is disproportionately clustered among the poor. The lifetime risk of dying in pregnancy in Mali is 1 over 15 compared to 1 over 2,800 in developed countries(WHO, USAID, UNFPA, & WB, 2007).According to the 2006 Demographic and Health Survey (DHS, 2006), less than half of women give birth in a health care facility. Therefore in order to improve the maternal and neonatal health status, the Mali government, since June 23, 2005; decides to provide free cesarean throughout all the country in the public health facilities such as public hospitals, referral health centers also known as CSRef (Centre de Santé de Reference) and army hospitals. It is being implemented in 57 health facilities with 59CSRef, 7 regional hospitals (Etablissements Publics Hospitaliers (EPH)) and 2 national university hospitals (CentresHospitaliersUniversitaires (CHU)).

A recent evaluation of that policy was made by USAID funded program ATN Plus (National Technical assistance plus) in 2010 (after 5 years of implementation). They found a cesarean rate disparity among the socio-economic status (SES) group. The C-section rate was smaller in the low SES group than the high one. So the rich people seem to benefit more from that policy. Therefore the study focuses on the factors affecting the likelihood of receiving cesarean among low and high socioeconomic groups, and draw some recommendation to ensure a better equity among the poorest.

1.2. Mali Background

1.2.1. Mali's context

The evaluation of the Mali demographic situation is quite difficult due to the lack of sufficient data at the national level.

The total fertility rate (number of children that the average woman has in her lifetime) was very high in 2011 (6.3 children per woman) with a very low but increasing contraceptive prevalence from 6.9 % in 2006 to 8 % in 2010 (Factbook). That fertility rate is characterized by a high level of births at young maternal ages with a peak around 25 – 29 years old and a medium age at first birth at 18.9 years old. In addition, a huge difference in fertility level exists among women with different socio-economic conditions. In rural areas, on average households have 7.3 children whereas in Bamako it is 4.9 children per household. Similarly, the woman fertility rate with secondary education or higher (4.1 children) is relatively less than women with primary education (6.6 children). Another concern is the adult literacy rate which is very low around 46 %. The male primary school enrollment rate is nearly 70 % whereas for the females it is only 56%. Further, more than 43.6 % of the population live below the poverty line (USAID, Unicef, WB, UNFPA, & Government, 2001)

Skilled birth attendance and life-saving obstetric procedures such as cesarean are considered critical interventions for safe motherhood, as they allow a timely response to potentially fatal emergencies. Inaccessible emergency obstetric care remains a major problem in Mali with just 7.7 percent of health care facilities offering basic emergency obstetric services – 0.68 centers per 500,000 populations, as opposed

to a norm of 4 (Paxton et al., 2006). With cesarean rates in 2005 below 1 percent of the population, there is a large unmet need for life-saving obstetric surgery in Mali. Progress towards meeting the Millennium Development Goals (MDG5) in Mali will require increased attention towards improving skilled birth attendance and access to life-saving obstetric procedures such as cesareans.

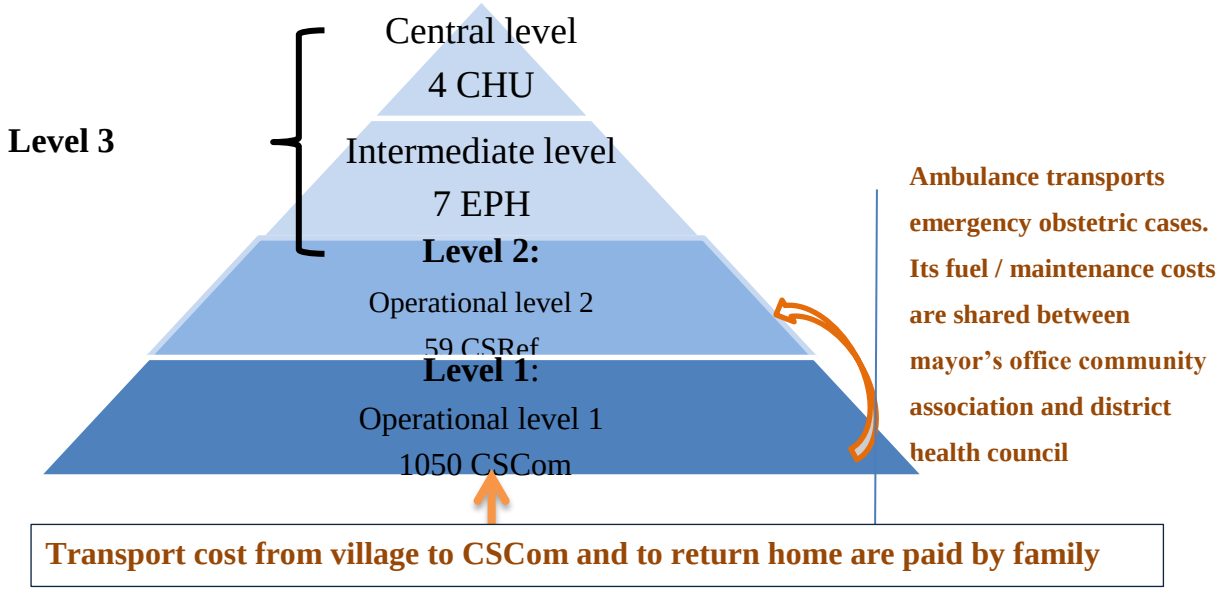
1.2.2. Mali referral system

The Mali health system has a pyramid structure with 3 levels: central, regional and local (Figure 1.1). At the base of the pyramid (1rst level), Mali has 1050 Community Health centers named in French "CSCom" (Centre de Santé Communautaire) in the outlying communities. At the second level or district level, 59 health districts with 59 Referral Health Centers named "CSRef" (Centre de Santé de Reference) are counted. And At the top of the pyramid, there are 8 administrative regions with and Bamako district. There are seven Regional Hospitals named 'EPH', and four National University Hospital (CHU) which are Point G, Gabriel Toure, IOTA and Kati hospitals and one maternal and child hospital which represent the most important referral level (USAID, CDC, & DHHS, 2012).

1.2.2.1 First level of Mali health pyramid

CSCom is a nonprofit private institution and constitute the first contact point with the patient. It is run by Community Health Association named "ASACO" and provides the basic preventive and curative services in maternal and child health. There are created since 1990 for a better cost recovery and community participation in the financing and management of health care. The ASACO strength is that they are the expression of people and they are autonomous from the central government. Further the cost of health care as the profit margins of the health centers are determined by the communities themselves based on their income. Its main challenge is the lack of ensuring good governance, high quality of health care and the deficiency in financial resources. 87% of the population of Mali live less than 15 Km from CSCom and 51 % within 5 Km (Falisse, 2012).

Figure 1. 1 Mali health pyramid (Mali SAMSS Site Visiting Team)



1.2.2.2 Second level of Mali health pyramid'

CSRef is a district hospital where the first referral system takes place. This referral system was first initiated in 1994 for obstetrical emergencies between different levels of health facilities. The CSRef has more technical support and more highly skilled personnel than the CSCom. It is created by the state and co-managed by the national and local government and by the community. Moreover the referral system uses its own fund to support staffing and operating costs and has 3 major components: providing essential obstetrical care, reducing financial barriers through solidarity funds and reducing the second delay through transportation and communication.

1.2.2.3 Third level of Mali health pyramid

Hospitals are the last resort for the patients especially for specialized interventions. There are managed by a director's board and supervised by MOH's special services directorate (Mullan, Diomande, Chen, & Cyprien, 2009)

1.2.3. Transportation and infrastructures challenges

The poor infrastructures, the long distance to health facilities with an expensive transportation cost, the lack of public transportation vehicles in some areas

and the poor availability of emergency vehicles hamper the quick access to maternal health services.

Even though all health sector vehicles are paid by the government, transportation to health facilities remains a big challenge. Each commune has drafted a document that outlines a standard transport procedure when a laboring woman at CSCom is in distress and requires referral care. But unfortunately, few of them have functional ambulances; therefore many patients rely on public transportation to access medical care. The public vans follow standard routes for 125 CFAF (US $ 0.30). However, they make many stops and often require passengers to make multiple transfers before arriving at the final destination. Those publics vans are also crowded and unsafe. Besides the public vans, chartering yellow taxis are more expensive ranging between 750 – 3000 CFAF (US $ 1.80 – 7.125) according to the distance and the daytime. These costs are beyond the means of many families in Mali. Therefore the distance to health care facilities and the need of transportation are considered as barriers to access health care services. Sometimes long delays (up to 10 hours) between the decision to evacuate and to arrive at the facilities have been highlighted as a significant contribution to the maternal mortality in certain hospitals (Women's DHS survey in 2006).

Moreover, some poor infrastructures and poor road condition have a negative effect on the access to health care due to many unpaved roads especially during the raining season. Sometimes heavy rains lead to flash floods and few roads have an adequate drainage system.

1.2.4. Free cesarean policy

Mali free cesarean policy concerns all Mali citizens and all non-foreigners' women living in Mali and delivering in Malian public health facilities (Bishnoi, 2011). Its aims are a life-saving emergency obstetric care and to make it accessible to all pregnant women with a cesarean delivery service. The implementation of the policy was driven by some reasons:

- Financial barriers to health care facilities due to medical fees: because of the high maternal care costs and to prevent catastrophic payment, less than 50 % of

women give birth in a health service. The poorest women who are less likely to afford C-section fees prefer to deliver at home with a traditional birth attendant.

- The desire to reduce the high maternal mortality ratio (MMR) by producing safe motherhood services (providing skilled birth attendance and easy access to live-saving obstetric procedures) to its populations.
- Improve equity especially among the poorest group to a better accessibility to health care facility during the pregnancy and the delivery period.
- The initiative has received so much support both inside and outside the country with high expectation of positive effect in the declining of MMR and ensuring a better equity among the low income population.

- **Which benefit package is included in the free cesarean policy**

The policy covers all direct institutional costs of C-sections. Those costs are reimbursed quarterly to health facilities and include pre-operative examination costs, cesarean kits, surgical costs, post-operative treatment and hospitalization. Facilities get up to US $ 60 (FCFA 30,000) per case for a simple cesarean, up to US $ 84 (CFA 42,000) for a complicated cesarean US $ 60 (CFA 30,000) for hospitalization/lab tests and drug costs as reimbursement.

- **Which services are excluded from the free cesarean policy**

Firstly, the policy does not cover transportation and other indirect costs related to the emergency transportation policy. Fuel and small maintenance costs for these ambulances as well as payments to drivers are shared between the local mayor's office, the district health council and local community associations (ASACO). Further, transportation costs from the village to the CSCom and to return home are paid for by the family. Secondly, the fees for normal delivery and antenatal care are still charged up to US $ 14 (7000 FCFA).

1.3. Problem and its significance

In order to assess the implementation of Mali's free cesarean policy and find out its impacts on maternal health, a recent evaluation of the policy by USAID funded

program ATN (El-Khoury, Gandaho, Arur, Keita, & Nichols, 2011)has found from 2006 to 2010 an increaseofcesarean rate in Mali from 0.9% to 2.3%, a rise of facilities deliveries from 53% to 64%, a reduction of maternal death after cesarean from 2.1% to 1.3% and neonatal death after cesarean from 14.2 % to 11.9 %.

The declining of maternal death and neonatal death and the increase in cesarean rates must be encouraged. Even though, the cesarean rate in 2010 shows great improvement, it is still low according to WHO international standard (5-15 % of deliveries).

On the other hand, Mali free cesarean policy still faces many challenges that need to be highlighted. Firstly, that USAID funded program ATN survey found that only 29.9 % of women delivering by C-section belong to the low SES group whereas almost half of women receiving cesarean (48.8%) belong to the high income group (richest third of the population). The skewed distribution implies that the free cesarean policy seems to be disproportionately benefiting to the wealthier group and to be less equitable. This means there are still some barriers to access health facilities among women with low SES. Secondly, the report shows that this policy is limited by a poor referral system and the lack of emergency transport system. Further, poor road condition, poor supply drugs, lack of awareness about the specific components of the policy and social and cultural barriers remain a big challenge to the maternal health services utilization. Finally the others remaining barriers which deter the utilization of obstetric health facilities are the financial burden (travelling cost and opportunity costs) and the normal delivery fees (7000 CFAF / US $ 14).

Moreover, cesarean decision is only taken by doctors based on medical indications. Even though the human behavior factors such as avoidance risk and financial incentive or posh to push factor are not observed in those public facilities in Mali, the rate is still higher for the high income group than low ones. Therefore from this USAID funded data, we would like to analyze the factors affecting the likelihood of receiving cesarean among low and the high SES group in public health facilities in Mali and draw some possible recommendations to improve the health status of the poorest and ensure a better equity among them.

1.4. Research questions

- What are the non-medical factors affecting the probability of getting cesarean among low and high socio-economic group in public health facilities in Mali?
- Is there any relationship between medical outcomes and non-medical determinants of women according to their socioeconomic status who delivered in Mali public health facilities?

1.5. Research objectives

- The main objective is to identify the non-medical factors affecting the likelihood of receiving cesarean among low and high socio-economic group in public health facilities in Mali.
- To analyze the relationship between medical outcomes and non-medical factors of women according to their socio-economic status.

1.6. Hypothesis

Some medical factors (emergency and elective cesarean) and non-medical factors such as demographic factors (the maternal age and the region), facilities factors (number of Obstetricians and the free cesarean policy), the pregnancy information (the birth order) and the socio-economic factors (the mother's education, the mother or father's occupation, the socio-economic proxy variables and the transportation cost) can affect the likelihood of receiving cesarean delivery.

1.7. Scope of the study

The survey conducted focused only on pregnant women who delivered in the randomly selected health facilities within a period of time (from February 2010 to September 2010). Further, this analysis will focus on the medical outcomes and non-medical factors of those women who delivered in the selected health facilities.

CHAPTER II
LITERATURE REVIEW

2.1. C-section overview

C-section is the delivery of a baby through a surgical incision in the mother's abdomen wall (laparotomy) and uterus wall (hysterectomy). In some circumstances, a C-section is scheduled in advance. In others it's done in response to an unforeseen complication.

2.2. Concept of C-section

The C-section rate is increasing over a period of time in developed countries, as well as in developing countries. It is also increasing for all women of all ages, race/ethnic group, gestational age, SES group. For instance in China the cesarean rate rose dramatically from 3.4 % in 1988 to 39.3 % in 2008 with the most dramatic increase among urban women (Feng, Xu, Guo, & Ronsmans, 2011). In USA, this rate climbed from 5% in 1960 to 31.8% in 2007 (Campbell, 2011). In Mali, the rate increase from 1.6 % in 2005 to 2.9 in 2009. Moreover in developed country the proportion of cesarean birth is 21.1 % on average whereas in developing countries it is only 2 % (Betran et al., 2007). This rate is quite under the international norm (5 % - 15 %) fixed by WHO since 1985.

2.3. Types of C-section

C-section is made based on two types of incision on the uterus: low transversal incision and vertical uterine incision. However the direction of incision on the uterus does not necessarily match with the incision on the skin (up, down or side to side).

The low transverse incision is a horizontal cut across the lower part of the uterus. It is the one which is safer and more successful to go through labor for having a vaginal delivery in later pregnancies.

The vertical incision on the uterus is used for delivering preterm babies, abnormally positioned placentas, pregnancies with more than one fetus and in extreme emergencies.

2.4. Medical factors (indications of cesarean)

Cesarean indications can be classified into 3 groups: maternal; fetal or maternal-fetal(Table 2.1).

Table 2. 1 Medical indication for cesarean decision

Maternal	Fetal	Maternal-fetal
• Medical condition: specific cardiac disease (Maran's Syndrome, unstable coronary artery disease); specific respiratory disease (Guillain-Barre syndrome); thrombocytopenia • Conditions associated with increased intracranial pressure • Mechanical obstruction of the lower uterine segment (tumors, fibroids) • Mechanical vulvar obstruction (condylomata) • Contracted pelvis (either congenital or acquired)	• No reassuring fetal status • Malpresentation: breech, transverse lie, brow or face/mentum posterior • Cord prolapsed • Maternal herpes or HIV • Congenital anomalies/Vasa previa	• Failure to progress in labor: either arrest to descent or arrest to dilate • CPD • Placental abruption • Placenta previa/ placenta abruption • Conjoined twin • Uterine rupture • Elective cesarean delivery

The most common indications for cesarean delivery in America is repeated cesarean (30 %), followed by dystocia or failure to progress (30 %), malpresentation (11 %) and non-reassuring fetal status (10 %) (Neil, Jorgensen, & Quinlan, 2012). In England, the most common indication is also repeated cesarean (29%) followed by presumed fetal distress (22 %), failure to progress (20 %) and breech birth (16 %) (POST, 2002). In Mali, the most common indications is prolonged/obstructed labor or suspected cephalopelvic disproportion (CPD) 40.4 %, followed by previous cesarean section 16.6 %, fetal distress (16.1 %) (Briand et al., 2012)

Table 2. 2 Different categories of C-section

Category 1: Emergency CS	Category 2: Urgent CS	Category 3: Scheduled CS	Category 4: Elective CS
There is an immediate threat to the mother or the fetus. Therefore the CS should be done **within the next 30 min** in order to save on time both mother and baby Abruption, cord prolapsed, scar rupture, scalp blood PH<7.20, fetal distress: prolonged FHR deceleration <80	There's maternal or fetal complication but was not immediately life threatening. In that case the delivery should be completed **within 60-75 min** Case with FHR abnormalities are those of concern	The mother needs early delivery but there is no maternal or fetal compromise. A concern of the continuation of pregnancy is likely to affect the mother or fetus in the coming hours or days. Iatrogenicpreterm delivery where there is need to give a course of steroid for lung maturity	The delivery is timed to suit the mother and staff. There are cases where there is an indication for CS but there is no urgency. Placenta previa with no active bleeding, malpresentation, history of previous cesarean…

Based on the timing of C-section at the time of decision making, the cesarean indications are grouped under one of those four categories (see Table 2.2).

Sometimes the cesarean indications are grouped in two groups by combining category 1 and 2 in one group "emergency CS'' and category 3 and 4 in another group "elective CS".

Table 2. 3 Common reasons for emergency and elective cesarean

Common reasons for emergency cesarean	Common reasons for elective cesarean
• Induction failure/ Unsuccessful assistance delivery • Undiagnosedfetalmalpresentation • CPD • Prolonged labor that is not progressing • Placenta abruption/ Cord prolapsed • Fetal distress when the induction has been performed • Maternal distress/ Acute pre-eclampsia • Failure of labor trial/ pre-rupture of uterus syndrome • Uterine rupture	• Multiple cesarean (twins, triplets or more) • Breech or transverse presentation • Placenta previa/Ante-partum hemorrhage • Intra uterine growth restriction • Contracted or borderline pelvis • Suspected CPD • Previous vaginal tear/Previous cesarean • History of big baby/ Pre-eclampsia • Maternal infectious disease/Gestational diabetes

Whereas the emergency cesarean is one that takes place during labor due to unforeseen labor complications, the elective cesarean is the one that takes place before the labor begins (Table 2.3).

2.5. Delivery complications according to normal, elective and emergency delivery

In general, the cesarean carries more maternal and fetal complications intra and post-partum (such as hemorrhage, post-partum infection, endometritis and thromboembolic complications) than the normal delivery. (Burrows, Meyn, & Weber, 2004) obtained the same result in their study and discovered also that more vaginal damages and lacerations occurred when women have a spontaneous vaginal delivery than operative vaginal delivery . Moreover the emergency cesarean leads to more

maternal and fetal complications than elective cesarean. For instance in (Raees, Yasmeen, Jabeen, Utman, & Karim, 2012)study, emergency cesarean is more associated to neonatal and maternal morbidity and mortality complications than elective cesarean and normal delivery. On the other hand, the failure of attempted vaginal delivery causes more delivery complications such as uterine rupture, vaginal and cervix tears, emergency cesarean, than elective cesarean (Beucher, Dolley, Lévy-Thissier, Florian, & Dreyfus, 2012).

2.6. Non-medical factors influencing C-section rate

Beside medical factors, non-medical reasons can also have an impact on the likelihood of having a C-section as well. Among those factors are maternal characteristics such as age, education, occupation, birth order, financial status (salary/affordability to pay medical fees and health insurance), residence, number of antenatal visits, health status. Those non-medical factors can greatly influence the C-section rate. Some demographic factors, especially the change in the characteristics of the childbearing population can affect cesarean delivery. Ethical and economic reasons may also have some influence on the rate of surgical delivery.

2.6.1. Maternal age

Several studies show that old women (over age 35) are more likely to have a high risk of pregnancy complication and cesarean delivery. Other studies found the same result in lower risk women population. A significant association was also found between the risk of having C-section and advanced maternal age at the first pregnancy (Herstad et al., 2012). In addition, the increase age and parity are reported to be associated with a high risk of adverse pregnancy outcomes and C-section rate. Dystocia, non-reassuring fetal condition, pre-eclampsia, placenta previa, abruptio-placenta, malpresentation, prolonged labor and macrosomia were significantly higher in older mothers with high parity. Another high association was found among advanced maternal age of women with previous C-section and increasing C-section rate (Hiasat, 2002).

2.6.2. Education of the mother

The role played by educational level in the C-section rate is controversial. (Gilbert, Benjamin, & Abenhaim, 2010) found in a study that planned C-section was carried out more often among educated women than uneducated ones. High education level influences also positively the C-section rate of women with previous C-section (Khawaja, Kabakian-Khasholian, & Jurdi, 2004). This significant rate of C-section rate among the more educated women are mainly due to either maternal choice for C-section (posh to push factor) or physicians behavior factors or the delay of motherhood until older age for educated women. On the other hand, when all those factors are taken into consideration, some studies show that the C-section rate is likely to be less among highly educated women because educated women are more aware about pregnancy complications and risks. Therefore they are more preventive and care better about their health during the pregnancy. For instance among women in the same age, the less educated ones are actually more likely to get a C-section (Harrison, 2012). Furthermore the education of the father doesn't have too much effect as the mother education on the C-section rate.

2.6.3. Occupation of the parents

Occupation of the mother is greatly associated with the cesarean delivery. A Nigerian study found that women with no occupation are more likely to have a vaginal delivery than those with a high occupation (Bolajoko Olusanya & Solanke, 2009). This might be due to some reasons such as maternal choice to deliver by C-section, delaying motherhood (due to the lack of time because of her work) at an advanced age or inequitable access to maternal health care.Astudy in Puerto Rico found a direct association with the father's occupation and the rate of surgical delivery. Fathers with no occupation are associated with a lower rate of C-section rate (Vazquez-Calzada, 1997) It is probably due to the same socio-economic reasons.

2.6.4. Birth order (parity)

Whereas a rising of C-section rate for the maternal age is apparent for almost all the live-birth order, live-birth order affects the rate of cesarean delivery

independently of the maternal age. The risk of cesarean delivery is greater among mothers having their first child no matters the age, except for teenage mothers. Then this risk falls down promptly with succeeding births. For instance, a USA study (Selma, 1994) found the cesarean rate declined as live-birth order rose to an age greater or equal to 20 years old mothers for both black and white women. In addition the highest cesarean rate for any age-birth order combination were found among women between 35-39 years of age having their first birth, followed by women 40-49 years. The lowest rate was for 20 year old women having a fourth or higher order birth and for teenagers having their second or third child. (Khawaja et al., 2004)found the same result: a higher likelihood of C-section delivery among low birth order compared to high one is expected since the delivery complications are more common among primiparous women leading to a higher rate of C-section.

2.6.5. Financial situation

- Income and SES group

The cesarean rate is important among people with a better financial situation even thoughthelow income group has a higher obstetrical risk. One Brazilian study (Hopkins & Amaral, 1998) found a higher C-section rate among the high income group than the low one.

Cesarean delivery is more common among people with high SES. This might be due to the fact that low SES faces often to financial and geographic barriers to access health care services.

- Ability and affordability to pay

Several studies found that Women or household with less financial ability and affordability to pay for health care will have high risk pregnancy but lower C-section rate (Hopkins et al , 1998).

- Health insurance

Cesarean rate is more common for insured women than uninsured ones. A study in Brazil (Cecatti, Pires, Faundes, & Duarte Osis, 2005) showed that the C-

section rate varies enormously according to the type of insurance. And the lowest rate is with insurance companies which contract with public facilities. Another study (KASSAK, ALI, & ABDALLAH, 2000) found that universal coverage by national health insurance had a greatest impact on the likelihood to increase C-section rate.

2.6.6. Rural / Urban areas

Many articles highlight the importance of residence place on the C-section rate. Mothers living in urban areas have a higher probability to deliver by C-section. This might be due to either a better access to health care in urban areas or the lack of appropriate equipment and skilled staff in rural areas. However it might also reflect the overused of cesarean delivery in urban areas (Yassin & Saida, 2012).

2.6.7. Number of antenatal visits

The prenatal care is another key factor influencing the C-section rate. The greater is its number (six or over), the higher is the likelihood to get C-section. This is due to the fact that higher pregnancy risk is more likely to have more antenatal visits. On the other hand, some studies found a strong association between medical knowledge of mother and number of antenatal visits (Habib, Abdulla, & Yacoub, 2011).

2.6.8. Health status

- Obesity

An increase in C-section rate appears in parallel with increasing obesity rate due to the rising likelihood of pregnancy complication (diabetes and hypertension). Further, both maternal and fetus weight influence the cesarean rate (Hendrickson, 2012).

- Pregnancy and delivery complication

Pregnancy complication, when it is not treated seriously can lead to serious issues. So it is an important factor affecting C-section decision. Some studies show a significant likelihood of getting cesarean birth for complicated pregnancies seeking health care(Choudhury, 2008). Chronic hypertension and uterine bleeding in Jose and

all studies were reported as the most common pregnancy medical risk associated with surgical delivery. Others are diabetes and anemia.

However delivery complications leading to C-section are more considered as medical factors. They are more important than pregnancy complication because they affect directly the normal delivery and increases highly the C-section likelihood. And the chance of having a cesarean is even more for those women with two or more delivery complication.

- Low/ high risk factor

C-section rate is lower among women with uncomplicated pregnancies than complicated ones. In addition a healthy woman is less likely to have pregnancy complication and C-section than the opposite (RCP, 2008).

2.6.9. Transportation costs

The long distance to health facilities, the expensive or lack of transportation can impede the easy access to health facilities on time. So poor women only go when the case is complicated. In(Mohanty & Srivastava, 2012) study, the costs of transportation in rural areas were double than in urbanareaswith high rate of cesarean. Similar result were found with (Gartoulla, Liabsuetrakul, Chongsuvivatwong, & McNeil, 2012).

2.6.10. Summary of non-medical factors

On the next page, there is a summary of all non-medical factors with the references and the expected sign.

Table 2. 4 Expected sign of non-medical factors

	Authors	Data	Year	Methodology	Expected sign
Maternal age	Herstad et al.	Descriptive Longitudinal	2012	Logisticregression Descriptive stat	≥ 35: +
Mother Education	Gilbert et al. Harrison	Retrospective Cross sectional	2010 2012	Logistic regression Statistical model	More educated: + Less educated: + If no confounding factors: less: +
Mother Occupation	Olusanya et al. Jose et al.	Cross sectional Retrospective	2009 1997	Logistic regression Logistic regression	Jobless mother : - Jobless father: - (few influence)
Birth Order	Taffel Khawaja et al.	Cross sectional Cross sectional	1994 2003	Descriptive statistic Logistic regression	BO ↑ : - Idem
Income and SES ability to pay	Hopkins et al.	Cross sectional	1998	Logistic regression	High SES: +
Health insurance	Cecatti et al	Retrospective Case control	2005	Logistic regression	Insured: +
Rural / Urban area	Yassin et al	-	2012	ogistic regression	Urban: +
Antenatal visit	Habib et al	Cross sectional	2011	Descriptive statistic	Number : +
Health status	Choudhury	Retrospective		ogistic regression	Risk ↑: +

2.7. Human behavior factors increasing C-section

2.7.1. Medical human behavior factors

Some factors can explain the rise of cesarean rate. First of all, there are large variations among clinicians, hospitals in the management of the woman labor which influence the cesarean rate. Secondly, even though the proportion of assisted breech baby's delivery does not increase, some clinicians prefer to avoid the risk due to the complication of normal delivery and practice an elective cesarean for breech babies because they think it is safer. In addition, the increasing use of in vitro fertilization (IVF) has led to the rising in the number of multiple births and those babies are often delivered by CS. Finally, the development of new surgical techniques, technologies and medical care has made C-section an increasingly safe operation.

2.7.2. Non-medical human behavior factors

2.7.2.1 Cultural and Organizational factors

In some cases, the C-section decision is very needed to save the mother and/or the baby. However this decision, in another situation is minutely a balanced judgment taken between clinical teams and the mother. So, the environment within the hospital unit and his staff is managed has greatly an impact on C-section decision, leading to a broad variation in the rate between hospitals. Further, some studies found that teaching hospitals tend to have lower cesarean rate than non-teaching health facilities and private clinics (KASSAK et al., 2000). On the other side, some ethical issues such as a doctors' obligation not to cause harm to patients and to obtain their consent prior to any treatment, instead of only to protect a patient's welfare can influence the physician choice.

2.7.2.2 Maternal choice

Some mothers, mainly the educated and famous ones prefer to give birth by C-section because they are scared of suffering for the vaginal birth. So this rise of C-section rate can be attributed to women's lifestyle choice. Because of this reason, the C - section rate in private hospitals is often higher than in public hospitals. But,

according to some studies about “cesarean culture of Brazil”, other reasons are found (Giguere, 2007):

- Due to modern and advanced, technological interventions, women perceived C-section as safer and more comfortable labor with better quality of health care
- They want to avoid the risk of perineal damage due to normal delivery that can affect women sexual function after childbirth.

On the other side, the prevalence of maternal preference varies widely according to the country context. A study in Hong Kong (Pang et al., 2007) found a low prevalence of 16.7 % for the maternal choice and the main reason was their perceived it safer for the baby. In another study, Iran the rate was 22 % (Alimohamandian, Shariat, Mahmoodi, & Ranezanzadeh, 2007).

2.7.2.3 Profile of doctors preferring C-section

- In general

The increasing cesarean rate can also be attributed to an unjustified physician’s choice due to his fear to bear the risk, face to litigation or financial incentive (want to make more money). It can also be due the patients demand.

Furthermore, there are worldwide various clinicians' opinions about the request of elective or emergency cesarean and many studies found contradictory results .(Al-Mufti, McCarthy, & Fisk, 1996) in a survey, found that 17% of Obstetricians in London (31% of female VS 8 % of male) prefer elective cesarean. Their choice was mainly based on the avoidance of perineal damage from vaginal birth and the risk of injury to the baby. Then 68 % of obstetricians choose cesarean delivery for cephalic presentation with an estimated weight greater than 4.5 Kg. Another similar study (Wagner, 2000) in USA, showed that 46,6 % obstetricians prefer the C-section with more males (56.5 %) than females (32.6 %). And 70 % of women delivered by C-section with an estimated weight greater than 4.6 Kg. However in (Mc Gurgan, Coulter-Smith, & PJ, 2001)study, they observed opposite result. There are more females than males who chose elective cesarean. Regarding the marital status, married clinicians do less emergency cesarean than the non-married ones (Turner et al., 2008). In addition, clinicians request (21 %) more cesarean

delivery than midwives (10 %) and colorectal surgeons, uro-gynecologists are more likely to request C-section.

Regarding the number of obstetricians and its influence on the cesarean rate, many studies found that when the number of physicians is few, they performed more vaginal birth with vacuum assisted-delivery and epidural analgesia. And the higher is their number, the greater s the cesarean rate. A study in Chicago, by comparing two group of obstetricians (one with low rate and another with high rate) confirmed what others previous studies found (Poma, 1999).

- Mali case

In Mali, the health personnel in public facilities are under salary based payment. The salary rate is based on the level of training and the number of years in service (Hoy, 2011). Therefore physicians have no incentive to increase the C-section rate. In addition when patients arrive at maternal health facilities, they first contact is made with the midwives and the medical students on duty. The Doctors is called in only when the case is complicated or special andneeds the doctor's advice. Therefore the mother’s request for cesarean delivery to doctors is not observed in those public facilities. The cesarean decision is only taken by physicians based on medical reasons.

CHAPTER III
RESEARCH METHODOLOGY

3.1. Conceptual framework

The goal of this study is to determine the factors (medical and non-medical) affecting the likelihood of C-section rate among pregnant women according to their SES in public sector health facilities in Mali. As discussed in the literature review, many variables can affect the C-section rate. Those variables are grouped by medical factors and non-medical factors.

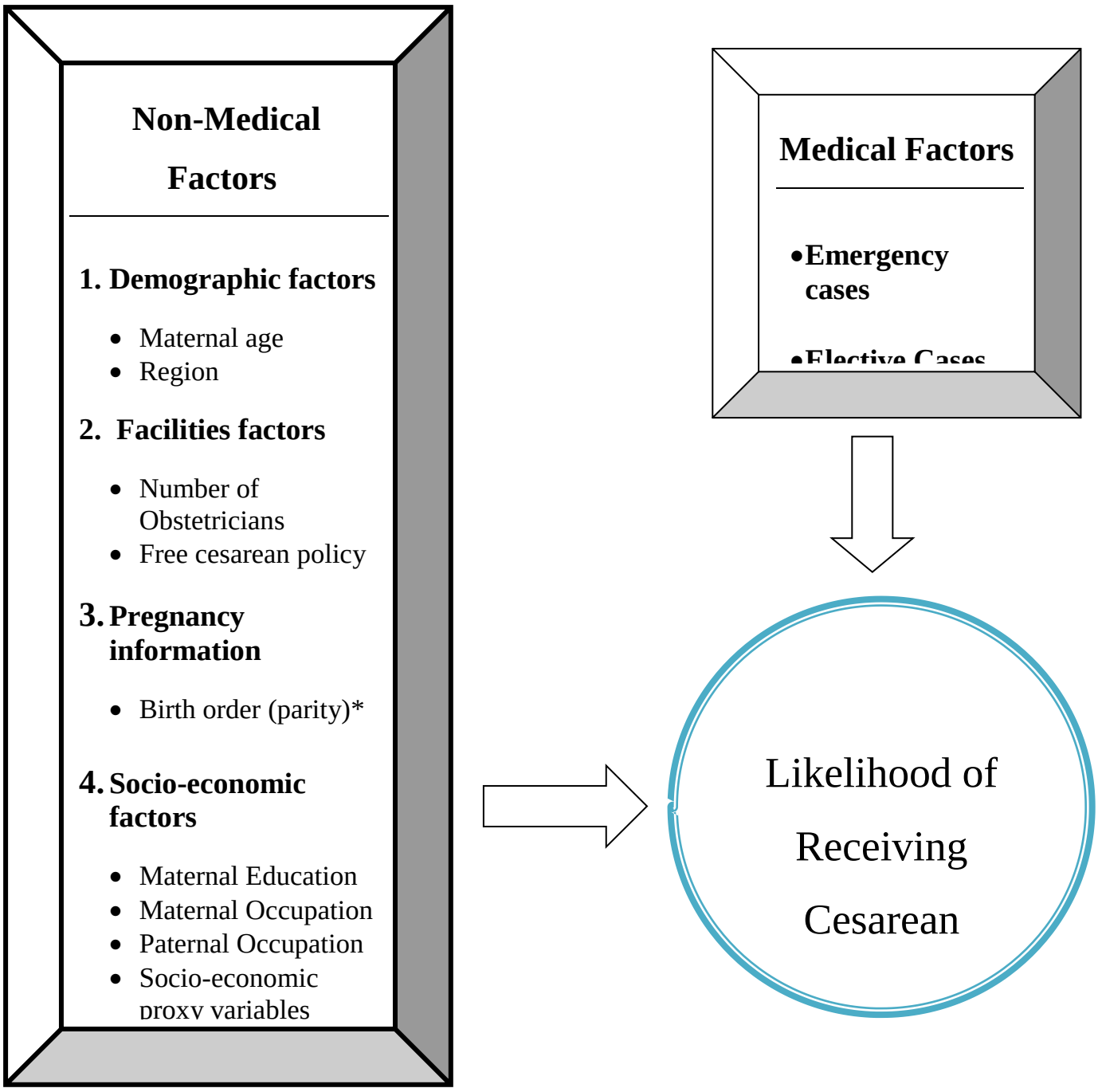
- There are many medical indications under the medical factors, and they can be categorized by either maternal, fetal and maternal fetal reasons or emergency and elective cesarean.
- For the non-medical factors, there are demographic factors (maternal age and region), the socio-economic factors (the maternal education and occupation, the paternal occupation, the socio-economic proxy variables and the transportation cost), the pregnancy information (the birth order or the parity) and the facilities factors (the number of obstetricians at post).

For the pregnancy information, some variables such as duration of pregnancy, history of previous cesarean section, number of antenatal visits are missing due to the lack of information. Similarly, for the facility factors, the free cesarean policy could not be analyzed because it is applied countrywide and to all women delivering in a public health facilities(only one choice).

For the transportation cost, an estimation model will be computed for the farthest distance and highest price a woman would pay from her home to the nearest health facility according to each region (Appendix B.).

This conceptual framework will help to set up the economic model and to respond the research questions enumerated above.

Figure 3. 1 Conceptual framework



* Only the birth order is considered. Because of lack of information about the pregnancy duration and the history of the previous cesarean in the available data, those factors were not included in the conceptual framework.

3.2. Research design

3.2.1. Overview

The USAID funded survey was an observational, descriptive and cross-sectional analysis. A quantitative data was collected from February 2010.

3.2.2. Population and sample design

The target population in that survey was all pregnant women, no matter their citizenship or SES group delivering in the 41 selected health facilities and who were willing to participate in the survey. The survey collected data on a small set of demographic and socioeconomic variables from 3,968 women who delivered in those facilities over an 8-months period. As sample size, a minimum sample of 245 was required for each of the 9 regions, except Kidal (13), Gao (152), Tombouctou (156) and Mopti (239) due to the low rate of health services utilization in those regions. The exclusion criteria was the pregnant women delivering in those 41 facilities and refusing to participate in the survey. Their number is only 3.

3.2.3. Research instrument

3.2.3.1 Questionnaire form

The questionnaire form was written in French and translated orally in Bambara (the dialectal language) to patients who could not read it. All data were collected through a descriptive questionnaire.As measure a nominal and ordinary scale was used. A nominal scale was used to identify the health center and to know from where, how and why the patients arrived to the selected health facilities (health centers and individual characteristics). Through the ordinary scale, educational status of women and some socio-economic data as a proxy were used (Appendix B).

A proxy wealth index was created for estimating women's SES using weighted answers to a set of five questions. These questions were the subset of those used to determine wealth quintiles in Mali 2006 DHS (Appendix D.). They were a mix of asset variables that typically varied across socio-economic group, as well as some variables defining the living conditions that were specific to the Malian context (Appendix B.: Socio-economic data). Using the individual female dataset from 2006 DHS, the threshold value of the wealth index was determined and that had defined

women belonging to either tertile or quintile of the wealth distribution, each containing one third or one fifth of the population. Then the same proxy wealth index based on responses was constructed and using the same DHS cutoff values to classify respondents by wealth tertile/quintile. For convenience, an assumption was made: the first tertile as the low SES group, the second tertile as the middle SES group and the third tertile as the high SES group. In the same way, the first quintile as the lowest SES group, the second quintile as the low SES group, the third quintile as the middle SES group, the fourth quintile as the high SES group and the fifth quintile as the highest SES group.

3.2.3.2 Health facilities selection

The survey was conducted in 41 health facilities in 9 different regions. Bamako, the capital of Bamako was treated as a region for the purpose of the study. Furthermore, the probability sampling was stratified sampling for selecting the regional hospitals in each region. The total number of regions was 9 (Kayes, Koulikoro, Sikasso, Segou, Mopti, Tombouctou, Gao, Kidal, and Bamako). Then, a random sampling was used to select the CSCom and CSRef as follows (Appendix B.):

- Hospitals: For each region, the regional hospital (EPH) was automatically included in the sample. Gabriel Toure hospital (a famous tertiary facility) in Bamako was purposively selected to be included in facility sample as a regional hospital existing in Bamako. Koulikoro and Kidal did not have a regional hospital. Therefore , the CSRef in these cities acted as the regional hospital.

- CSRef: The CSRef in each region was classified in two groups based on cesarean rate in 2008 in that region- those with C-section above the median for the region and those below the median. Then, CSRef from each group was randomly selected. Moreover, at the time of the sampling design, none of CSRef in Kidal had had any registered cesarean procedure. Therefore, CSRef from the sample in Kidal were excluded, except the one CSRef that has acted as the regional hospital.

- CSCom: From the CSCom list of C-section rate, oneCSCom was randomly selected from each group of CSCom chosen and included in the sample.

In total, given the exclusion of Kidal region for the CSRef, the total sample size was 41. Those 41 health facilities were distributed as follows: six regional hospitals (Kayes, Segou, Sikasso, Mopti, Tombouctou, Gao) and two regional CSRef (Kidal and Koulikoro); one tertiary hospital in Bamako city; 16 CSRef and 16 CSCom in all regions except Kidal.

Therefore, for each region, there were one regional hospital, one CSRef having C-section rate above the median and another one with a rate below the median, one CSCom chosen randomly from a list of CSCom referring to each CSRef selected. The only Kidal region has one CSRef which stands for a regional hospital.

3.2.3.3 Data extraction

It is a survey which was funded by USAID Mali ATN plus and HS 20_20 in support to Malian Government to evaluate the efficiency and equity of the free cesarean policy. Data was collected by HMIS personnel and the cesarean focal persons in the selected facilities. During my stay in Mali in 2010, I have participated to the database entry and the data cleaning. I am using the same data to identify the relationship between medical and non-medical factors of cesarean rate among Malian's pregnant women according to their SES. Further additional information about the transportation cost from a village to the selected facility (Appendix F.) and the number of gynecologists performing the cesarean in each selected health facility (Appendix E.) were for analyzing data

3.3. Econometric model

3.3.1. Variables needed

The different variables needed to determine the factors (medical and non-medical) affecting the likelihood of receiving C-section among low and high SES group are the following.

3.3.1.1 Dependent variable: C-section rate

Because I have two models, two dependent variables area needed (one in each model). For the model 1 the dependent variable ("Ces" variable) is defined as a dichotomous variable (two mutually exclusive values): coded 1 for cesarean delivery

and 0 for vaginal delivery. For the model 2 the dependent variable ("Mef" variable) is defined as multinomial outcomes (three mutually exclusive values); coded 2 for elective cesarean, 1 for emergency cesarean and 0 for normal delivery.

3.3.1.2 Independent variables

The independent variables are categorized by the medical factors(emergency cesarean and elective cesarean) and the non-medical factors (socio-economic, demographic and facilities factors and pregnancy information).

- **For the medical factors**

Table 3. 1 Independent variables for the medical factors

Independent variables		Abbreviation	Description
Medical factors	Normal delivery	Mef_0	Dummy variable
	Emergency cesarean	Mef_1	
	Elective cesarean	Mef_2	

- **For the non-medical factors**

Table 3. 2 Independent variables for the non-medical factors

Independent	Variables	Abbreviation	Description	Expected sign
Maternal	**Age**	Age	Continuous variable	+
Socio-economic proxy variable : Quintile (Quin)	First quintile: Lowest	Quin1	Continuous variable	-
	Second quintile: Low	Quin2		-
	Third quintile: Middle	Quin3		+/-
	Fourth quintile: high	Quin4		+
	Fifth quintile: Highest	Quin5		+
Birth order (Bor)	- 1 parity	Borr0	Continuous or Dummy Variable[1]	+
	- 2-3 parities	Borr1		+/-
	- 4-5 parities	Borr2		-
	- > 5 parities	Borr3		-

[1]The birth order will be used as a continuous variable for the model 1 (first equation $Y_{A0i)}$ and for the model 2 ,then for the interaction terms variables (Model 1 second equation Y_{A1i}, birth order will be used as dummy variable (see page 32-33).

Independent	Variables	Abbreviation	Description	Expected sign
Transportation cost (Trc)	Mean transportation cost to CSCom / Hosptial	Trc1: Estimated maximum cost Trc2: Estimated average cost Trc3: Real maximum cost	Continuous variables[1]	+
Number of obstetricians (Obsr_3)[2]	(1-2)	Obsr_3 0	Dummy variables	-
	(3-4)	Obsr_3 1		+
	(7-21)	Obsr_3 2		+
Mother Education (Edu)	None	Edu1	Dummy variables	+
	Primary	Edu2		+
	Secondary	Edu3		+/-
	University	Edu 4		-
Mother Occupation (Ocm_for) [3]	Housewife/unemployed Pupils/Students	Ocm_for 1	Dummy variables	-
	Employees/Technician/Administrator/ Health personnel	Ocm_for 2		+
	Agriculture Artisans/ Servant/ unskilled manual work	Ocm_for 3		+/-
	Sellors / Sales / Services / Merchants	Ocm_for 4		+/-
Father Occupation (Ocf_fiv)	Pupils/Students/Unemployed/ Religious men	Ocf_fiv 1	Dummy variables	-
	Health personnel/Employee Executive/Technician/Manager	Ocf_fiv_2		+
	Agriculture / Artisans / Taxi driver / unskilled manual work	Ocf_fiv_3		+/-
	Sellors / Sales / Services / Merchants / small business	Ocf_fiv_4		+/-
	Skilled manual work	Ocf_fiv_5		+/-
Regions (Reg)	Kayes	Reg_1	Dummy variables	-
	Koulikoro	Reg_2		-
	Sikasso	Reg_3		-
	Segou	Reg4		+
	Mopti	Reg5		+
	Tombouctou	Reg6		-
	Gao	Reg7		-
	Kidal	Reg8		-
	Bamako	Reg9		+
Admission mode	Came by themselves	Mode_0	Dummy variables	-
	Referral	Mode_1		+
	Evacuation	Mode_2		+
	Other: referred by ATR	Mode_3		+

[1] For the transportation cost, see the explanation in Appendix C.

[2] For the number of Obstetricians, see more details in Appendix B.

[3] In the equation, either the occupation of the mother or the occupation of the father will be used but not both of them in the same equation. .

3.3.2. Measurement

3.3.2.1 Description of the models needed

To answer all the research questions, two models are needed. A binomial probitmodel (model 1) and a multinomial probit model (model 2) will be run withstataforascertaining first, the association between C-delivery and non-medical factors; then determine the relationship between the medical indications outcomes and the non-medical factors among women delivering in Malian public health facilities. The dependent variable is in the form of $\mathbf{Y}_i$where:

- **Model 1**

In model 1,the dependent variable ("Ces") is in the form of $\mathbf{Y_{Ai}}$ where

$$\mathbf{Y_{Ai}}= \begin{cases} 1 \text{ for cesarean delivery} \\ 0 \text{ for normal delivery} \end{cases}$$

The model 1 will combine first all the explanatory variables together(medical and non-medical factors) in one equation ($\mathbf{Y_{A0i}}$). Then it will use some interaction terms between some independent variables to see the effect of one predictor variable one the dependent variable when the second predictor variable changes by one unit ($\mathbf{Y_{A1i}}$).

- **For Y_{A0i}an equation will be run with stataamong all women**

$$\mathbf{Y_{A0i}} = \beta_0 + \beta_1 Reg + \beta_2 Ocm\_for + \beta_3\ Age + \beta_4\ Age^2 + \beta_5 Edu + \beta_6 Bor + \beta_7 Quin + \beta_8\ Trc3 + \beta_9 Obsr + \beta_{10} Mef + \varepsilon i$$

- **For Y_{A1i}, an equation for interaction terms will be run**

A cross effect equation will be used to see the effect of one explanatory variable on Y_{A1i}due to the change of another independent variable. For instance, if $Y= \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \varepsilon$; the possible cross terms are X_1*X_2 and $X_1*X_3$with X1 as continuous variable and X_2 and X_3 as dummy variables.

$$\mathbf{Y_{A1i}} = \beta_0 + \beta_1 Reg + \beta_2 Ocm\_for + \beta_3 Age + \beta_4 Age^2 + \beta_5 Edu + \beta_6 Bor + \beta_7 Quin + \beta_8 Trc3 + \beta_9 Obsr + \beta_{10} Mef + \beta_{11} (Age*Borr) + \beta_{12} (Age*Edu) + \beta_{13} (Quin*Reg) + \beta_{14} (Borr*Ocm\_for) + \beta_{15} (Borr*Reg) + \beta_{16} (Quin*Edu) + \beta_{17} (Quin*Reg) + \beta_{18} (Quin*Borr) + \beta_{19} (Quin*Ocm\_for) + \beta_{20} (Ocm\_for*Edu) + \beta_{21} (Ocm\_for*Reg) + \beta_{22} (Obsr\_3*Reg) + \varepsilon i$$

- **Model 2**

In model 2,thedependent variable("Mef") is in the form of $\mathbf{Y_{Bi}}$where

$$\mathbf{Y_{Bi}} = \begin{cases} 2 \text{ for elective delivery} \\ 1 \text{ for emergency delivery} \\ 0 \text{ for normal delivery} \end{cases}$$

The model 2 will run a multinomial regression among the medical and the non-medical factors among all women.

$$\mathbf{Y_{Bi}} = \beta_0 + \beta_1 Reg + \beta_2 Ocm\_for + \beta_3 Age + \beta_4 Age^2 + \beta_5 Edu + \beta_6 Bor + \beta_7 Quin + \beta_8 Trc3 + \beta_9 Obsr + \beta_{10} Mode + \varepsilon i$$

3.5.2.2 Binary probitmodel

Assume that PR is the probability of cesarean delivery occurs, then

$$\Pr = \frac{1}{[1+\exp(\beta X_i)]} \text{ and } Ln, \left[\frac{\Pr_i}{1-\Pr_i}\right] = X_i\beta + \varepsilon_i = Z$$

If $\mathbf{Y}_i^* = X_i \beta + \varepsilon_i$ where $\varepsilon i \sim N(0, \sigma^2)$ and $\mathbf{Y}_i = 1$, then

PR ($\mathbf{Y_i = 1}$)= PR ($\mathbf{Y}_i^* > 0$) = PR ($X_i\beta + \varepsilon_i > 0$) = PR ($\varepsilon_i > - Xi\beta$= PR ($\varepsilon_i \leq - Xi\beta$)

- If the error term ε is normally distributed with mean 0 and variance 1 then we have a probit model $\Pr(Yi = 1) = \int_{-\infty}^{t} \frac{1}{\sqrt{2\Pi}} \exp(-Xi\beta^2 / 2)dt = \Phi(Xi\beta)$

- If Xi is dummy variable, there are 3 ways (marginal effect, relative risk and elasticity) to estimate from binary choice model the magnitude of the coefficient.

- If Xi is continuous variable, there are 2 ways (relative risk and elasticity) to estimate from binary choice model the magnitude of the coefficient.

CHAPTER IV
RESULTS

In accordance with the research methodology outlined in the previous chapter, 3968 observations are analyzed about the medical and non-medical determinants of cesarean, using secondary data from a USAID funded survey. In addition, transportation cost from a village to health facilities and the number of obstetricians were estimated. The medical indications outcomes (emergency or elective cesarean) were determined based on the literature review directives. This chapter will show the results obtained from the data analysis and will interpret it.

4.1. The characteristic of women and the cesarean rate

4.1.1. Description about women delivering in the selected health facilities

The mean age of all women delivering in Mali public health facility was 25.64 years old (range from 13 to 51); with a mean parity of 3-4 children (range from 1 to 15). From table 4.1 there is no big difference for the mean age and parity among women who delivered naturally and those who had a C-section.

Table 4. 1 Mean of women characteristics by delivery mode

Characteristics	Number	Mean	Std. Dev.	Min	Max
Normal delivery					
	1483	25.40	6.66	13	46
	1489	3.56	2.44	1	13
Cesarean delivery					
	2458	25.78	7.07	13	51
	2468	3.43	2.58	1	15

Moreover, the majority of women were uneducated (68.4 %), without employment (85.2 %). The most used mean transportation was the taxi (26.1 %). The

highest percentage of women belonged to the richest household (40.9 %; see Appendix G.)

In Table 4.2, whereas among women who deliver normally, the majority was respectively the non-working women (87.1 %), women with unskilled manual work (7.0 %), tradeswomen (3.8 %) and officer women (2.3 %); among women who had C-section the majority was respectively jobless women (84.1 %), officer women (6.0 %), tradeswomen (5.8 %) and women with unskilled manual work (4.2 %). For the education in both side, the majority was respectively the uneducated women, followed by primary education then secondary education, tertiary education and others education. Regarding the mean of transportation, while the majority of women who delivered normally came by others means (by foot); all the women who came by ambulance and most of them who arrived by taxi, had a cesarean. Whereas almost all women who delivered naturally, came by themselves (96.6 %); among those who had C-section, the majority either came by themselves (42.8 %) or were evacuated (42.0 %).

Table 4. 2 Frequency of socio-demographic characteristics by delivery mode

	Normal delivery		**Cesarean delivery**	
	Frequency	**Percent (%)**	**Frequency**	**Percent (%)**
Grouped occupation of the Mother				
1. Unemployed	**1,277**	**87.1**	**2,028**	**84.0**
2. Officer	33	2.3	144	6.0
3.Unskilled manual work	102	7.0	101	4.2
4. Tradeswomen	55	3.8	140	5.8
Mother education				
1.None	**1,031**	**74.9**	**1,474**	**64.6**
2. Primary	211	15.3	455	19.9
3. Secondary	79	5.8	228	10.0
4.Tertiary	49	3.6	90	3.9
5. Others	7	0.5	36	1.6
Transportation mean				
1.Ambulance	-	-	**781**	**32.6**
2.Vehicle	150	10.5	398	16.6
3.Taxi	263	18.4	735	30.7
4.Motorbike	386	27.0	242	10.1
5.Public transportation	42	2.9	119	5.0
6. Others	**588**	**41.2**	120	5.0
Admission mode				
0. Came by themselves	1,428	96.5	1,048	42.8
1. Referral	1	0.1	370	15.1
2. Evacuation	1	0.1	1,029	42.0
3. Referred by ATR	49	3.3	2	0.1

4.1.2. Description of facilities, region, proxy wealth index and cesarean rate

4.1.2.1 Sample size and health facilities

The table 4.3 showed the total number of records by region and facility type of the all 3,968 women delivering either normally or by C-section in public health facilities in Mali. Bamako had the highest recorded number (34.6 %) and Kidal the lowest one (0.3 %). Normal delivery is only done in the CSCom facilities and there are more women who delivered by C-section than natural.

Table 4. 3 Sample size by region and facility type

Region	**Hospital (number of C-section)**	**CSRef(number of C-section)**	**CSCom(number of normal delivery)**	**TOTAL**
Kayes	249	132	91	472
Koulikoro	153	96	229	478
Sikasso	222	68	202	492
Segou	157	187	248	592
Mopti	20	91	128	239
Tombouctou	37	55	64	156
Gao	63	42	47	152
Kidal	13	0	0	13
Bamako	222	670	482	**1374**
Total	**970**	**1507**	**1491**	**3968**

4.1.2.2 Access to health facility by women

Concerning the accessibility of the women accessed to the health facilities; the majority of them came by themselves (63.0 %),anddirectlyarrivedfrom their home (64.3 %) and were admitted for “painful uterine contraction” (54.7 %; see Appendix H.). The majority of women who came by themselves (96.6) deliver normally. However the majority who were either referred of evacuated (57,2 %) had a C-section.

4.1.2.3 Cesarean by facilities type and proxy wealth index

From the Table 4.4, the highest proportion of women receiving C-section, either in a hospital or a CSRef belonged to the highest SES household.

Table 4. 4 Cesarean rate by quintile and facility type

	EPH		CSRef		Total cesarean	
	Frequency	Percent %	Frequency	Percent %	Frequency	Percent %
Highest SES	460	47.4	660	43.8	1,120	45.2
High SES	227	23.4	361	24	588	23.7
Middle SES	146	15.1	194	12.9	340	13.7
Low SES	50	5.1	97	6.4	147	5.9
Lowest SES	87	9.0	195	12.9	282	11.4
Total	**970**	**100**	**1,507**	**100**	**2477**	**100**

The figure 4. 1 shows that in the majority of cases, the cesarean rate was the greatest among either the highest SES or the high SES, except the Mopti region where in the CSRef, the highest proportion of C-section rate belonged to the lowest SES. Further, the cesarean rate was significantly important (more than 70 %) among the highest SES in Bamako and Kidal hospitals and Bamako CSRef. In the opposite side, the cesarean rate was significantly low (less than 10 %) in the lowest SES in the following regions: Kayes, Tombouctou, and Bamako, in both CSRef and EPH and in the EPH of Segou.

Figure 4. 1 Cesarean rate by quintile, facility type and region

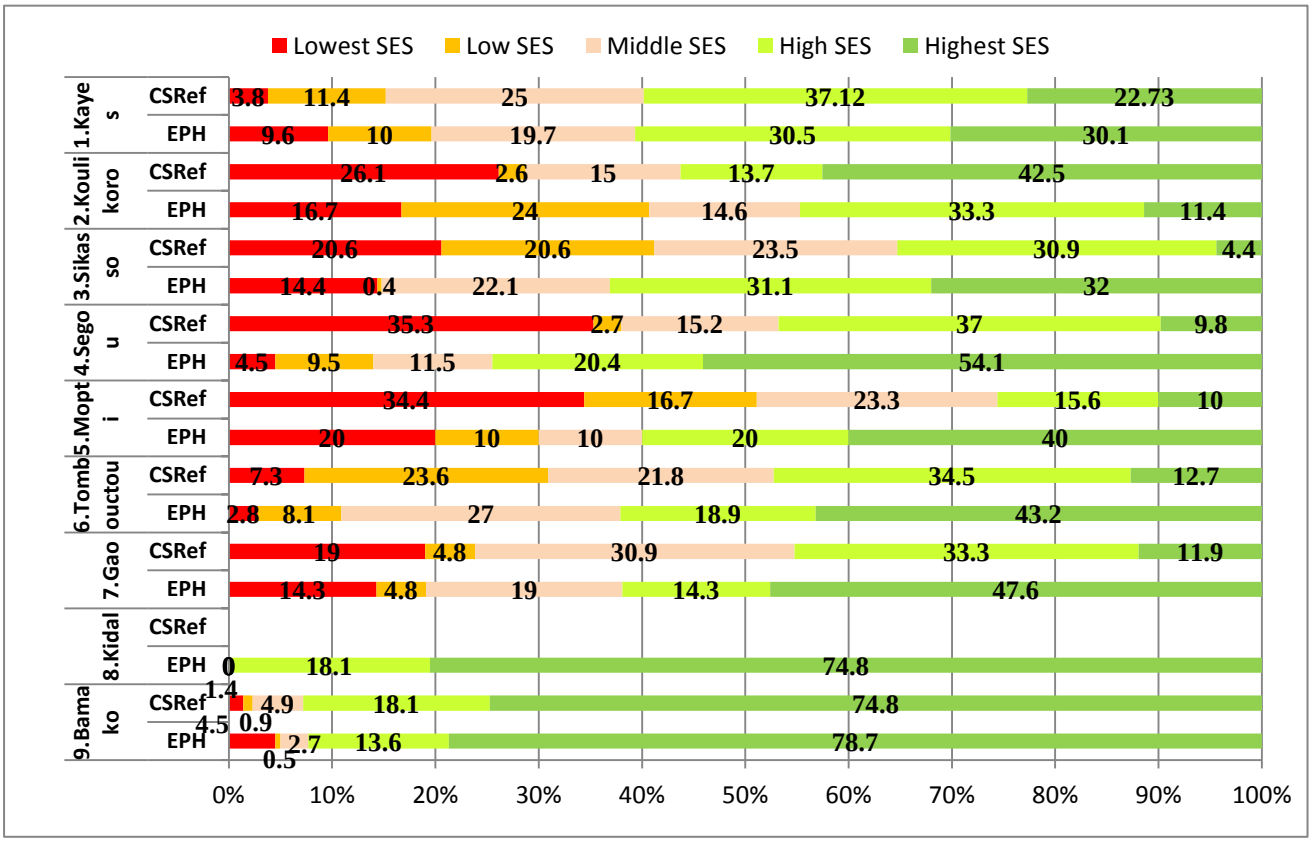


Table 4. 5 Cesarean delivery rate by quintile and region

CESAREAN DELIVERY										
	Lowest SES		Low SES		Middle SES		High SES		Highest SES	
	Frequency	Percent %	Frequency	Percent %	Frequency	Percent %	Frequency	Percent %	Frequency	Percent %
Kayes	29	7.6	40	10.5	82	21.5	125	32.8	105	27.6
Koulikoro	56	22.5	27	10.8	37	14.9	53	21.3	76	30.5
Sikasso	46	15.9	15	5.2	65	22.4	90	31.0	74	25.5
Segou	74	21.5	20	5.8	47	13.7	100	29.1	103	29.9
Mopti	36	32.4	17	15.3	23	20.7	18	16.2	17	15.3
Tombouctou	5	5.4	16	17.4	22	23.9	26	28.3	23	25
Gao	17	16.2	5	4.8	25	23.8	23	21.9	35	33.3
Kidal	0	0	0	0	0	0	2	15.4	11	84.6
Bamako	19	2.1	7	0.8	39	4.4	151	16.9	676	75.8
NORMAL DELIVERY										
Kayes	7	7.7	3	3.3	9	9.9	24	26.4	48	52.7
Koulikoro	106	46.3	31	13.5	32	14	58	25.3	2	0.9
Sikasso	88	43.6	40	19.8	23	11.4	51	25.2	0	0
Segou	171	69	8	3.2	46	18.5	22	8.9	1	0.4
Mopti	17	13.3	41	32.0	44	34.4	17	13.3	9	7.0
Tombouctou	1	1.6	4	6.2	24	37.5	34	53.1	1	1.6
Gao	4	8.5	4	8.5	33	70.2	6	12.8	0	0
Kidal	-		-		-		-		-	
Bamako	0	0	0	0	10	2.1	32	6.6	440	92.3

Table 4. 6 Normal and cesarean delivery by wealth quintile

	Normal delivery		Cesarean delivery		Total delivery	
	Frequency	**Percent %**	**Frequency**	**Percent %**	**Frequency**	**Percent %**
Highest SES	501	33.6	1,120	45.2	1,621	40.9
High SES	244	16.4	588	23.7	832	21.0
Middle SES	221	14.8	340	13.7	561	14.1
Low SES	131	8.8	147	5.9	278	7.0
Lowest SES	394	26.4	282	11.4	676	17.0
Total	1,491	100	2,477	100	3,968	100

In Table 4.5, comparing the cesarean delivery and the normal delivery by quintile and region, in all regions (except Mopti), the cesarean rate was significantly predominant among either the highest or the high SES group. On the other hand, the normal delivery was significantly important among the poorest and the poor household in only 4 regions: Koulikoro, Sikasso, Segou and Mopti.

The Table 4.6 showed that, generally the cesarean rate was high first among the richest then the rich household. Even though the normal delivery rate was higher than the cesarean rate among the poorest and the poor SES group, it was still lowamong the richest and the rich SES group.

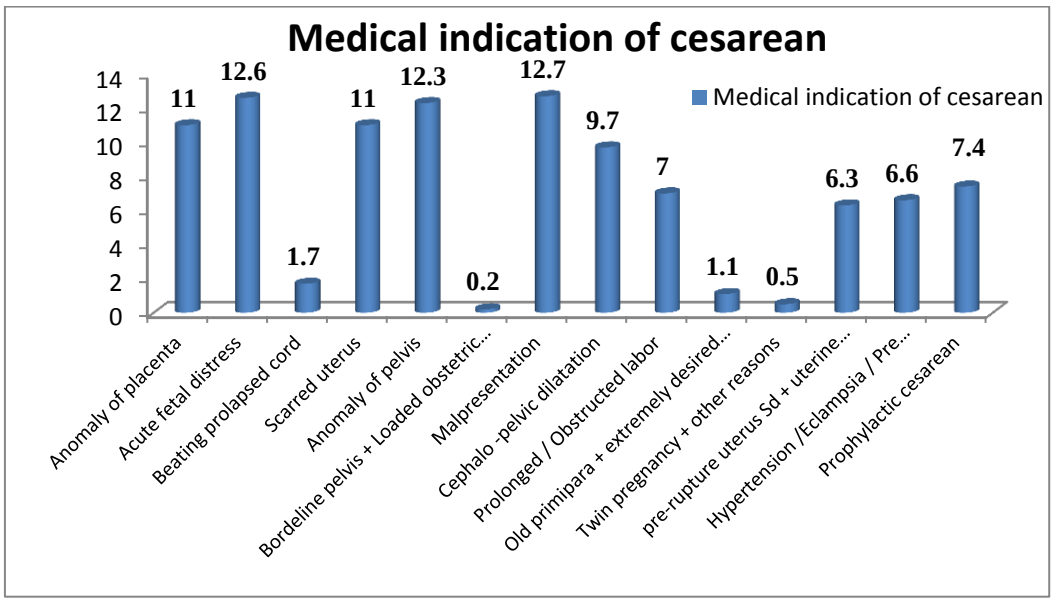
4.2. Medical factors of cesarean

4.2.1. Medical indications of cesarean

The five main indications of cesarean are respectively acute fetal distress (12.6 %), contracted pelvis and cephalo pelvic disproportion (9.7 %), prophylactic cesarean (7.4 %) and bi-scarred uterus (7.3 %; see Appendix I.).

By grouping some indications together in the same category such as all the abnormal presentation together, all anomaly of placenta and pelvis together and all the scarred uterus in the same group, the Figure 4.2 showed that the five main indications are the malpresentation 12.7 % (with a predominance of breech presentation), acute fetal distress 12.6 %, anomaly of pelvis 12.3 % (with a predominance of contracted pelvis), anomalies of placenta 11.0 % (with a majority of abruption placenta) and scarred uterus or repeated cesarean 10.1 %.

Figure 4. 2 The different medical indications of cesarean



4.2.2. Emergency and elective cesarean by regions, admission and facility type

By grouping all the medical indications of cesarean in two categories (emergency and elective cesarean) according to regions (Table 4.7), I observed that even though the total number of elective cesarean was higher than the emergency one in the total of all regions, five regions out of nine (Kayes, Mopti, Tombouctou, Gao, Bamako) have more emergency cesarean than elective one. Theproportion of elective cesarean was also greater than the emergency one inthe health facilities.

Table 4. 7 Emergency and elective cesarean according the regions

	Emergency Cesarean		Elective Cesarean		Total Cesarean	
Regions	**Number**	**Percent %**	**Number**	**Percent %**	**Number**	**Percent %**
1: Kayes	161	16.8	220	14.5	381	15.4
2: Koulikoro	73	7.6	176	11.6	249	10.1
3: Sikasso	80	8.3	210	13.9	290	11.7
4: Segou	121	12.6	220	14.5	341	13.8
5: Mopti	58	6.1	52	3.4	110	4.5
6:Tombouctou	41	4.3	51	3.4	92	3.7
7: Gao	59	6.2	46	3.0	105	4.3
8: Kidal	5	0.5	8	0.5	13	0.5
9: Bamako	**361**	**37.6**	**530**	**35.0**	**891**	**36.0**
Total	**959**	**100**	**1513**	**100**	**2472**	**100**

The Table 4.8 shows that among the evacuated women (from a CSCom to either a CSRef or EPH), the majority had an emergency cesarean. However when they were referred, most of them had an elective cesarean. When they came by themselves, the majority of them delivered normally.

Table 4. 8 Emergency and elective cesarean by the mode of admission

	Normal Delivery		Emergency cesarean		Elective cesarean	
	Number	Percent %	Number	Percent %	Number	Percent%
Referral	2	0.5	80	21.6	289	77.9
Evacuation	3	0.3	537	52.1	490	47.6
Came by themselve	1,430	57.8	332	13.4	714	28.8
Others[1]	49	96.0	1	2.0	1	2.0

[1]Others correspond to women who were referred by trained medical birth attendant women.

4.2.3. Socio-economic, and demographic factors by mode of delivery

There are more elective cesarean (38.1 %) than normal delivery (37.8 %) and more normal delivery than emergency cesarean (24.1 % (see Appendix J.)). There is not too much difference between the mean age of those three categories of delivery mode (around 25-26 years old). The majority of womenwho delivered normally, or by elective cesarean were either [20-24] years old or came by themselves (respectively 96.4 % and 47.8 %) or had two-three parities (respectively 34.2 % and 36.2), whereas, most women who have emergency cesarean were either [25-29] years old or were evacuated (56.5 %) or were uniparous (30.4 %). No matter the type of delivery mode, the majority of women was uneducated and unemployed ,in Bamako region and belonged to the highest SES group. Further, The most women who delivered naturally, came by foot (32.7 %), whereas the majority of those who had elective cesarean, came by taxi (32.7 %) and the most that had emergency delivery came by ambulance (41.89 %). The three main cesarean indications for elective cesarean are contracted pelvis (15.71 %), cephalo-pelvic dilatation (15.0 %) and bi-scarred uterus (12 %). The three main indications for emergency cesarean are acute fetal distress (32.3 %), abruptio placenta (17.0 %) and pre-rupture uterine syndrome / uterine rupture (respectively 8.1 %). The mean for transportation cost was more expensive for

those who had emergency cesarean (US $ 12.32) than elective cesarean (US $ 10.64) and the cheapest for those who delivered naturally (US $ 4.40).

4.3. Factors affecting C-section among low and high SES group

4.3.1. Relationship between cesarean and non-medical factors

4.3.1.1 Binomial probit for factors affecting C-section

To analyze the relationship between cesarean and non-medical factors affecting the probability of receiving cesarean, a probit model was used as defined in chapter III Model 1 ($Y_{A0i} = \beta_0 + \beta 1$ Reg + β_2Ocm_for +β_3 Age + β_4 Age2 + β_5Edu + β_6 Bor + β_7Quin + β_8 Trc3 + β_9Obsr + β_{10}Mef + εi with $\mathbf{Y_{A0i}}$ = **"Ces"**); to estimate the values of coefficients and others indicators. The result was listed below.

Table 4. 9 Probit regression for factors affecting C-section (all variables)

Log likelihood = 1.9095446				Prob > chi2 = 0.0000		
LR Chi (7) = 62.57				Pseudo R2 = 0.9425		
Ces	**Coef**	**Std. Err**	**Z**	**P. |Z|**	**[95 % Conf.**	**Interval]**
_Ireg_2	(omitted)					
_Ireg_3	174.7444					
_Ireg_4	203.0103	12210.38	0.02	0.987	-23728.89	24134.91
_Ireg_5	8.733653	3639.058	0.00	0.998	-7123.69	7141.157
_Ireg_6	(omitted)					
_Ireg_7	(omitted)					
_Ireg_8	(omitted)					
_Ireg_9	(omitted)					
_Iocm_for_2	(omitted)					
_Iocm_for_3	(omitted)					
_Iocm_for_4	(omitted)					
age	7.591283	398.0278	0.02	0.985	-772.5288	787.7114
age2	-0.1408552	7.707365	-0.02	0.985	-15.24701	14.9653
_Iedu_1	(omitted)					
_Iedu_2	(omitted)					
_Iedu_3	(omitted)					
_Iedu_4	(omitted)					
bor	-1.642229	74.20615	-0.02	0.982	-147.0836	143.7991
quin	-8.896425	290.285	-0.03	0.976	-577.8445	560.0516
trc3	0.058852	3.516497	0.02	0.987	-6.833356	6.95106
_Iobsr_3_1	(omitted)					
_Iobsr_3_2	(omitted)					
_Imef_1	(omitted)					
_Imef_2	(omitted)					
_cons	-388.4354	19304.17	-0.02	0.984	-38223.92	37447.05

The table 4.9 showed that all regions (Reg), mother occupation (Ocm_for) and education (Edu), number of obstetricians (Obsr_3) and medical indications (Mef) as dummy variables were omitted. In addition, all the remaining independent variables are insignificant. A correlation test will be made between the omitted variables to see how those omitted variables are correlated.

Table 4. 10 Correlation test among some independent variables

correlate regocm_foredumef obsr_3 ces
(obs=3584)

reg	ocm_for	edu	mef	obsr_3	ces
reg	1.0000
ocm_for	0.0336	1.0000
edu	0.2429	0.1276	1.0000
mef	0.0032	0.0286	0.0918	1.0000
obsr_3	0.4890	0.1063	0.1679	0.5161	1.0000
ces	0.0230	0.0319	0.1000	**0.8988**	0.5783	1.0000

From the table 4.10 there is a strong correlation between Mef and Ces (0.89), then a weak correlation between Mef and Obsr_3 (0.51), and between Ces and Obsr_3 (0.58). So Mef will be excluded to see if there is any change in the regression.

After doing the second regression (without Mef as variable: $Y_{A0i} = \beta_0 + \beta_1 Reg + \beta_2 Ocm\_for + \beta_3 Age + \beta_4 Age2 + \beta_5 Edu + \beta_6 Bor + \beta_7 Quin + \beta_8 Trc3 + \beta_9 Obsr + \varepsilon_i$), a significant result is obtained (see Appendix K.). The R^2 was 0.7434, meaning that 74.65 % of independent variables can explain for dependent variable. The P-value of F-test (0.000 %) is significant, meaning that there is some relationship between the dependent variable and all the independent variables together. Further, there is no strong correlation ($\geq$ 0.8) among all the variables. Therefore no strong inter-correlation was observed between two variables (see Appendix K.).

On the other side, by replacing Ocm_for (mother occupation) by Ocf_fiv (occupation of the father) in the equation ($Y_A'_{0i} = \beta_0 + \beta_1 Reg + \beta_2 Ocf\_fiv + \beta_3 Age + \beta_4 Age2 + \beta_5 Edu + \beta_6 Bor + \beta_7 Quin + \beta_8 Trc3 + \beta 9\ Obsr + \varepsilon i$), all dummy variables for Ocf_fiv are insignificant, meaning that occupation of the father didn't influence the likelihood of having cesarean (Appendix L.).

4.3.1.2 Interpretetaion of coefficients of variables

It is found that, region; occupation and education of the mother, number of obstetricians in facilities, quintile, transportation cost and age of the mother are the factors affecting the likelihood of receiving cesarean in public health facilities in Mali

- For dummy independent variables(Table 4.11. or Appendix K.)

The probit regression for cesarean showed that, the region was a factor that affected the cesarean rate. The coefficients for regions 5, 6, 7, 9 were respectively -1,3274; -6.2081; -7.5881; -1.6294 and significant (p<5%). It means that, by comparison with the region 1 (Kayes), when the number of women (who delivered at the selected health facilities) in the region 5 (Mopti), the region 6 (Tombouctou), the region 7 (Gao) and the region 9 (Capital Bamako) rises by one unit, keeping other independent variables constant, the cesarean rate will decrease by their respective coefficients. In other words, for one more woman who delivers, the cesarean rate will be the smallest respectively in Gao (region7), Tombouctou (region 6) and highest in Mopti (region 5) and Bamako (region 9).

Besides the p-value of region 2 (Koulikoro), region 3 (Sikasso) and region 4 (Segou) are insignificant (> 5%); meaning that they are not different from region 1 (Kayes). The cesarean rate rather increases in those regions (Reg 1, 2, 3, 4).

The occupation of the mother was also a factor affecting C-section rate. Only the p-value of "Ocm_for_2" is significant and its coefficient is 1.0016. It means that, by comparison with "Ocm_for_1" (unemployed group), when the number of women in officer group (Ocm_for_2) increases by one unit, keeping other independent variables constant, the cesarean rate will rise by 1.0016. Therefore the officer women (employees, technicians, administrators or health personnel ("Ocm_for_2" group)) are more likely to experience an increase in cesarean rate. However the p-value of self employed women (unskilled manual work group (Ocm_for 3) and tradeswomen (Ocm_for 4)) is insignificant. It means that self-employed group and jobless group are not different and have a lower cesarean rate.

Regarding the mother's education, it was another factor affecting the rate of C-section. Solely "Edu_1" (primary education) and "Edu_4" (other education: Koranic (see Appendix G.)) are significant with p-value ≤ 2%. The meaning is that, in

comparison with the non-educated group (Edu_0), when women with primary education or koranic education augment by one unit, the rate of cesarean will rise respectively by 0.3554 and 1.460. So when women have no education or low level of education, she is more likely to increase the cesarean rate. On the other side Edu_2 (secondary education) and Edu_3 (tertiary education) are insignificant but Edu_2 seems closer to Edu_0 (without education) because it is more insignificant. So, it means that women, who have either no education (Edu_0) or low education, have higher cesarean rate than those with high education (Edu_3).

Table 4. 11 Effect of predators variables on cesarean with their signs

Independent variables			Coefficient	Effect on Cesarean	Obtained sign	Expected sign
DUMMY VARIABLES						
REGIONS	**Significant**	***Reg_5***	-1.3274 *** [1]	Reduce	-	+
		Reg_6	-6.2081 ***	Reduce	-	_
		Reg_7	-7.5881 ***	Reduce	-	-
		Reg_9	-1.6294 ***	Reduce	-	+
	Insignificant	***Reg_2***	0.1074	Increase	+	-
		Reg_3	-0.0052	Increase	+	-
		Reg_4	0.2541	Increase	+	+
		Reg_8	(Omitted)	Increase	+	-
Mother occupation	**Significant**	***Ocm_for_2***	1.0016 **	Increase	+	+
	Insignificant	***Ocm_for_3***	0.0490	Reduce	-	+/-
		Ocm_for_4	0.1116	Reduce	-	+/-
Father occupation	**Insignificant**	***Ocf_fiv_2***	0.3887	No effect	0	+
		Ocf_fiv_3	0.9346	No effect	0	+/-
		Ocf_fiv_4	0.1490	No effect	0	+/-
		Ocf_fiv_5	-0.0640	No effect	0	+/-

Independent variables			Coefficient	Effect on Cesarean	Obtained sign	Expected sign
Obstetricians	**Significant**	***Obsr_3_1s***	3.9341 ***	Increase	+	+
		Obsr_3_2	5.6692 ***	Increase	+	+
Mother Education	**Significant**	***Edu_1***	0.3554 *	Increase	+	+
		Edu_4	1.4600 ***	Increase	+	
	Insignificant	***Edu_2***	0.0934	Increase	+	+/-
		Edu_3	-0.4586	Reduce	-	-
CONTINUOUS VARIABLES						
Age	**Significant**	***Age***	-0.0784 *	**Between [13-25] years:** Reduce	-	-
Age squarre	**Significant**	***Age2***	0.0016 *	**More 25 years:** rise	+	+
Transportation cost	**Significant**	***Trc3***	0.0065 ***	Increase	+	+
Parity	**Insignificant**	***Bor***	-0.0096	No effect	0	-
Quintile	**Significant**	***Quin***	0.1185 ***	Increase	+	+
Constant	**Significant**		-1.5622 **			

[1] * = P <0.05 ; ** = P < 0.01 ; *** = p < 0.001

The last dummy variable which is the number of obstetricians in the health facilities (Obsr_3_1 and Obsr_3_2) is significant. It means that, by comparison with Obsr_3_0 (less or equal to two obstetricians), when the number of obstetricians increases by one unit either in Obsr_3_1 group (3 or 4 obstetricians) or Obsr_3_2 group (more than 4 obstetricians), the rate of cesarean will increase respectively by 3.9340 and by 5.6692. So the more the number of obstetricians increases, the higher is the cesarean rate.

- For continuous independent variables(Table 4.11 or Appendix K.)

The quintile (Quin) variable can affect the cesarean rate because its p-value is significant (0 %). That means when the quintile augments by one unit, the cesarean rate will rise by 0.118. So more richer is a woman, the more likely she is to contribute to the increase cesarean rate.

Concerning the transportation cost (Trc3), which is significant, when it goes up by one unit, the rate of cesarean will increase by 0.0006, So the more expensive is the transportation cost, the higher is the cesarean rate.

- Explanation of Age and age square

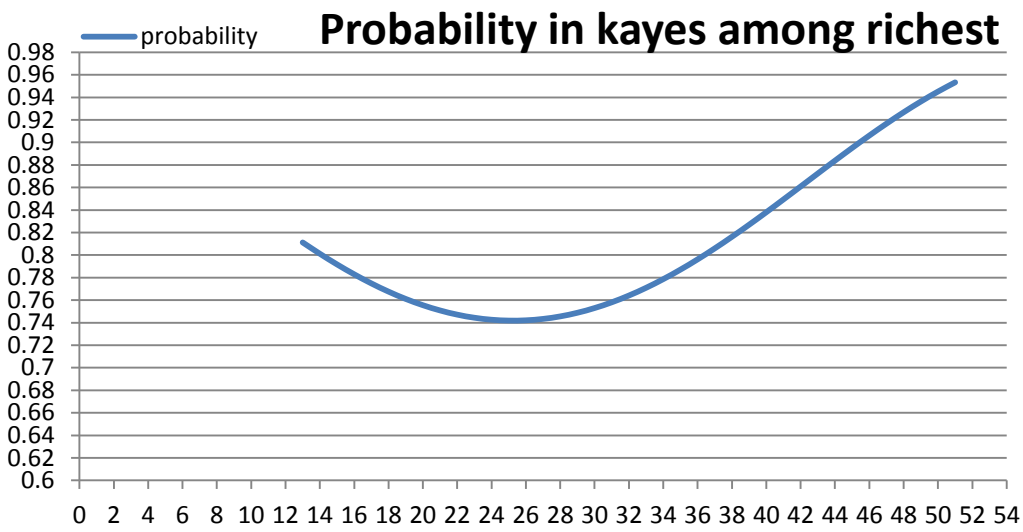
The relationship between age, age square and the rate of cesarean was significant with p-value< 7 %. So when the age goes up by one unit, the probability of having C-section will reduce by 0.0784. The coefficient of age square is positive (0.0015526). It means that, firstly the cesarean rate decreases until a minimum age; and then after that minimum age, it begins to increase.

To determine the minimum age point, firstly the minimum age of a specific group of women need to be defined. Therefore some characteristics of that specific group of women, need to be set up. Let assume that the specific group has those characteristics: a mean parity of 3, a mean transportation cost of 4085.358 FCFA, 5 as quintile (richest group), living in region 1 (Kayes), without occupation and education and with less than 3 obstetricians (Obsr_3_0) in health facilities. Secondly the Z-score of that specific group and their probability of receiving cesarean will be computed by their age. Finally a graph will be drawn to see the trend and find out the minimum age.

From the Table 4.12, in the group of women living in the Kayes region, without education and occupation, belonging to the richest household, a thirteen year-old woman has the highest probability of receiving cesarean (81.12 %). Then that probability decreases until 74.19 % for a 25 year-old woman (25 years old is the minimum age). Beyond the age 25 this probability increases again until reaching 95. 33 % for a 51 year-old women.

In Appendix M., the chart shows the effect of age on cesarean probability of women living in Kayes and Bamako region (without education and jobless) according to the SES level (richest and poorest). Compare to Kayes, in Bamako, a richest thirteen year-old and fifty one year-old woman has a lower probability of receiving cesarean (respectively 22.75 % and 51.93 %).

Table 4. 12 Cesarean probability by age in Kayes among the richest



4.3.1.3 Comparison of all independent variables signs with the expected sign

The Table 4.11 showed a comparison on the obtained sign (from the regression) and the expected sign (from the literature review) that I will describe in more detail in the discussion chapter.

In Bamako and Mopti (main regions) the C-section rate is rather reduced. But this reduction is higher in Tombouctou (Reg_6) and Gao (Reg_7) which have the same sign with the literature review.

For the mother's occupation, and education, the same sign as in the literature review (the rise of C-section) is observed among primary and koranic education (in comparison with illiterate women) and officer women (compare to unemployed women). The same positive sign is observed with the SES level and the age of women.

4.3.1.4 Marginal effect with explanatory variables

From Table 4.10 and Table 4.13, Women in Reg_5 (Mopti), Reg_6 (Tombouctou), Reg_7 (Gao) and Reg_9 (Bamako) have (respectively 36.95 %, 95.02 %, 95.42 % 34.69 %) a higher probability of receiving normal delivery than cesarean. In addition by ranking them, Bamako has the lowest probability of receiving normal delivery (34.69 %), followed by Mopti, Tombouctou and Gao (85.42 %). In other word, by comparison with Tombouctou (Reg_6) and Gao region (Reg_7), a woman in Bamako has a higher probability of getting cesarean.

Table 4. 13 Marginal effect after cesarean probit regression

Variables	dy/dx	Std Err	Z	P›IZI	[95% CI]		x
Ireg_2*	0.0152763	0.02482	0.62	0.538	- 0.033363	0.063916	0.122316
Ireg_3*	- 0.0007793	0.02777	- 0.03	0.978	- 0.055201	0.035643	0.132486
Ireg_4*	0.0336543	0.02129	1.58	0.114	- 0.00807	0.075378	0.140678
Ireg_5*	- 0.3694792	0.07515	- 4.92	0.0000	- 0.516768	- 0.222191	0.064689
Ireg_6*	- 0.9501738	0.0114	- 83.36	0.0000	- 0.972516	- 0.927832	0.040395
Ireg_7*	- 0.9542279	0.00879	-	0.0000	- 0.971453	- 0.937003	0.038418
Ireg_8	(Omitted)		108.58				
Ireg_9*	- 0.3469246	0.0765	- 4.54	0.0000	- 0.496854	- 0.196996	0.343503
IOcm_for_2*	0.0791304	0.01791	4.42	0.0000	0.044026	0.114234	0.04548
IOcm_for_3*	0.007162	0.0279	0.26	0.797	- 0.047511	0.061841	0.052542
IOcm_for_4*	0.0156625	0.03358	0.47	0.641	- 0.050145	0.08147	0.052825
Age	- 0.0118132	0.00684	- 1.73	0.084	- 0.025227	0.0016	25.6661
Age2	0.0002338	0.00012	1.88	0.06	- 9.50E+06	0.000477	706.701
I edu_1*	0.0457154	0.01443	3.17	0.002	0.017438	0.03992	0.181356
I edu_2*	0.0133195	0.03002	0.44	0.657	- 0.045525	0.072164	0.082486
I edu_3*	- 0.0910856	0.12572	- 0.72	0.469	- 0.337483	0.155312	0.037853
I edu_4*	0.0817031	0.01538	5.31	0	0.051551	0.111855	0.011582
bor	- 0.0014439	0.00408	- 0.35	0.723	- 0.009435	0.006547	3.48842
quin	0.0178543	0.00556	3.21	0.001	0.006961	0.028748	3.58842
trc3	0.0000973	0.0001	7.06	0	0.00007	0.000124	3975.23
Iobsr_1*	0.2350446						0.171186
Iobsr_2*	0.4442373	0.03725	11.93	0	0.371236	0.517239	0.221469

Regarding the profession, whereas the officers women (employees, technicians, administrators or health personnel women ("Ocm_for_2")) have a higher probability of getting cesarean instead of normal delivery (PR of Ocm_for = 79.13 %), the self-employed (Ocm_for 3. Ocm_for 4) and unemployed women (Ocm_for_0) have a higher probability of receiving normal delivery than cesarean.

For the mother's education, the uneducated women, and the women with primary, secondary and koranic education have a higher likelihood of receiving cesarean than those with high education. Furthermore, the higher is the number of obstetricians in the health facilities, the greater is the probability (PR of Obsr_3_2 = 44.42 %) of having cesarean.

Besides, the older or very younger a woman is (over 25 years old or less or equal to 13 years old), the greater is her probability (PR of age = -0.02) of receiving cesarean. The richer is the woman's family, the higher is her probability (PR of Quin = 17.85 %) of getting C-section. And the higher is the transportation cost, the greater is her probability (PR of Trc3 = 0.01 %) of receiving C-section, but this probability is very low.

4.3.2. The interaction terms between the independent variables

By crossing some significant independent variables between them (and see their significance) to evaluate the effect of one predictor on the response on cesarean on another predictor, it is found that the following predictors interact between each other on cesarean:

- Quintile (Neil et al.) # Education (i.Edu)
- Quintile (Neil et al.) # Region (i.Reg)
- Quintile (Neil et al.) # Mother occupation (i.Ocm_for)
- Number of delivery (i.Borr) # Region (i.Reg)

By using a regression with all the 4 interactions terms($Y_{A1i}= \beta_0 + \beta_1$Reg + β_2Ocm_for +β_3 Age + β_4 Age^2 + β_5Edu + β_6Bor+β_7Quin + β_8 Trc3 + β_9Obsr + β_{10}(Quin * Edu) + β_{11}(Quin * Reg) + β_{12}(Quin * Ocm_for) + β13(Borr * Reg with $\mathbf{Y_{A1i}}$ = **"Ces"**) +εi, the Table 4.14 (see also Appendix N.) is obtained.

Table 4. 14 Interaction terms on cesarean and their signs

Cross terms		Coefficients			Effect on cesarean (ces) Probability (pr)			
Socio-economic status # Region	**Quin* Reg**	**α* Reg**	**β * Reg * Quin**	**α+β**	**When there is no change in Quintile**		**When there is a change in Quintile**	
	1 5	-2.807	2.0743 **[1]	-0.7325	*If change in other SES group*	**Lower** pr of receving ces	*If change in poorest SES group*	**Higher** pr of receiving ces
	3 4	1.000	-2.3213 *	-1.3212	*If change in other SES group*	**Higher** pr of receiving ces	*If change in middle SES group*	**Lower** pr of receving ces
	3 6	-0.537	-7.0943 ***	-7.6311	*If change in other SES group*	**Higher** pr of receiving ces	*If change in middle SES group*	**Lower** pr of receving ces
Number of delivery # Region	**Borr* Reg**	a* Reg	b*Reg* Quin	a*b	When there is no change in Borr		When there is a change in Borr	
	0 5	-2.807	1.0550 *	-1.751	*If woman has > 1 child*	**Lower** pr of receving ces	*If woman has only 1 child*	**Higher** pr of receiving ces
	0 6	-0.537	-1.8030 *	-2.340	*If woman has > 1 child*	**Higher** pr of receiving ces	*If woman has only 1 child*	**Lower** pr of receving ces
	0 9	-2.476	1.1001 *	-1.376	*If woman has > 1 child*	**Lower** pr of receving ces	*If woman has only 1 child*	**Higher** pr of receiving ces
	1 6	-0.537	-3.1320 ***	-3.669	If woman has <2 or >3 kids	**Lower** pr of receving ces	*If woman have 2 or 3 children*	**Higher** pr of receiving ces
	1 9	-2.476	0.9610 *	-1.515	If woman has <2 or >3 kids	**Lower** pr of receving ces	*If woman have 2 or 3 children*	**Higher** pr of receiving ces
	2 6	-0.537	-2.331 *	-2.868	If woman has <4 or >5 kids	**Higher** pr of receiving ces	*If woman have 4 or 5 children*	**Lower** pr of receving ces

[1] * = P <0.05 ; ** = P < 0.01 ; *** = p < 0.001

The R^2 was 0.8063, meaning that it is a good model and 80.63 % of independent variables can explain for dependent variable. The P-value of F-test (0.000 %) is significant, meaning that there is some relationship between the dependent variable and all the independent variables together (see Appendix N.).

Moreover a significant result was found between some dummy variables of quintile(Neil et al.) and region (Reg) and some dummy variables of number of delivery (Borr) and region (Reg).

4.3.2.1 Interaction term between quintile and Region

The dummy variables Quin_1 * Reg_5, Quin_3 * Reg_4 and Quin_3 * Reg_6 are significant (value < 5 %) with their respective coefficients 2.0743, -2.3213 and -7.0943. So it means that the change in quintile affects the cesarean likelihood but also depends on the region

So the interaction between Quin_1 (the poorest SES group) and Reg_5 (Mopti region) is: cesarean = α * Reg_5 + β * Reg_5 * Quin_1 with α = -2.8068. When there is no change in the Quin_1, the Reg_5 reduces the cesarean likelihood by 2.8068. However when the Quin_1 group change by one unit, the Reg_5 reduce less the cesarean probability by 0.7325 ($\alpha + \beta$ = -2.8068 + 2.0743).In other words, in Mopti region, the probability of receiving cesarean is lower when the change occurs in other SES group and higher when the change happens in the poorest SES group.

Then, the second interaction term is between Quin_3 (the middle SES group) and Reg_4 (Segou region): cesarean = α_1* Reg_4 + β_1 * Reg_4 * Quin_3 with α**1** = 1.00007. When there is no change in the Quin_3, the Reg_4increases the cesarean likelihood by 1.00007. However when the Quin_3 group change by one unit, the Reg_4 reduce the cesarean probability by 1.3212 ($\alpha_1 + \beta_1$ = 1.00007 - 2.3213). In other words, in Segou region, the probability of having C-section is higher when the change occurs in other SES group than the middle SES group.

The last interaction term is between Quin_3 (the middle SES group) and Reg_6 (Tombouctou region): cesarean = α_2* Reg_6 + β_2 * Reg_6 * Quin_3 with α_3 = -0.5368. When there is no change in the Quin_3, the Reg_6 reduce the cesarean likelihood by 0.5368. However when the Quin_3 group change by one unit, the Reg_6 reduce more the cesarean probability by 7.6311 ($\alpha_2 + \beta_2$ = -0.5368 - 7.0943). In other words, in Tombouctou region, the likelihood of getting cesarean is more when the change occurs in other SES group and less when it occurs in middle SES group.

4.3.2.2 Interaction term between parity and region

The dummy variables Borr_0 * Reg_5, Borr_0 * Reg_6, Borr_0 * Reg_9, Borr_1 * Reg 6, Borr_1 * Reg_9 and Borr_2 * Reg_6 are significant (value< 7 %) with their respective coefficients 1.0554; -1.8034; 1.1001; -3.1323; 0.961; and -2.331. So it means that the change in the number of delivery affects the cesarean likelihood but also depends on the region .

The first interaction term is Borr_0 (only one child) and Reg_5 (Mopti): cesarean =a_1 *Reg_5 + b_1 * Reg_5 * Borr_0 with a_1 = -2.8068. If there is no change in Borr_0, Reg_5 reduces the cesarean likelihood by 2.8068. But for one unit change in Borr_0, the effect of Reg_5 on the probability of getting cesarean islessreducedby1.7514 (a_1 + b_1 = -2.8068 + 1.0554). So in Mopti, a woman who has more than one child, has a lower probability of receiving C-section, but the one who has no child or only one, has a higher probability of getting cesarean.

The second interaction term is Borr_0 (only one child) and Reg_6 (Tombouctou): cesarean =a_2 *Reg_6 + b_2 * Reg_6 * Borr_0 with a_2 = -0.5368. If there is no change in Borr_0, Reg_6reduces the cesarean likelihood by 0.5368. But for one unit change in Borr_0, the effect of Reg_6 on the probability of getting cesarean ismore reduced by 2.3402 (a_2 + b_2 = -0.5368 -1.8034). So in Tombouctou, a woman who has more than one child, has a higher probability of receiving C-section, but the one who has no child or only one, has a lower probability of getting cesarean.

The third interaction term is Borr_0 (only one child) and Reg_9 (Bamako): cesarean =a_3 *Reg_9 + b_3 * Reg_9 * Borr_0 with a_3 = -2.476. If there is no change in Borr_0, Reg_9reduces the cesarean likelihood by 2.476. But for one unit change in Borr_0, the effect of Reg_9 on the probability of getting cesarean is less reduced by 1.376 (a_3 + b_3 = -2.476+ 1.1001). So in Bamako, a woman who has more than one child, has a lower probability of receiving C-section, but the one who has no child or only one, has a higher probability of getting cesarean.

The fourth interaction term is Borr_1 (2 or 3 children) and Reg_6 (Tombouctou): cesarean =a_4 *Reg_6 + b_4 * Reg_6 * Borr_1 with a_4 = -0.5368. If there is no change in Borr_1, Reg_6 reduces the cesarean likelihood by 0.5368. But

for one unit change in Borr_1, the effect of Reg_6 on the probability of getting cesarean is more reduced by 3.6691 ($a_4 + b_4$ = -0.5368 - 3.1323). So in Tombouctou, a woman who has more than one child and less than four, has a lower probability of receiving C-section than other parity group which has a higher probability.

The fifth interaction term is Borr_1 (2 or 3 children) and Reg_9 (Bamako): cesarean =a_5 *Reg_9 + b_5 * Reg_9 * Borr_1 with a_5 = -2.476. If there is no change in Borr_1, Reg_9 reduces the cesarean likelihood by 2.476. But for one unit change in Borr_1, the effect of Reg_9 on the probability of getting cesarean is less reduced by 1.515 ($a_5 + b_5$ = -2.476+ 0.961). So in Tombouctou, a woman who has more than one child and less than four, has a higher probability of receiving C-section than other parity group which has a lower probability.

The sixth interaction term is Borr_2 (4 or 5 children) and Reg_6 (Tombouctou): cesarean =a_6 *Reg_6 + b_6 * Reg_6 * Borr_2 with a_6 = -0.5368. If there is no change in Borr_2, Reg_6 reduces the cesarean likelihood by 0.5368. But for one unit change in Borr_2, the effect of Reg_6 on the probability of getting cesarean is more reduced by 2.8678 ($a_6 + b_6$ = -0.5368 - 2.3310). So in Tombouctou, a woman who has more than four child and less than six, has a lower probability of receiving C-section than other parity group which has a higher probability.

4.3.2.3 Interaction terms between occupation, education and quintile

Even though, some dummy variables for SES level(Neil et al.)# i.edu (education of the mother) and Quin # i.ocm_for (occupation of the mother) were significant when run separately. However when all the four interaction terms are run together, they are all insignificant.

4.3.3. Multinomial probit regression with medical factors as dependent variable

The second model will figure out the relationship between medical outcomes (as dependent variable) and the non-medical factors (as predictors variables). The medical outcomes are categorized into emergency cesarean, elective cesarean and

normal delivery (Mef variable). The following equation ($\mathbf{Y_{B0i}} = \beta_0 + \beta_1$ Age + β_2 Age^2+β_3 Obsr_3+ β_4Quin + β_5Bor + β_6Trc3 + β_7Edu + β_8Ocm_for + β_9 mode+ β_{10}Reg + εi with $\mathbf{Y_{B0i}}$**= "Mef"**) will be run to see that relationship. Because "Mef" variable has three outcomes (normal delivery. emergency delivery and cesarean delivery), a multinomial probit regression is run. Table 4. 15 shows the results.

4.3.3.1 Interpretation of multinomial probit results

The R2 is 0.5615, meaning that 50.16 % of independent variables can explain the dependent variable. The p-value of F-test (0.000 %) is significant . Therefore there is some relationship between the dependent variables and all the independent variables together. (Table 4.15).

Besides, the p-values of the following variables : regions (Reg 5, Reg6, Reg 7, Reg 8, Reg 9), mother education (Edu_1,Edu_4), quintile(Neil et al.), transportation cost (Trc3), number of obstetricians in health facilities (obsr_3_1, Obsr_3_2), mode of delivery (mode_1, mode_2) are significant ($p \leq 5$ %)

In the following regions: Mopti (Reg 5), Tombouctou (Reg 6), Gao (Reg 7), Kidal (Reg 8) and Bamako (Reg 9) women have more normal delivery than emergency cesarean and more emergency cesarean than elective cesarean. On the other side, in Kayes (Reg 1), Koulikoro (Reg 2), Sikasso (Reg 3), Segou (Reg 4) there are more elective cesarean than normal delivery and more normal delivery than emergency cesarean.

For the mother education, women with primary education (Edu_1) and koranic education (Edu_4), are more exposed to emergency cesarean than normal delivery and to more normal delivery than elective cesarean. As uneducated women, the low education (Edu_1, Edu_2 and Edu_4) are more exposed to emergency cesarean than to normal delivery and more normal delivery than elective cesarean.However women with high education (Edu_3) would have more normal delivery than elective cesarean and more elective cesarean than emergency delivery.

When the number of obstetricians increases, the transportation cost becomes more expensive and the SES level is higher, the women is more likely to have more elective cesarean than the emergency one and more emergency delivery than normal delivery.

For the delivery mode, women who were referred by health facility had a higher elective cesarean rate than normal delivery rate (in comparison with those who came by themselves) and a higher normal delivery rate than emergency cesarean rate. However women who were either evacuated by ambulance(mode_2), or referred by a trained birth attendant (mode_3) were more exposed to emergency cesarean than normal delivery and more normal delivery than to elective cesarean.

Table 4. 15 Multinomial probit with medical factors as dependent variable

Log likelihood = -1696.5212 **Prob> chi2 = 0.000**
Pseudo R2 = 0.5615

mef	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
normal_delivery (base outcome)						
EMERGENY						
_Ireg_2	-0.2822597	0.353602	-0.8	0.425	-0.9753069	0.410788
_Ireg_3	-0.2001632	0.3435122	-0.58	0.56	-0.8734347	0.473108
_Ireg_4	0.2701294	0.3207087	0.84	0.4	-0.358448	0.898707
_Ireg_5	-1.699234	0.3640099	-4.67	0.000	-2.41268	-0.98579
_Ireg_6	-7.677092	0.6044476	-12.7	0.000	-8.861787	-6.4924
_Ireg_7	-8.433519	2.225393	-3.79	0.000	-12.79521	-4.07183
_Ireg_8	-9.85403	0.6637288	-14.85	0.000	-11.15491	-8.55315
_Ireg_9	-2.542108	0.5191472	-4.9	0.000	-3.559617	-1.5246
_Iocm_for_2	0.9770748	0.7914059	1.23	0.217	-0.5740524	2.528202
_Iocm_for_3	0.1098969	0.4422103	0.25	0.804	-0.7568193	0.976613
_Iocm_for_4	0.2194051	0.4769123	0.46	0.645	-0.7153258	1.154136
age	0.0756308	0.0890385	0.85	0.396	-0.0988814	0.250143
age2	-0.0004739	0.0016104	-0.29	0.769	-0.0036302	0.002683
_Iedu_1	0.8126917	0.2226787	3.65	0.000	0.3762495	1.249134
_Iedu_2	0.576866	0.4116475	1.4	0.161	-0.2299483	1.38368
_Iedu_3	0.0390243	0.9423873	0.04	0.967	-1.808021	1.886069
_Iedu_4	2.259311	0.6081086	3.72	0.000	1.06744	3.451182
bor	-0.0474285	0.0551363	-0.86	0.39	-0.1554936	0.060637
quin	0.3550005	0.0661152	5.37	0.000	0.2254171	0.484584
trc3	0.0007883	0.0000491	16.06	0.000	0.0006921	0.000885
_Iobsr_3_1	4.819061	0.4219315	11.42	0.000	3.99209	5.646031
_Iobsr_3_2	8.55443	0.7545645	11.34	0.000	7.07551	10.03335
_Imode_1	3.558797	0.4564337	7.8	0.000	2.664203	4.45339
_Imode_2	5.017574	0.3963066	12.66	0.000	4.240827	5.794321
_Imode_3	0.4969191	0.6267168	0.79	0.428	-0.7314233	1.725261
_cons	-6.887409	1.233555	-5.58	0.000	-9.305132	-4.46969
	Coef.	Std. Err.	Z	P>z	[95% Conf.	Interval]
ELECTIVE						
_Ireg_2	0.3717056	0.3379612	1.1	0.271	-0.2906862	1.034097
_Ireg_3	0.2888163	0.3308547	0.87	0.383	-0.3596471	0.93728
_Ireg_4	0.6537241	0.3112825	2.1	0.036	0.0436215	1.263827
_Ireg_5	-2.039419	0.3583394	-5.69	0.000	-2.741751	-1.33709
_Ireg_6	-8.133733	0.5878291	-13.84	0.000	-9.285857	-6.98161
_Ireg_7	-9.42142	2.226562	-4.23	0.000	-13.7854	-5.05744
_Ireg_8	-10.81767		.	.	. .	.
_Ireg_9	-3.089943	0.5189669	-5.95	0.000	-4.107099	-2.07279
_Iocm_for_2	0.9958038	0.7897876	1.26	0.207	-0.5521513	2.543759
_Iocm_for_3	-0.1261691	0.4264653	-0.3	0.767	-0.9620257	0.709688
_Iocm_for_4	0.253567	0.4623635	0.55	0.583	-0.6526487	1.159783
age	0.0313265	0.0860221	0.36	0.716	-0.1372736	0.199927
age2	0.0001457	0.001558	0.09	0.925	-0.002908	0.003199
_Iedu_1	0.7860695	0.2131677	3.69	0.000	0.3682684	1.203871
_Iedu_2	0.2310886	0.4062065	0.57	0.569	-0.5650614	1.027239
_Iedu_3	0.039608	0.9411343	0.04	0.966	-1.804981	1.884197
_Iedu_4	2.005064	0.5889217	3.4	0.001	0.850799	3.159329
bor	-0.088839	0.0535913	-1.66	0.097	-0.193876	0.016198
quin	0.3720661	0.0626894	5.94	0.000	0.249197	0.494935
trc3	0.0008103	0.0000486	16.66	0.000	0.0007149	0.000906
_Iobsr_3_1	4.938203	0.4203676	11.75	0.000	4.114297	5.762108
_Iobsr_3_2	9.231139	0.7562212	12.21	0.000	7.748973	10.71331
_Imode_1	4.000259	0.4525472	8.84	0.000	3.113283	4.887236
_Imode_2	4.23246	0.3947437	10.72	0.000	3.458777	5.006143
_Imode_3	-0.6708291	0.8213646	-0.82	0.414	-2.280674	0.939016
_cons	-5.660909	1.188532	-4.76	0.000	-7.990389	-3.33143

4.3.3.2 Marginal effect between medical factors and non medical outcomes

From Table 4.16 and Appendix O., in Mopti (Reg 5) Tombouctou (Reg_6), Gao (Reg_7) and Kidal (Reg_8) , and Bamako (Reg_9), women have a higher probability of delivering normally (respectively 20.26 %, 99.23 %, 99.29 %, 98.61 % and 24.47 %) than by C-section and have a higher probability of receiving emergency cesarean than elective cesarean. Whereas illiterate women (Edu_0) and women with primary (Edu_1), secondary education (Edu_2)and koranic education (Edu_4)have a higher probability of receiving emergency cesarean than normal delivery and elective delivery; women with tertiary education have a lower probability of getting emergency cesarean (-0.02 %) and higher probability of delivering by elective cesarean (0.08 %).

The evacuated women in a health facility by ambulance, and women referred by a trained birth attendant have a higher probability of receiving emergency cesarean (respectively 25.65 % and 31.58 %) than normal delivery and elective one. In comparison with women who came by themselves to hospital, the referred women by health facilities have a higher probability of receiving elective cesarean (13.03 %) than normal delivery (-2.98 %) and emergency cesarean (-10.05 %). When the number of obstetricians increases, the probability of having elective cesarean is higher than having emergency delivery and normal delivery. In addition the more obstetricians a hospital has, the less is the probability of receiving emergency cesarean.

The more a woman has a high SES status, the most likely she is of receiving elective cesarean and the less likely she is of delivering normally. But the quintile variable is not significant. If the parity and age variables are significant, the more a woman has children or get older, the more likely she is to have emergency cesarean or normal delivery than elective cesarean. If mother's occupation is significant, an unskilled manual worker is more likely to have emergency cesarean than normal delivery and elective cesarean. An employee woman, is more likely to have elective cesarean then emergency cesarean and normal delivery And a tradeswoman, is more likely to get elective cesarean than normal delivery and emergency cesarean.

The transportation cost has a very low influence on the cesarean probability and when the transportation is expensive, the more likely is the women to have elective cesarean than emergency cesarean then normal delivery.. .

Table 4. 16 Marginal effects after multinomial probit regression

Independent variables		Normal delivery		Emergency cesarean		Elective cesarean		Ranking[1]		
		dy/dx	Std.Err	dy/dx	Std.Err	dy/dx	Std. Err	Normal delivery	Emergency delivery	Elective delivery
Dummy variables										
REGIONS	***Reg_2***	-0.0032	0.008	**-0.1616 *****	0.04	**0.1649 *****	0.04	2	3	1
	Reg_3	-0.0027	0.008	**-0.1237 *****	0.04	**0.1265 *****	0.04	2	3	1
	Reg_4	-0.0108	0.007	**-0.0950 ***	0.04	**0.1058 ****	0.04	2	3	1
	Reg_5	**0.2026 ****	0.080	0.0040	0.06	**-0.1986 ****	0.06	1	2	3
	Reg_6	**0.9923 *****	0.004	**-0.3769 *****	0.02	**-0.6155 *****	0.02	1	2	3
	Reg_7	**0.9929 *****	0.003	**-0.3718 *****	0.02	**-0.6211 *****	0.02	1	2	3
	Reg_8	**0.9861 *****	0.006	**-0.3784 *****	0.02	**-0.6078 *****	0.02	1	2	3
	Reg_9	**0.2447 ****	0.09	0.0299	0.08	**-0.2746 *****	0.08	1	2	3
Mother occupation	***Ocm_for_2***	**-0.0144 ***	0.007	0.0013	0.06	0.0131	0.06	3	2	1
	Ocm_for_3	0.0006	0.013	0.0641	0.06	-0.0647	0.05	2	1	3
	Ocm_for_4	-0.0058	0.009	-0.0066	0.05	0.0125	0.05	2	3	1
Mother Education	**Edu_1**	**-0.0160 ****	0.007	0.0142	0.03	-0.0018	0.03	2	1	3
	Edu_2	-0.0087	0.007	**0.0990 ***	0.05	**-0.0929 ***	0.05	2	1	3
	Edu_3	-0.0008	0.03	-0.0002	0.07	0.0006	0.07	3	2	1
	Edu_4	**-0.0153 ***	0.06	0.0770	0.10	-0.0617	0.09	2	1	3
Obstetricians	**Obsr_3_1**	-0.6519 *	0.02	0.0036	0.03	0.0688	0.03	3	2	1
	Obsr_3_2	-0.2664 ***	0.05	-0.0541	0.06	**0.3205 ***	0.06	3	2	1
Admission mode	**Mode_1**	**-0.0298 ***	0.01	**-0.1005 *****	0.03	**0.1303 *****	0.03	2	3	1
	Mode_2	**-0.1038 *****	0.03	**0.2565 *****	0.03	**-0.1527 *****	0.03	2	1	3
	Mode_3	0.013	0.02	0.3158	0.22	-0.3170	0.22	2	1	3
Continuous variables										
Age	**Age**	-0.0015	0.003	0.0125	0.01	-0.0110	0.01	2	1	3
Age square	**Age2**	$3.43*10^{-6}$	0.000	-0.0017	0.00	0.0002	0.00			
Parity	**Bor**	0.0020	0.002	0.0102	0.01	**-0.0123 ***	0.01	2	1	3
Quintile	**Quin**	-0.0106	0.004	-0.000013	0.01	0.0106	0.01	3	2	1
Transportation cost	**Trc3**	**-0.00002 ***	0.000	$4.24*10^{-6}$	0.0000	**0.00001 ***	0.00	3	2	1

[1] I order from 1 to 3 the probability to have each type of delivery mode according the variables with 1 = highest probability and 3 the lowest.

CHAPTER V
DISCUSSION

5.1. Overview of the results

The study find the majority of the women were 25 years old with a mean of 25.64 years. Most of them had at least 3-4children, were uneducated and unemployed. Whereas almost all women who delivered naturally came by themselves (96.6 %); among those who had cesarean, 42.8 % came by themselves and 42.0 % were evacuated (Table 4.2). The majority of women who came by themselves (57.8 %) delivered naturally. The majority of those who came by taxi (47.9 %) had an elective cesarean. However the majority of women who were evacuated (52.1 %) had an emergency cesarean and the most of those who were referred (77.9 %) had an elective cesarean (Table 4.8).

Among women who delivered naturally (Appendix J), 31.5 % (96.4 % * 32.7 %)came by themselves and by foot, 34.2 % had two-three parties and 26.0 % were between 20-24 years old. And among those who had elective cesarean, the highest frequency belongs to age group [20-24] with 36. 2 % who had two and three parities and 15.7 % who came by themselves and by taxi. And among those who had emergency cesarean, 23.7 % were evacuated by ambulance, 30.4 % were uniparous and 21.8 % belongs to age group [25-29].

Whereas the highest proportion of cesarean was among high SES group, mainly in Bamako and Kidal region; the normal delivery was significant in KoulikoroSikasso and Segou regions and among the poor SES group. Only Mopti region has a high cesarean rate among the poor SES group (Table 4.3 and 4.7). Moreover, in general, the total number of elective cesarean is higher than the emergency one except in Kayes, Mopti, Tombouctou, Gao and Bamako regions (Table 4.7)

For the medical factors, the common indications of cesarean are the malpresentation 12.7 % (with a predominance of breech presentation), the acute fetal distress 12.6 %, the pelvis anomaly 12.6 % (with a majority of contracted pelvis), the placenta anomaly 11.0 % (with more abruption placenta rate) and the repeated cesarean 10.1 % (Figure 4.2). The result is different from the literature review. (Tita,

2012) in his study found as main causes the dystocia (failure to progress and cephalopelvic disproportion), malpresentation, multi fetal pregnancy. A British/ America study found as main reasons repeated cesarean, followed by fetal distress or failure to progress and malpresentation (Neil et al., 2012; POST, 2002).

5.2. Factors affecting the probability of receiving C-section

5.2.1. Relationship between cesarean and non-medical factor of cesarean

The main finding from my data analysis are that region, mother occupation and education, number of obstetricians, age, the SES level and the transportation cost are the factor affecting the likelihood of receiving cesarean among Malian women in the public health facilities. The number of delivery (parity) and father occupation have no influence on that probability.

5.2.1.1 Region affecting cesarean probability

Even though the probability of having cesarean is reduced in all the 4 regions, women in Mopti and Bamako are more likely to receive cesarean than the ones in Tombouctou and Gao. Compared to a study by (Yassin & Saida, 2012) (Table II.4), the cesarean rate, in Mali doesn't increase in urban areas in the data set. It rather decreased in Bamako and Moptiregionin spite of the free cesarean policy. It means that the access to maternal health care is still a barrier in Mali, mainly in Tombouctou and Gao regions which benefit less from the free cesarean policy. Regarding to the others 5 regions (Kayes (1), Koulikoro (2), Sikasso (3), Segou (4), Kidal (5)), women have a higher probability of getting cesarean, meaning that those regions benefit more from the free cesarean policy than the remaining regions.

5.2.1.2 Mother occupation affectingcesarean probability

Compared to the unemployed and self-employed women, the probability of having cesarean increases in officer women group (employees, technicians, managers, administrators and health personnel).Result was similar in the literature review where a study found that non-working women have a lower probability of getting cesarean

than the employed women(Bolajoko Olusanya & Solanke, 2009). Therefore those officer women benefit more from the free cesarean policy than the unemployed, the unskilled manual work (agriculture, fishing, animal husbandry, artisans, servants…) and the tradeswomen.

5.2.1.3 Mother education affecting cesarean probability

The illiterate and low educated women (primary, secondary andkoranic education) are more likely to receive cesarean than the highly educated women. The same result was found in (Harrison, 2012)study where the illiterate women have a higher probability of having cesarean. Furthermore, women in koranic school group have a higher probability of receiving cesarean than women with primary education. So the less schooling a woman have, the more likely she is of having cesarean; and the less likely she is once she complete secondary school.

5.2.1.4 Number of obstetricians affecting cesarean probability

Regarding the number of obstetricians in the public health facilities, the more obstetricians there are, the greater is the cesarean likelihood. This might be explained by the fact that people or health personnel refer patients in the health facilities where there are more obstetricians. But it might also be due to physicians preference to perform more normal delivery with vacuum (if they have choice) than cesarean when they are few. One study confirmed it (Poma, 1999).

5.2.1.5 Mother's age affecting cesarean probability

The maternal age is also a factor which influences the cesarean likelihood. The very younger and older is a woman, the greater is her probability of receiving cesarean. In comparison with some articles, same results were found. (Herstad et al., 2012) that the older a woman is, the greater is her probability of receiving cesarean, mainly when she is over 35 years and elderly primipara. However in my study, the parity does not influence the cesarean rate and this higher probability increases steadily after 25 years old. One of the explanation for the high cesarean probability among the youngestwomenis that the majority of youngest women who delivered by cesarean have a restricted or immature pelvis as medical indications of cesarean. A

study (I.Teguete et al., 2012)confirmed this reason in their finding. They discovered that the contracted pelvis and acute fetal distress are the most common factors which lead to cesarean decision at national hospital point G in Mali, especially among the youngest.

5.2.1.6 Socio-economic status affecting cesarean probability

The socio-economic status is another factor which has effect on cesarean probability. The richer is her household, the more likely is the woman of having cesarean. Similar results are found with (Hopkins & Amaral, 1998): The higher is a woman income and her ability to pay, the greater is her probability of receiving cesarean. And as the USAID survey also found, the rich people benefit more from the free cesarean policy in Mali than the poor people(El-Khoury et al., 2011)

5.2.1.7 The transportation cost affecting cesarean probability

The transportation constitutes a big issue in the accessibility to maternal health facilities. The significance of the transportationshows that the higher the transportation cost is, the greater is the woman's probability of getting cesarean. And as the transportation is also linked to the distance (from the village to health facilities) and the nature of the roads, the longest is a distance, the more difficult is the access to the health facilities and the more exposed a woman is to the complication of pregnancy and delivery.

5.2.2. Relationship between interaction terms and cesarean probability

5.2.2.1 Interaction terms between region and SES group

- <u>Poorest SES group</u>

For the interaction term between region and the proxy wealth index, in Mopti region, the probability of receiving cesarean among the poorest is higher than in other SES group. Thereforethe free cesarean policy benefit really to the poorest group only in Mopti region.

- Middle SES group

In SegouandTombouctouregions, the middle SESgrouphave a lower probability of receiving cesarean than the poorest-poor group and the rich-richest group. So even though the free cesarean policy benefits more to the high-highest SES group than the poor-poorest group, in Segou and Tombouctou regions, the poor-poorest group seems to benefit more than the middle SES group.

5.2.2.2 Interaction terms between region and parity

- Tombouctou region (Reg 6)

Regarding the interaction term between Tombouctou region and the parity, it is found that whereas women who have either one parity or four-five parities have a lower likelihood of getting cesarean, those who have two-three parities or more than five have a higher probability or receiving cesarean.

- Bamako region (Reg 9)

Looking at the interaction term between Bamako region and the parity , it is found that women who have less than four parities have a higher probability of receiving cesarean than those who have more than three parities.

- Mopti region (Reg 5)

For the interaction term between Mopti region and the parity, women who have only one parity are more likely to receive cesarean than those who have more than one.

In summary, according to (Selma, 1994) and(Khawaja et al., 2004) studies, when the parity increases, the likelihood of receiving cesarean decrease. So only Bamako (Reg9) and Mopti (Reg5) follow this pattern (over 3 for Bamako and one for Mopti).But Tombouctou (6) does not. Further the parity has no effect on cesarean likelihood in the remaining regions (Kayes (Reg1), Koulikoro (Reg2), Sikasso (Reg3), Segou (Reg4), Gao (Reg7) and Kidal (Reg8)).

5.2.3. Relationship between medical outcomes and non-medical factors

The following non-medical factors: region, education, SES level, transportation cost, number of obstetricians in public health facilities, mode of admission have some relationship with the medical indications outcomes factors (normal delivery, emergency cesarean and elective cesarean).

Women in the regions, such as Mopti (Reg 5), Tombouctou (Reg 6), Gao (Reg7), Kidal (Reg8) and Bamako (Reg 9) are more likely to deliver normally than by cesarean. However when women could not deliver normally, they have a higher probability of emergency cesarean than elective cesarean. Except Bamako region (which is the capital) and Mopti (which is the second main city) similar results were found in (Ahmad & Mir, 2007) study where over 50 % of people who had emergency cesarean belonged to the rural areas. Therefore the government should promote normal delivery in health facilities and improve the management of emergency obstetrical care. (Fournier, Dumont, Tourigny, Dunkley, & Drame, 2009) revealed in their article that by improving maternal referral system, emergency obstetric care program, communication and ambulance transport, the quality and accessibility of comprehensive emergency obstetric care services will be better and the emergency cesarean rate and all the morbidity and mortality related to the delivery complications, will reduce and the quality of life of patients will be enhanced.

In Kayes (Reg1), Koulikoro (Reg2), Sikasso (Reg3), Segou (Reg 4), have the highest rate of elective cesarean and the lowest rate of emergency cesarean. So those regions are less exposed to the morbidity and mortality (intra and post-partum) associated with emergency cesarean. Probably because of their high rate of elective cesarean, those regionsbenefitmorefrom the free cesarean policy.

Moreover, the non-educated women and the low educated women (primary, secondary and koraniceducation) have the highest probability of emergency cesarean and the lowest probability of normal delivery. However the highly educated women have the opposite model (highest likelihood of normal delivery and lowest probability of emergency cesarean). It means that, people with lower education are less likely to access maternal antenatal care and to deliver in health facilities. (TollÅNes, Thompson, Daltveit, & Irgens, 2007) found a similar result where they showed that

the lower is the woman's education, the higher is her likelihood of receiving cesarean especially emergency cesarean. Therefore education of women should be promoted and prioritized until the tertiary level to improve birth outcomes.

When the number of obstetricians in health facilities increases, people are more likely to have elective cesarean than emergency cesarean. Therefore if government can supply maternal health facilities with enough qualified health personnel or obstetricians which can meet the patients 'demand, maternal health will improve.

Looking at the socio-economic status of women, the poorest group has the highest probability of getting emergency cesarean and the lowest probability of elective cesarean. (Gagnon, Merry, & Haase)found similar result in his study.Therefore the poor and poorest benefit less from the free cesarean policy, and are more exposed to emergency cesarean. This suggests that more health subsidy programs need to be implemented to favor the poorest in order to improve their accessibility to health care services.

Whereas people who were referred by health personnel, had the highest probability of elective cesarean and the lowest likelihood of emergency cesarean; those who were evacuated, had a highest probability of emergency cesarean and the lowest likelihood of normal delivery. An analogue finding was revealed in an article(Sorbye, Vangen, Oneko, Sundby, & Bergsjo, 2011)that the emergency women cases received more emergency cesarean than the elective women cases. On opposite side, the elective women cases had more elective cesarean than emergency women cases.Results suggest that preventive measure should be taken to limit or reduce the evacuated cases.

The influence of transportation cost on the medical indications outcomes is very low (PR for emergency cesarean = -1.2*10-6; PR for elective cesarean = 0.000015). When the transportation cost is higher, the probability of having elective delivery is the highest with the lowest chance to deliver normally. This is due to the fact that the majority of women who had emergency cesarean where evacuated by ambulance or others vehicles and did not pay any transportation fees. But the majority of those who had C-section came by themselves and paid out of pocket their transportation fees.

Compared to (Fakokunde et al., 2009) study where itwasfound that a higher parity and younger women (between 16 and 20 years old) had a higher likelihood of getting emergency cesarean than elective one, my study found that a woman with a higher parity have more likelihood of emergency cesarean (similar result) and the older women (minimum age 25) have a higher probability of elective cesarean (opposite result). However the age and the parity have insignificant p-value. The occupation of the mother also has insignificant p-value. It means that it among the age, the parity and the occupation of the mother,it was not possible to explain whichonesincreases the likelihood of emergency or elective cesarean.

CHAPTER VI
CONCLUSION AND RECOMMENDATIONS

6.1. Summary

Improving maternal and neonatal health condition is one of the major priority of Mali government. By implementing the free cesarean policy for all women delivering in public health facilities, the government was able to improve the maternal and neonatal health indicators. However, despite the free cesarean policy, maternal and neonatal death are still remaining high and the cesarean rate is still low 2.9 % (in comparison with the norm established by WHO [5-15 %]). Moreover, the free cesarean policy benefits more to the high SES group (rich) than the low SES group (poor) and financial barriers to access maternal antenatal care and delivery in health facilities remain a big challenge. In order to improve the health status of the mother, to help the poor SES group to benefit more from the government free cesarean policy, to promote delivery of women in the health facilities, This study is to contribute to the reduction of some barriers to women's access to maternal and neonatal health care.

My main objectives are to determine the non-medical factors affecting the probability of receiving cesarean among low and high SES group in public health facilities in Mali, then to analyze the relationship between medical indications outcomes and the non-medical factors of women. The results obtained were based on secondary dataanalysis.Data were collected from February to September 2010 in forty one randomly selected health facilities in all regions of Mali by a USAID funded survey.For the research design, the data set was an observational, descriptive and cross-sectional analysis.

Three thousand nine hundred and sixty eight women (3,968) delivering in the selected facilities were selected. They were evaluated on the socio-economic, demographic and medical factors affecting the cesarean rate. A proxy wealth index was also used to estimate their SES level and additional information about the transportation cost and number of obstetricians in health facilities wasalso used. Moreover, two models (one for binomial probit and the second for multinomial probit) were applied to identify firstly the factors affecting the cesarean rate and

secondly to explore the relationship between the medical indications outcomes and non-medical factors of women delivering in public health facilities in Mali.

The normal delivery was only in the selected CSCom and the C-section in the selected CSRef and hospitals with a high cesarean rate (62.4 %). There are more elective cesarean (61.2 %) than emergency cesarean. The highest recorded number was in Bamako region (34.6 %) and the lowest one in Kidal (0.3 %). The mean and medium age of women are around 25 years with a high frequency of normal and elective delivery among [20 – 24 years old] and high frequency of emergency delivery among [25 -29 years old]. The mean parity is around 3-4 children with a high predominance of emergency cesarean among uniparous group and high predominance of normal and elective delivery among the two-three parity group. The high proportion of women was uneducated, unemployed and belonging to the rich household.

Whereas the majority of women who came by themselves and by foot (31.5 %) delivered normally, the majority who came by themselves and by taxi (15.7 %) had elective cesarean and most of thosewho were evacuated by ambulance (23.7 %) had emergency cesarean. The majority of them directly arrived either from their home (64.3 %) or from CSCom (25.1 %). Except Mopti which recorded an important C-section rate among the poor group, the highest proportion of C-section was found among the high SES group, mainly in Bamako and Kidal. Furthermore, the main indications of cesarean are malpresentation (12.7 %), followed by acute fetal distress (12.6 %) and 12.3 % anomaly of pelvis (mainly among young women less than 20 years old).

6.2. Conclusion

The factors affecting the likelihood of receiving cesarean among women delivering in the public health facilities in Mali are region, age, occupation and education of the mother, the quintile, the number of obstetricians in public health facilities. The parity and the occupation of the father have no influence on it. There is no relationship between the mother’s occupation and age, the parity and the medical factors of delivery mode (normal, elective and emergency delivery).

The cesarean likelihood rather decreases in Bamako and Mopti (the main cities). Women in those regions and in Tombouctou and Gao are more likely to deliver normally; but they have also a higher probability of having emergency cesarean compared to Kayes, Koulikoro, Sikasso, Segouregions. Those regions benefit less from the free cesarean policy mainly Tombouctou, Kidal and Gao are more exposed to the complications associated to the emergency cesarean. The promotion of safe delivery in public health facilities mainly in those regions is important.

Education of the mother plays also an important role in the probability of having cesarean.The lower is the educational level; the higher is the probability of getting emergency cesarean and the lower is the probability to have normal delivery. Therefore girl's education at least up to secondary school must be promoted.

In the same way, for the occupation of the mother, the unemployed and the self employed benefit less from free cesarean policy. So financial barriers to acces health facilities remains a problem among those groups of women. Then more priority should be given to those groups for a better access to health facilities.

For the mother's age, the extremes ages (the younger and the older women) have a higher probability of receiving cesarean; and this probability increases steadily after 25 years old.

The quintile variable has a positive influence on the probability of having cesarean. The poorest and poor SES group has a highest probability of getting emergency cesarean and lowest likelihood of delivering normally. It means, while the rich and richest benefit more from the free cesarean policy, the poor and poorest are still having financial barriers to access maternal health care and are more exposed to morbidity and mortality (intra and post-partum) complications associated to emergency cesarean. This suggests that more policies are needed to favor the poor and poorest groups for improving their accessibility to health facilities and their health status.

The increase in the number of obstetricians is parallel with the rise of elective cesarean and the reduction of normal delivery. And as the transportation cost rises, the probability of having elective cesarean is higher and normal delivery is lower.

There is also a relationship between the admission mode and the medical factors. In comparison with the women who came by themselves, those ho are referred by health personnel have a highest likelihood of receiving elective cesarean and the lowest probability of emergency cesarean; those who are evacuated are more exposed to emergency cesarean and have a lowest chance to deliver normally. Consequently, the maternal referral system, the transportation system should be improved with the lowest time reduction of the referred and evacuated women.

Furthermore, regarding to the interaction terms, Only in Mopti region, the poorest benefit more from the free cesarean policy. In Segou and Tombouctou, even though, the poor and poorest benefit more from the free cesarean policy than the middle SES group, the rich and richest are still benefitting more than poor and poorest. On the other side, having less than four parities in Bamako and uniparous women in Mopti are more likely to have C-section; whereas those with four-five parities in Tombouctou are less likely to get cesarean.

6.3. Recommendations

In general, the poor and poorest women, the uneducated and low educated women, non-working women and unskilled manual worker, women in the northern regions (Tombouctou, Mopti and Gao), and in the main cities (Bamako and Mopti) as well as the evacuated women are more likely to have emergency cesarean than elective delivery (higher in Kayes, Koulikoro, Sikasso andSegou regions). The elective cesarean is also higher among the rich and the richest women, the highly educated, officer and referred women with an expensive transportation cost. Based on this result, a Bergson social welfare is needed through some policy decisions to favor the neediest women and improve their health status by a safer motherhood. From my findings, the indigent women are those who are poor (quintile 1 and 2), uneducated or women with low education (primary, secondary and koranic schooling), non-working and unskilled manual worker women.

Because, Women in the northern regions benefit less from the free cesarean policy and are more exposed to emergency cesarean, more attention are needed to the women delivering in those regions. Mali government should promote delivery of women by skilled birth attendant in health facilities. He should also mitigate some

financial barriers which prevent the indigent women for accessing maternal health service and antenatal care services.

Further girls' schooling is another key factor of improving maternal health care. The Mali government should support girls' education and make it mandatory up to secondary level through a free schooling policy mainly in rural areas or northern regions.

For the unemployed and unskilled manual workerwomen, the poorest and poor women who benefit less from the free cesarean policy and are more likely to have emergency delivery, the Mali government should favor more the poor and give them more attention for ensuring a better equity in health.

The implementation of Mali referral health system contributes a lot to reduce maternal and neonatal deaths. Nevertheless, many reforms and improvements are needed in the maternity referral system for a better quality of health care and a reduction of birth outcomes. More CSCom and CSRef should be built to reduce the geographic barriers for access to health facilities. The communication systems within health facilities need to be reinforced. And the transportation system (ambulance vehicle) must be improved to reduce as much as possible the delay in transportation of emergency and referral cases from a CSComto a CSRef or a hospital. The community financing system which contributes to the maintenance of ambulances must be reinforced, encouraged and subsidized financially by the government.

6.4. Limitation of the study

This studyfocused on the non-medical factors affecting the probability of receiving cesarean among women delivering in public health facilities in Mali and made some recommendations that could help indigent people benefit more from government policies. However,using secondary data from a USAID funded survey for this analysis have some limitations such as

1. The absence of comparison group of women who delivered or failed to deliver at home and were evacuated to health facilities.

2. The missing information about

- The follow-up of the pregnancy, the number of antenatal care visits of women and the birth spacing between pregnancies.
- The mortality and the morbidity complications of the mother and the baby associated to the mode of delivery.

3. The absence of internal reasons to explain some results on the factors affecting the cesarean probability and hence no recommendations could be made for those factors. Further investigations are needed to be for a better understanding of the findings.

6.5. Expected benefits

This analysis has paved ways for the government of Mali to improve its free cesarean policy as to meet its objectives of reducing maternal and neonatal morbidity and mortality. Results indicate areas for further actions to ensure a better equity and reinforce the existing health system especially on the remaining factors to be addressed for improving access of women to maternal health services for safe motherhood.

6.6. Further study of the thesis in the future

Further researches should be conducted to understand properly the reasons for which certain factors affect the cesarean likelihood. Besides it is also important to assess the effect of having safe motherhood and positive birth outcomes and why implementing those policies is worthwhile.

1. Factors leading to the poorest women to benefit from the cesarean policy in Mopti region.
2. Factors affecting the reduction of cesarean rate in public health facilities in Bamako capital.
3. Determinants of the rise of cesarean likelihood with the augmentation of the number of birth order (parity) in Tombouctou region.
4. Possible benefits of having access to antenatal care and maternal health care services for a safe motherhood in short and long run in Mali. .

REFERENCES

Ahmad, S.N., & Mir, I.H. (2007). Emergency Peripartum Hysterectomy: Experience at Apex Hospital of Kashmir Valley The Internet Journal of Gynecology and Obstetrics, 8(2).

Al-Mufti, R., McCarthy, A., & Fisk, N. M. (1996). Obstetricians' personal choice and mode of delivery. Lancet, 347(9000), 544.

Alimohamandian, Masoomeh, Shariat, MAmak, Mahmoodi, Mahmood, & Ranezanzadeh, Faterneh. (2007). Choice of delivery in Tehran and some related factors Journal of Family and Reproductive Health, 1(2).

Betran, A. P., Merialdi, M., Lauer, J. A., Bing-Shun, W., Thomas, J., Van Look, P., & Wagner, M. (2007). Rates of caesarean section: analysis of global, regional and national estimates. Paediatr Perinat Epidemiol, 21(2), 98-113. doi: 10.1111/j.1365-3016.2007.00786.x

Beucher, G., Dolley, P., Lévy-Thissier, S., Florian, A., & Dreyfus, M. (2012). Bénéfices et risques maternels de la tentative de voie basse comparée à la césarienne programmée en cas d'antécédent de césarienne. Journal de Gynécologie Obstétrique et Biologie de la Reproduction, 41(8), 708-726. doi: http://dx.doi.org/10.1016/j.jgyn.2012.09.028

Bishnoi, Rati. (2011). Celerate Solutions: free cesarean policy increases utiliation in Mali, but changes remain. from http://www.womendeliver.org/updates/entry/celebrate-solutions-free-caesareans-policy-increases-utilization-in-mali-bu

Briand, Valérie, Dumont, Alexandre, Abrahamowicz, Michal, Sow, Amadou, Traore, Mamadou, Rozenberg, Patrick, . . . Fournier, Pierre. (2012). Maternal and Perinatal Outcomes by Mode of Delivery in Senegal and Mali: A Cross-Sectional Epidemiological Survey. PLoS ONE, 7(10), e47352. doi: 10.1371/journal.pone.0047352

Burrows, L. J., Meyn, L. A., & Weber, A. M. (2004). Maternal morbidity associated with vaginal versus cesarean delivery. Obstet Gynecol, 103(5 Pt 1), 907-912. doi: 10.1097/01.AOG.0000124568.71597.ce

Campbell, Candace. (2011). Elective Cesarean Delivery. Nursing for Women's Health, 15(4), 308-319. doi: 10.1111/j.1751-486X.2011.01651.x

Cecatti, J. G., Pires, H. M., Faundes, A., & Duarte Osis, M. J. (2005). Factors associated with vaginal birth after previous cesarean section in Brazilian women. Rev Panam Salud Publica, 18(2), 107-113.

Choudhury, Chayan Roy. (2008). Cesarean Births: The Indian Scenario Research Scholar, International Institute for Population Sciences, Mumba, 1 - 18.

DHS. (2006). Measure DHS-Mali. Standard DHS. Mali: Demographic and Health Survey.

El-Khoury, Marianne, Gandaho, Timothee, Arur, Aneesa, Keita, Binta, & Nichols, Lisa. (2011). Improving access to life saving maternal health services: The effects of removing user fees for caesareans in mali. Mali: USAID funded and program ATN.

Factbook, CIA World. (2013, January 2013). from https://cia.gov/library/publications/the-world-factbook/geos/ml.html

Fakokunde, A., Al-Khalid, A., Tailor, V., Okolo, S., Yoong, W., & Ahmed, A. Baba. (2009). O285 Risk factors for emergency caesarean section in a multiethnic environment. International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics, 107, S174.

Falisse, J. B. (2012). 25th Bamako Initiative Anniversary Series: the community health centres in Mali *25th Bamako Initiative Anniversary Series:* . Website: Harmonization for Health in Africa.

Fareeduddin, R., & Schifrin, B. S. (2008). Subgaleal hemorrhage after the use of a vacuum extractor during elective cesarean delivery: a case report. J Reprod Med, 53(10), 809-810.

Feng, Xing Lin, Xu, Ling, Guo, Yan, & Ronsmans, Carine. (2011). Factors influencing rising caesarean section rates in China between 1988 and 2008. 90, 30 - 39. doi: 10.2471/BLT.11.090399

Fournier, P., Dumont, A., Tourigny, C., Dunkley, G., & Drame, S. (2009). Improved access to comprehensive emergency obstetric care and its effect on institutional maternal mortality in rural Mali. Bull World Health Organ, 87(1), 30-38.

Gagnon, Anita J., Merry, Lisa, & Haase, Kristen. Predictors of emergency cesarean delivery among international migrant women in Canada. International Journal of Gynecology & Obstetrics(0). doi: http://dx.doi.org/10.1016/j.ijgo.2012.12.017

Gartoulla, Pragya, Liabsuetrakul, Tippawan, Chongsuvivatwong, Virasakdi, & McNeil, Edward. (2012). Ability to pay and impoverishment among women who give birth at a University Hospital in Kathmandu, Nepal.

Global Public Health, 7(10), 1145-1156. doi: 10.1080/17441692.2012.733719

Giguere, Rebecca. (2007). Social Determinants of Cesarean Deliveries in Latin America: A Case Study of Brazil (Vol. 27ed.): Department of Maternal and Child Health.

Gilbert, A., Benjamin, A., & Abenhaim, H. A. (2010). Does education level influence the decision to undergo elective repeat caesarean section among women with a previous caesarean section? J Obstet Gynaecol Can, 32(10), 942-947.

Habib, Huda Adnan, Abdulla, Maysaloun Muhammed, & Yacoub, Selwa Elias. (2011). Knowledge and Preference of Mothers Delivering at ALKadhumyia Teaching Hospital Regarding Caesarean Section and Normal Vaginal Delivery. The iraq post graduate medical journal, 10(4).

Harrison, Jeff. (2012, 12 April 2012). C-Sections a Measure of Ethnic, Economic Disparities. Retrieved 2 February, 2013, from http://web.sbs.arizona.edu/college/node/866

Hendrickson, Kirstin. (2012). Cesarean Sections in the U.S.: The Trouble with Assembling Evidence from Data: Scientific American.

Herstad, L., Klungsoyr, K., Skjaerven, R., Tanbo, T., Eidem, I., Forsen, L., . . . Vangen, S. (2012). Maternal age and elective cesarean section in a low-risk population. Acta Obstet Gynecol Scand, 91(7), 816-823. doi: 10.1111/j.1600-0412.2012.01405.x

Hiasat, Mohammed S. (2002). The impact of maternal age and the parity on the cesarean section rate. JRMS, 12, 30 - 34.

Hopkins, Kristine, & Amaral, Ernesto. (1998). The Role of Nonclinical Factors in Cesarean Section Rates in Brazil. 1 - 10.

Hoy, Rachel. (2011). Health Needs Assessment for the City of Bamako, Mali *MCI Social Sector Working Paper Series*. New York: Millennium Cities Initiative

I.Teguete, Traore, Y., Sissoko, A., Djire, M. Y., Thera, A., Dolo, T., . . . Dolo, A. (2012). Determining Factors of Cesarean Delivery Trends in Developing Countries: Lessons from Point G National Hospital (Bamako - Mali). Medicine Obstetrics and Gynecology, p1 - 41. doi: 10.5772/47914

KASSAK, K.M., ALI, A. MOHAMMAD, & ABDALLAH, A.M. (2000). Opting for a cesarean: what determines the decision? . American University of Beirut. , 13(3), 100 - 122.

Khawaja, Marwan, Kabakian-Khasholian, Tamar, & Jurdi, Rozzet. (2004). Determinants of caesarean section in Egypt: evidence from the demographic and health survey. Health policy (Amsterdam, Netherlands), 69(3), 273-281.

Mc Gurgan, P., Coulter-Smith, S., & PJ, O' Donovan. (2001). A national confidential survey of obstetrician's personal preferences regarding mode of delivery. Eur J Obstet Gynecol Reprod Biol, 97(1), 17-19.

Mohanty, Sanjay K, & Srivastava, Akanksha. (2012). Out-of-pocket expenditure on institutional delivery in India. Health Policy and Planning. doi: 10.1093/heapol/czs057

Mullan, Fitzhugh, Diomande, Seble Frehywot, Chen, Candice, & Cyprien, Soeurette. (2009). Medecine), Bamako, Website. Retrieved from http://www.samss.org/samss.upload/wysiwyg/Full%20Site%20Visit%20Reports/U%20of%20Mali.pdf

Neil, Murphy, Jorgensen, Sarah K., & Quinlan, Jeffrey D. (2012). Cesaerean delivery. 1 - 38.

Olusanya, BO, Ebuehi, OM, & Somefun, AO. (2009). Universal infant hearing screening programme in a community with predominant non-hospital births: a three-year experience. J Epidemiol Comm Health, 63, 481 - 486.

Olusanya, Bolajoko, & Solanke, Olumuyiwa. (2009). Maternal and neonatal factors associated with mode of delivery under a universal newborn hearing screening programme in Lagos, Nigeria. BMC Pregnancy and Childbirth, 9(1), 41.

Pang, Selina MW, Leung, Danny TN, Leung, TY, Lai, CY, Lau, TK, & Chung, Tony KH. (2007). Determinants of preference for elective caesarean section in Hong Kong Chinese pregnant women. Hong Kpng Med J., 13(2), 100 - 105.

Poma, Pedro A. (1999). Effects of obstetrician characteristics on cesarean delivery rates: A community hospital experience. American Journal of Obstetrics and Gynecology, 180(6), 1364-1372. doi: http://dx.doi.org/10.1016/S0002-9378(99)70021-9

POST. (2002) (Postnote ed., pp. pp 2). websi: Parliamentary office of science and technology.

Raees, Mehnaz, Yasmeen, Sumaira, Jabeen, Sadaqat, Utman, Naeema, & Karim, Rukhsana. (2012). MATERNAL MORBIDITY ASSOCIATED WITH EMERGENCY VERSUS ELECTIVE CAESAREAN SECTION (Vol. 27ed.).

RCP. (2008). Best Practices in the Use of Cesarean ovo Scotia: The Reproductive Care Program of Nova Scotia.

Rutstein, Shea O. (2008). The DHS Wealth Index: Approaches for Rural and Urban Areas DHS WORKING PAPERS.

Schackman, B. R., Oneda, K., & Goldie, S. J. (2004). The cost-effectiveness of elective Cesarean delivery to prevent hepatitis C transmission in HIV-coinfected women. AIDS, 18(13), 1827-1834.

Selma, Taffel M. (1994). Cesarean Delivery in the United States, 1990 (Vol. 21ed.). US.

Sorbye, I. K., Vangen, S., Oneko, O., Sundby, J., & Bergsjo, P. (2011). Caesarean section among referred and self-referred birthing women: a cohort study from a tertiary hospital, northeastern Tanzania. BMC Pregnancy Childbirth, 11, 55. doi: 10.1186/1471-2393-11-55

Terajima, K., Onodera, H., Kobayashi, M., Yamanaka, H., Ohno, T., Konuma, S., & Ogawa, R. (2003). Efficacy of intrathecal morphine for analgesia following elective cesarean section: comparison with previous delivery. J Nippon Med Sch, 70(4), 327-333.

Tita, Alan Thevenet N. (2012). When Is Primary Cesarean Appropriate: Maternal and Obstetrical Indications. Seminars in Perinatology, 36(5), 324-327. doi: http://dx.doi.org/10.1053/j.semperi.2012.04.014

TollÅNes, Mette C., Thompson, John M. D., Daltveit, Anne K., & Irgens, Lorentz M. (2007). Cesarean section and maternal education; secular trends in Norway, 1967–2004. Acta Obstetricia et Gynecologica Scandinavica, 86(7), 840-848. doi: 10.1080/00016340701417422

Turner, C. E., Young, J. M., Solomon, M. J., Ludlow, J., Benness, C., & Phipps, H. (2008). Vaginal delivery compared with elective caesarean section: the views of pregnant women and clinicians. BJOG, 115(12), 1494-1502. doi: 10.1111/j.1471-0528.2008.01892.x

USAID, CDC, & DHHS (Writers). (2012). Malaria operational plan [report].

USAID, Unicef, WB, UNFPA, & Government, Mali. (2001). <Mali demographic and health survey 2001.pdf>. Report. MAli.

Vazquez-Calzada, J. L. (1997). Cesarean childbirth in Puerto Rico: the facts. P R Health Sci J, 16(4), 395-400.

Wagner, M. (2000). Choosing caesarean section. Lancet, 356(9242), 1677-1680. doi: 10.1016/s0140-6736(00)03169-x

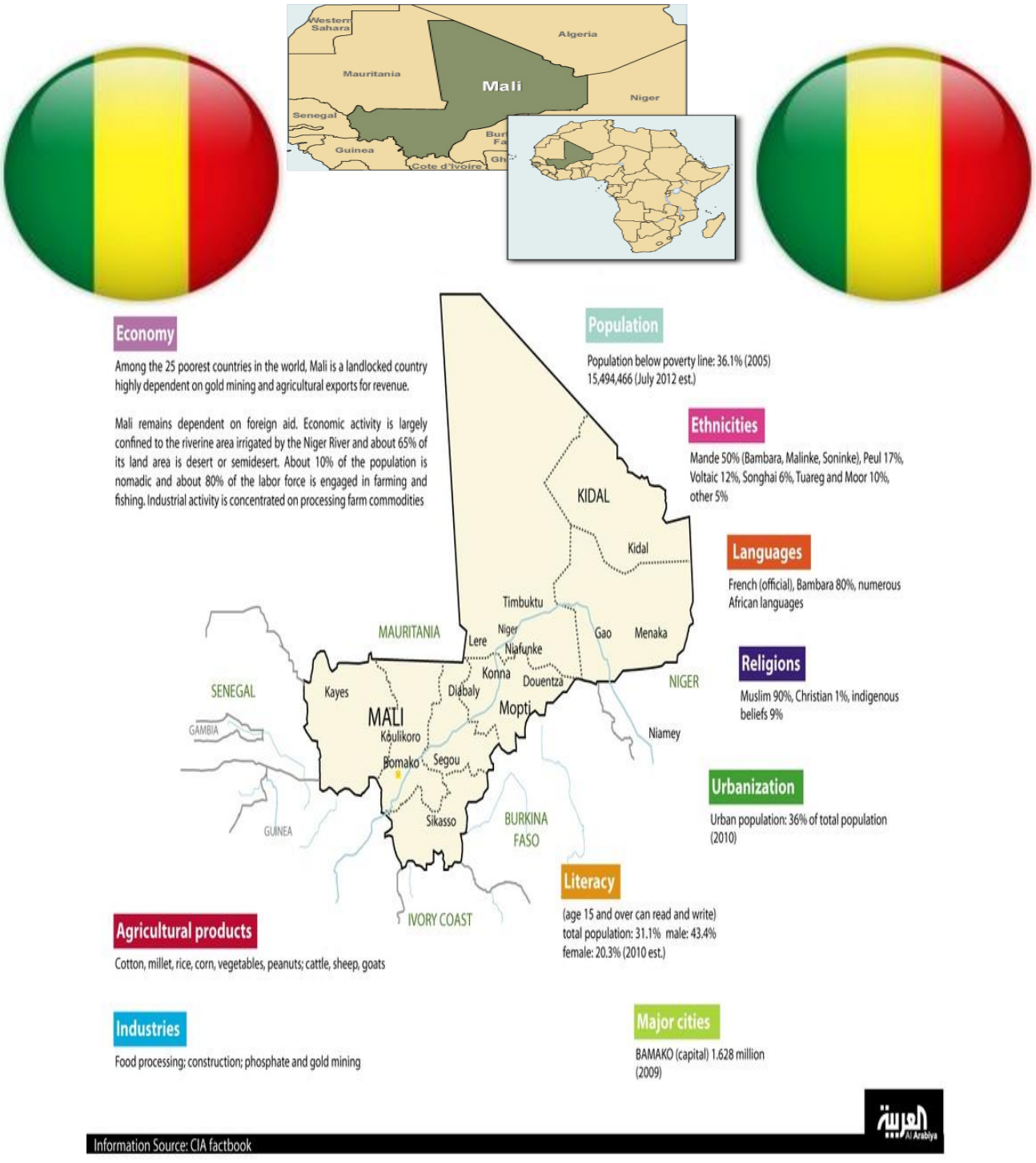
WHO, USAID, UNFPA, & WB. (2007). <maternal mortality in 2005 WHO.>: World Health Organiztion United States Agency for international Development Unated Nations population Fund World Bank.

Yassin, Khaled, & Saida, Ghanim Abu. (2012). Levels and Determinants of Caesarean Deliveries in Egypt: Pathways to Rationalization. World Health and Societal Politics, 7(2). doi: 10.5580/2c74

APPENDICES

Appendix A.

Mali Map



Appendix B.

Questionnaire form

EVALUATION OF THE FREE CAESAREAN POLICY SOCIO-ECONOMIC DATA COLLECTION AT HEALTH CENTERS (HOSPITAL, REFERRAL CENTERS AND COMMUNITY HEALTH CENTERS) IN MALI

CONSENT FORM

Hello Madam
My name is _____, and I work _____

We are collecting information to improve the implementation of the free caesarean policy in Mali focusing on the remaining barriers/obstacles. In this survey, we examine the socio-economic barriers that may reduce access of the poorest women to caesarean section.

We would like to ask you to participate in this survey. We will ask you some questions and your responses will be treated confidentially. The answers you will provide to us will remain confidential.

If you do not want to answer to our questions, know that you have the right and we respect your decision. Even if you agree to answer to our questions, you are not obliged to answer all our questions. You can stop your participation at any time without having to justify yourself.

Do you agree to answer our questions?

1. YES THE WOMAN ACCEPTED → ▼ CONTINUE
2. NO THE WOMAN REFUSES → ▼ STOP AND WRITE IT ON THE LINE "NOTE"
3. THE WOMAN ACCEPTED THEN INTERRUPTED HER PARTICIPATION → ▼ STOP AND WRITE IT ON THE LINE "NOTE"
NOTE: _____
_____

Questionnaire No : _____10___/ __/__/__/

Do write here Serial number

MINISTRY OF HEALTH REPUBLIC OF MALI

-=-=-=-=-=-=- One People – One Aim – One Faith GENERALSECRETARIAT

=-= -=-=-=-=-

NATIONAL DIRECTORATE OF HEALTH EVALUATION OF THE FREE CEASARIEAN POLICY

A) IDENTIFICATION OF THE HEALTH CENTERS

Q1. REGION_____Q2.HOSPITAL_____Q3. CSREF _____Q4. CSCOM _____

Q5. Form completed by: _____ Q6. Qualification_____
(name and surname)

Q7. Questionnaire No: _____10___/ __/__/__/ Q8. DATE : DD/___/___/MM /___/___/ 2010

Do not write here Serial number

B) PARTURIENTE: Q9. FileN°/__/__/__/ __/ (Number from admission register)

Q10. Name and Surname_____Q11. Occupation_____

Q12. Age (years)//____/____/ Source_____Q13.Date of birthDD/___/___/ MM /___/___/ YY /___/___/

Q14. Profession of Husband_____Q15.Village/City_____Q16. Quarter_____

Q17. Education (circle): 0. None1. Primary 2. Secondary 3. University 4. Other _____

Q18. Arriving From (circle) 1. CSCOM_____2. CSREF_____3. Hospital_____
4. Her home 5. Private medical clinic_____
6. Referred by a health personnel not in service in CSCOM / CSREF
7. Other (specify): _____

Q19. Date of admission: DD/___/___/ MM /___/___/ 2010 Q20. Time of admission___/___/h___/___/mn

Q21. Reason for admission (circle):1. Painful uterine contractions 2. Acute fetal distress
3. Programmed caesarean (prophylactic)4. Hemorrhages (from uterus)5. Prolonged labor
6. Excessive Uterine Volume 7. Had caesarean in the past8.Viciouspresentation
9. Fetus bigger than pelvis10. Prolapsed cord with heart bits
11. Globally narrow pelvis (BGR) 12. Retro-Placenta Hemorrhage (HRP)
13. Hypertension/Eclampsia 14. Other (specify): _____

Q22. Admission mode (circle): 1. Referral 2. Evacuation
3. Came by herself 4. Other (specify) : _____

Q23. Mean of transport to structure(circle): 1. Ambulance 2. Vehicle 3. Taxi 4. Motorbike
5. Public transport 6. Other (specify) :_____

Q24. Nb Pregnancies __/__/Q25. Parity__/__/ Q26. Nb living child __/__/Q27.Nb dead child __/ Q28. Nb of abortions __/__/Q29. Date and Time ofCaesareanDD /__/__/ MM /__/__/2010__/__/h__/__/mn

Q30. Indication of Caesarean: _____/__/__/__/

Questionnaire No : _____10___/ __/__/__/

C) SOCIO-ECONOMIC DATA:

Q31. In your household, what is the main floor material? (CIRCLE ONE RESPONSE)

Natural material

1. *EARTH / SAND*
2. *COW / ANIMAL DUNG*

Modern material

3. *PARQUET OR POLISHED WOOD*
4. *VINYL OR LINOLEUM /ASPHALT*
5. *TILES*
6. *CEMENT*
7. *CARPET*
8. *OTHER(SPECIFY)_____*

Q32. In your household, is there someone who owns a bicycle?(CIRCLE)

1. *YES*
2. *NO*

Q33. In your household, is there someone who owns a television? (CIRCLE)

1. *YES*
2. *NO*

Q34. In your household, what kind of fuel or source of energy do you mainly use for cooking?

(CIRCLE ONE RESPONSE)

1. *ELECTRICITY*
2. *GAS IN BOTTLE*
3. *CHARCOAL*
4. *FIREWOOD, STRAW*
5. *ANIMAL DUNG*
6. **OTHER (SPECIFY)_____**

Q35. What is the <u>main</u> source of drinking water for the members of your household?
(CIRCLE ONE RESPONSE)

1. *PIPED INTO DWELLING*
2. *PIPED TO YARD / PLOT*
3. *PUBLIC TAP / STANDPIPE*
4. *OPEN AND UNPROTECTED WELL*
5. *COVERED WELL ORBORING (PROTECTED)*
6. *SURFACE WATER ((SOURCE, RIVER / DAM, LAKE, POUND)*
7. *RAINWATER*
8. *BOTTLED WATER*
9. *OTHER (SPECIFY)_____*

Appendix C.

List of selected facilities in the sample size

Regions	Selected facilities
Kayes (South)	**Hospital: Kayes**
	CSRef 1: Diéma
	CSRef 2: Nioro
	CSCom 1(CSRef - Diéma) : Guomitra
	CSCom2(CSRef – Nioro): DianveilyCounda
Koulikoro (South)	**Hospital: CSRef Koulikoro***
	CSRef 1: Kangaba
	CSRef 2: Banamba
	CSCom 1(CSRef -Kangaba) : Narena
	CSCom 2(CSRef – Banamba):Toukoroba
Sikasso (Center)	**Hospital: Sikasso**
	CSRef 1: Yan folia
	CSRef 2: Kolondieba
	CSCom1 (CSRef – Yan folia) : Niessoumala
	CSCom 2(CSRef – Kolondieba): Fakola
Segou (center)	**Hospital: HNF**
	CSRef 1: Bla
	CSRef 2: San
	CSCom 1(CSRef - Bla) : Penesso
	CSCom 2(CSRef – San):Dieli
Mopti (center)	**Hospital: Mopti**
	CSRef 1:Douentza
	CSRef 2:Tenenkou
	CSCom 1(CSRef - Douentza) : Boni
	CSCom 2(CSRef – Tenenkou) :Diguicire
Tombouctou (North)	**Hospital: Tombouctou**
	CSRef 1:Goundam
	CSRef 2:Niafunke
	CSCom 1(CSRef - Goundam) : Tin Aicha
	CSCom 2(CSRef – Niafunk):Gounambougou
Gao (North)	**Hospital: H Gao**
	CSRef 1:Ansongo
	CSRef 2: Bourem
	CSCom 1(CSRef - Ansongo) : Bara
	CSCom 2(CSRef – Bourem):Kermachoe
Kidal (North)	**Hospital: CSRef***
	CSRef 1: NO
	CSRef 2: NO
	CSCom 1(CSRef -) : No
	CSCom 2(CSRef –): No
Bamako	**Hospital:** Gabriel Toure
	CSRef 1: Commune V
	CSRef 2: Commune II
	CSCom 1*(CSRef–Commune V)* : Benkady
	CSCom 2*(CSRef – Commune II)* :Asacotoqa

*Acting as regional hospital

Appendix D.

Designing the proxy wealth index

"The DHS Wealth Index is widely employed to examine health, population, nutrition, education, and other indicators of societal well-being according to economic status" (Rutstein, 2008) It has proved to be one of the more useful background characteristic available from DHS data.

In our secondary data a simplified proxy wealth index was created for classifying women into tertile/quintile group. The purpose of this note is to explain the method used to:

- 1) Develop the 4 – 6 simplified key indicators (from the larger set of DHS indicators) needed for the creation of the proxy wealth index
- 2) Assess the proxy wealth index by weighting those simplified keys indicators into one composite wealth index
- 3) Ascertain the validity of the proxy wealth index as a mean for identifying the poorest tertile/quintile group.

The method used (weighting scheme) was defined from an analysis of the patterns of variation in the selected indicators of our simplified proxy wealth index. The simplified index will be a powerful tool in analyzing and interpreting the socioeconomic correlates of service delivery, collected at the facility level when caesarians are performed. However, in statistical terms the weighting scheme inherent in the index could still be considered 'ad hoc'. Therefore, it is important to validate the simplified index against another index which is created from more robust statistical methods. Following the methodology in Pitchforth et al. (2007) a 'gold standard' index of wealth or general SES was created using principal component analysis or PCA. The use of PCA for creating a general indicator of SES has been reviewed in other studies (Vyas and Kumaranayake2006; Filmer and Pritchett 2001). As previously stated, the DHS Wealth Index is itself created via PCA.

As a first step, dummy variables were created for the three categorical variables of interest. All asset variables in the dataset were included in the PCA, given the increasing importance of these in such analyses (Vyas and Kumaranayake 2006). Then, the descriptive statistics was generated on all the variables for purposes of identifying variables that were similar enough and had low frequency such that they

could be combined. Based on these, two variables were combined each within the 'main floor materials' and 'type of cooking fuel' groups. We conducted the PCA, selecting for components with a minimum eigenvalue of one. The factor coefficients for the variables (factor weights) were generated.

Step 1:Settlement of a relationship between individual characteristic variables and the DHS poverty tertile/quintile

The simplified key indicators were made based on the literature (Pitchforth et al. 2007) and the Mali DHS 2006 dataset (a nationally representative sample survey in all eight regions and Bamako district with 14,383 women at reproductive age (15-54 years old) (see Appendix D.1).

Appendix D. 1 Key SES indicators reviewed from the Mali DHS 2006

Key SES indicators reviewed from the Mali DHS 2006	
Educational attainment	Has bicycle
Has electricity	Has television
Main floor material	Source of drinking water
Literacy	Has car/truck*
Education in single years*	Ethnicity*
Has telephone	No. of children <=5*
Has radio	Type of cooking fuel*
Type of toilet facility	

* Indicators not examined by Pitchforth et al.

Appendix D. 2 Simplified key indicators used in the USAID survey

Simplified key indicators
Main floor material
Has bicycle
Has television
Cooking fuel
Source of drinking water

In the DHS dataset, some wealth index variables are used to classify the wealth tertile/quintile ranging from poorest to richest. The assignment of the quintile was made based on the 20%cutoff points calculated according to the value of DHS wealth index in 2006 for each individual in the sample. Then from the key indicators reviewed in Appendix D.1., a set of five questions were selected (Appendix D.2.); and they have showed sufficient variation across the quintiles of the DHS wealth index. While two are asset wealth-related binaries, the other three are categorical variables related to living circumstances. They are shown in Appendix D.3.

Step 2: **Assessment of the proxy wealth index**

- Categorize women into poverty group by using crude score

A Principal Component Analysis (PCA) was used to assign a crude score to each variable in each key indicator. Each variable is considered as a principal component. The components are ordered so that the first principal component (PC1) explains the largest amount of variation in the data and it shows the low proportion of the total variance (Appendix D.2.).

- Rescale the crude score (factors coefficients or weights)

The categorization of the variables in the creation of the crude score was rescaled to take values in the range of 0 to 1. Certain rescaled scores were assigned to each of the indicators based on the strength of variation So, the indicator with a smoothly variation across the DHS wealth quintile are assigned a higher weight and the ones with a wide variation are assigned lower weight.

The rescaled score is computed based on PCA method, using a linear combination through the following formula:

$$Y_1 = \alpha_1\left(\frac{X_1 - \overline{X_1}}{S_1}\right) + \alpha 2\left(\frac{X_2 - \overline{X_2}}{S_2}\right) + \ldots + \alpha_k\left(\frac{X_k - \overline{X}_k}{S_k}\right)$$

Where, $\overline{X}_k$ and S_k are the mean and standard deviation of asset X_k , and$\alpha_r$epresents the rescaled score for each variable X_k for the first principal component (Table D.3.)

- Assign the weight for the poverty score

Appendix D. 3 Unweighted and weighted scores for selected wealth indicators

Variables and responses groupings	Crude Score*	Rescaled Score*	Weight	Weighted poverty score*
Main floor material				
Dirt/Sand	1	0	3	0
Dung	2	0.17		0.5
Parquet or polished wood	4	0.5		1.5
Vinyl or linoleum/ asphalt				
Tiles	3	0.33		1.0
Cement	7	1.0		3
Carpet	6	0.8		2.5
other	5	0.67		2.0
Has bicycle				
No	1.5	0.66	Weights vary (see Table 3)	Various
Yes	1	0		Various
Source of drinking water				
Piped into dwelling	9	0.9	2	1.8
Piped to yard/plot	8	0.8		1.6
Public tap/standpipe	10	1		2
Protected well	5	0.4		0.9
Unprotected well	1	0		0
Protected spring	4	0.3		1
River/dam/lake/ponds/	3	0.2		0.4
Rainwater	2	0.1		0.2
Bottled water	7	0.7		1
Other	6	0.6		1.1
Has television				
No	1	0	5	0
Yes	2	1		5
Type of cooking fuel				
Electricity	5	1	1	1
LPG	5	1		1
Charcoal	4	0.75		0.75
Wood	1	0		0
Animal dung	2	0.25		0.25
Other	3	0.5		0.5

* A higher value on those scores is correlated with a higher SES level

Different Ways are used to assign weighting values to the indicators variables. For this reason, Filmer and Pritchett recommended using principal components analysis (PCA) to assign the indicator weights, the procedure that is used for the DHS wealth index. (Appendix D.3.).

The majority of the indicators showed similar variance patterns across the wealth quintiles in each region and a single weight was given to them. However, the indicator ‘has bicycle’ had a definite pattern of variation in only one group of regions. In the other group of regions the pattern ran in the counterintuitive direction where there was insufficient variation across the DHS wealth quintiles. A higher weight was

assigned to regions with a strong pattern of wide variation. A lower weight was assigned to those exhibiting a weaker pattern (e.g. Bamako). Regions showing little variation was weighted lowest (Appendix D.4.).

Appendix D. 4 Weights for the 'has bicycle' indicator by region

Kayes	1
Koulikoro	4
Sikasso	4
Segou	4
Mopti	1
Tombouctou	1
Gao	1
Kidal	1
Bamako	2

Step 3:Validity of the proxy wealth index

Kappa analysis was performed to measure the degree of agreement between the various ratings, to validate our proxy index. Table C.5.shows the results of the kappa analysis. Based on Landis and Koch (1977), the proxy wealth index and the DHS Wealth Index have 'moderate' agreement since the kappa statistics falls between 0.41 and 0.6.

In addition, we created an index using the PCA methodology on our five selected indicators in the larger DHS dataset (PCA index). The use of PCA for creating a general indicator of SES has been reviewed in other studies (Vyas and Kumaranayake 2006; Filmer and Pritchett 2001). We created tertile based on the PCA index and performed Kappa analysis (Appendix C.5.). With a Kappa statistic of 0.61, our proxy wealth index and the PCA index show 'substantial' agreement.

Appendix D. 5 Kappa analysis using the median as cutoff point on indices

Comparison on tertile rating	Agreement	Expected Agreement	Kappa statistic
Proxy Wealth Index (weighted) VS. DHS wealth index	65.3 %	33.4 %	0.48
Proxy Wealth Index (unweighted) VS. PCA index	73.6%	33. 5 %	0.61

Appendix E.

Number of Obstetricians form

Number of gynaecologists and surgeons according to each region and each health facility

List of Hospitals, CSREF and CSCOM with their ID codes

REGION: 1= Kayes ; 2= Koulikoro; 3=Sikasso; 4=Segou; 5=Mopti; 6=Tombouctou , 7=Gao; 8=Kidal; 9=Bamako (district)

HEATLH FACILITY: 1=Hospital ; 2=CSREF 1 ; 3=CSREF 2 ; 4=CSCOM 1 ; 5=CSCOM 2

ID Number: Region-Health Facility (11=Kayes Hospital, 14=CSCOM Guomitra)

REGIONS	HOSPITAL/CSREF (CODE)	CSCOM (CODE)	Trained physicians[1]	Gyneco logists	Total physicians doing the C-section
Kayes (S)	Hospital Kayes (11)		1	2	3
Kayes (S)	CSREF Diéma (12)		1	0	1
Kayes (S)	CSREF Diéma	Guomitra (14)			
Kayes (S)	CSREF Nioro (13)		1	0	1
Kayes (S)	CSREF Nioro (13)	DianveilyCounda (15)			
Koulikoro (S)	CSREF Koulikoro (21)		0	0	
Koulikoro (S)	CSREF Kangaba (22		1	0	1
Koulikoro (S)	CSREF Kangaba (22	Narena (24)			
Koulikoro (S)	CSREF Banamba (23)		1	0	1
Koulikoro (S)	CSREF Banamba (23)	Toukoroba (25)			
Sikasso (C)	Hospital Sikasso (31)		1	2	3
Sikasso (C)	CSREF Yan folila (32)		1	0	1
Sikasso (C)	CSREF Yan folila (32)	Niessoumala (34)			
Sikasso (C)	CSREF Kolondiéba (33)		1	0	1
Sikasso (C)	CSREF Kolondiéba (33)	Fakola (35)			
Ségou (C)	HNF Hospital Segou (41)		1	1	2
Ségou (C)	CSREF Bla (42)		4	0	4
Ségou (C)	CSREF Bla (42)	Penesso (44)			
Ségou (C)	CSREF San (43)		1	0	1
Ségou (C)	CSREF San (43)	Dieli (45)			
Mopti (C)	Hospital Mopti (51)		3	4	7
Mopti (C)	CSREF Douentza (52)		2	0	2
Mopti (C)	CSREF Douentza (52)	Boni (54)			
Mopti (C)	CSREF Tenenkou (53)		3	0	3
Mopti (C)	CSREF Tenenkou (53)	Diguicire (55)			
Tombouctou (N)	Hospital Tombouctou (61)		1	1	2
Tombouctou (N)	CSREF Goundam (62)		1	0	1
Tombouctou (N)	CSREF Goundam (62)	Tin Aicha (64)			
Tombouctou (N)	CSREF Niafunke (63)		1	0	1
Tombouctou (N)	CSREF Niafunke (63)	Gounambougou (65)			
Gao (N)	Hospital Gao (71)		1	1	2
Gao (N)	CSREF Ansongo (72)		1	0	1
Gao (N)	CSREF Ansongo (72)	Bara (74)			
Gao (N)	CSREF Bourem (73)		1	0	1
Gao (N)	CSREF Bourem (73)	Kermachoe (75)			
Kidal (N)	**CSREF** Kidal (81)		1	0	1
Bamako (S)	U Hospital Gabriel Toure (91)		0	21	21
Bamako (S)	CSREF Commune II (92)		1	3	4
Bamako (S)	CSREF Commune II (92)	Benkady(94)			
Bamako (S)	CSREF Commune V (93)		1	6	7
Bamako (S)	CSREF Commune V (93)	Asacotoqua (95)			
TOTAL			31	41	72

[1]Trained physicians are general doctors who are trained in Bamako (for 4 month) for doing cesarean, hernia, appendicitis and craniotomy

N=North C=centre S=South

Appendix F.

Estimation of the transportation cost

Estimation of the transportation cost according to each region and each health facility

List of Hospitals, CSREF and CSCOM with their ID codes

REGION: 1= Kayes ; 2= Koulikoro; 3=Sikasso; 4=Segou; 5=Mopti; 6=Tombouctou, 7=Gao; 8=Kidal; 9=Bamako (district)

HEATLH FACILITY: 1 = Hospital ; 2 = CSREF 1 ; 3=CSREF 2 4=CSCOM 1 ; 5=CSCOM 2

ID Number: Region-Health Facility (11=Kayes Hospital, 14=CSCOM Guomitra)

The average distance is computed by taking the mean of all distance from each village to the selected health facility

The maximum (Max) distance is the farthest distance obtained from a village to the selected health facility

The minimum (Min) distance is the minimum distance obtained from a village to the selected health facility. This distance is very close that the patient can go to the health facility by foot. For this reason I only consider the max distance to find out the highest cost of transportation spent from a region to a chosen health facility.

The number (Terajima et al.) of villages is the total number of villages in the vicinity of a selected health facility

The estimated maximum cost (Max cost computed) is the maximum cost a person can pay with the farthest distance going to the selected health facility. This cost is computed by timing the max distance (to each health facility) by 70. The number 70 is calculated based on the following assumption. Assume that for 100 Kilometers (Schackman, Oneda, & Goldie), ten liters (L) are needed. So for 1 Km, 0.1L is needed and the oil cost 700 FCFA for each 1 Km. Therefore for 1Km, we need 0.1L with 70 FCFA/Km (700*0.1=70)

The estimated average cost (Average cost computed) is the average cost a person can pay with the farthest distance going to the selected health facility. This cost is computed by timing the average distance (to each health facility) by 70.

The real maximum cost (real max cost) is the most expensive cost a person can really pay for the farthest distance from a village to a health facility by using the most common and used transportation mean (indicated in the chart)

FCFA is the currency in Mali and US $ is the USA currency

REGION	HOSPITAL/ CSREF (CODE)	CSCOM (CODE)	Average distance	Max distance	Min distance	Num of villages	Max cost computed	Average cost computed	Real max Cost	Transportation mean
				KM	KM		Trc1	Trc2	Trc3	
Kayes (S)	Hospital Kayes (11)		13.042	89	0	341	Fcfa: 6230 US $: 13.26	Fcfa: 913 US $: 1.94	Fcfa: 3000 US $: 6.38	Chariot
Kayes (S)	CSREF Diéma (12)		10.734	45	0	117	Fcfa: 3150 US $: 6.70	Fcfa: 751 US $: 1.60	Fcfa: 6000 US $: 12.77	Chariot
Kayes (S)	CSREF Diéma	Guomitra (14)	8.571	15	0	7	Fcfa: 1050 US $: 2.33	Fcfa: 600 US $: 1.28	Fcfa:5000 US $: 10.64	Chariot
Kayes (S)	CSREF Nioro (13)		10.2	60	0	201	Fcfa: 4200 US $: 8.94	Fcfa: 714 US $: 1.52	Fcfa: 5000 US $: 10.64	Motorcycle
Kayes (S)	CSREF Nioro (13)	Dianveily Counda (15)	1.2	5	0	5	Fcfa: 350 US $: 0.74	Fcfa: 84 US $: 0.18	Fcfa: 500 US $: 1.06	Chariot
Koulikoro (S)	CSREF Koulikoro (21)		10.687	59	0	249	Fcfa: 4130 US $: 8.79	Fcfa: 748 US $: 1.59	Fcfa: 5000 US $: 10.64	Motorcycle
Koulikoro (S)	CSREF Kangaba (22)		9	33	0	62	Fcfa: 2310 US $: 4.91	Fcfa: 630 US $: 1.34	Fcfa: 3000 US $: 6.38	Motorcycle
Koulikoro (S)	CSREF Kangaba (22)	Narena (24)	11	12	0	5	Fcfa: 840 US $: 1.79	Fcfa: 770 US $: 1.64	Fcfa: 1000 US $: 2.13	Motorcycle
Koulikoro (S)	CSREF Banamba (23)		11.06	55	0	203	Fcfa: 3850 US $: 8.19	Fcfa: 774 US $: 1.65	Fcfa: 5000 US $: 10.64	Motorcycle
Koulikoro (S)	CSREF Banamba (23)	Toukoroba (25)	11.2	23	0	10	Fcfa: 1610 US $: 3.43	Fcfa: 784 US $: 1.67	Fcfa: 2000 US $: 4.26	Motorcycle
Sikasso (C)	Hospital Sikasso (31)		10.4	46	0	539	3220 US $: 6.85	728 US $: 1.55	4000 US $: 8.51	Motorcycle
Sikasso (C)	CSREF Yan folila (32)		9.76	37	0	145	Fcfa: 2590 US $: 5.51	Fcfa: 683 US $: 1.45	Fcfa: 3500 US $: 7.45	Motorcycle
Sikasso (C)	CSREF Yan folila (32)	Niessoumala (34)	6.571	18	0	14	Fcfa: 1260 US $: 2.68	Fcfa: 460 US $: 0.98	Fcfa: 2000 US $: 4.26	Motorcycle
Sikasso (C)	CSREF Kolondiéba (33)		9.4	30	0	224	Fcfa: 2100 US $: 4.47	Fcfa: 658 US $: 1.40	Fcfa: 3000 US $: 6.38	Motorcycle
Sikasso (C)	CSREF Kolondiéba (33)	Fakola (35)	10.9	17	0	10	Fcfa: 1190 US $: 2.53	Fcfa: 763 US $: 1.62	Fcfa: 1500 US $: 3.19	Motorcycle
Ségou (C)	HNF Hospital Segou (41)		8.76	45	0	394	Fcfa: 3150 US $: 6.70	Fcfa: 613 US $: 1.30	Fcfa: 5000 US $: 10.64	Motorcycle
Ségou (C)	CSREF Bla (42)		6	20	0	295	Fcfa: 1400 US $: 2.98	Fcfa: 420 US $: 0.89	Fcfa: 2000 US $: 4.26	Motorcycle
Ségou (C)	CSREF Bla (42)	Penesso (44)	6.875	10	0	8	Fcfa: 700 US $: 1.49	Fcfa: 481 US $: 1.02	Fcfa: 1500 US $: 3.19	Motorcycle
Ségou (C)	CSREF San (43)		7.122	28	0	407	Fcfa: 1960 US $: 4.17	Fcfa: 499 US $: 1.06	Fcfa: 2400 US $: 5.11	Motorcycle
Ségou (C)	CSREF San (43)	Dieli (45)	7	19	0	25	Fcfa: 1330 US $: 2.83	Fcfa: 490 US $: 1.04	Fcfa: 1500 US $: 3.19	Motorcycle

REGION	HOSPITAL/ CSREF (CODE)	CSCOM (CODE)	Average distance	Max distance	Min distance	Num of villages	Max cost computed	Average cost computed	Real max Cost	Transportation mean
				KM	KM		Trc1	Trc2	Trc3	
Mopti (C)	Hospital Mopti (51)		7.17	48	0	429	Fcfa: 3360 US $: 7.15	Fcfa: 502 US $: 1.07	Fcfa: 5000 US $: 10.64	Motorcycle
Mopti (C)	CSREF Douentza (52)		15.7	50	0	280	Fcfa: 3500 US $: 7.45	Fcfa: 1099 US $: 2.34	Fcfa: 5000 US $: 10.64	Motorcycle
Mopti (C)	CSREF Douentza (52)	Boni (54)	18.185	45	0	27	Fcfa: 3150 US $: 6.70	Fcfa: 1273 US $: 2.71	Fcfa: 5000 US $: 10.64	Motorcycle
Mopti (C)	CSREF Tenenkou (53)		11.1	55	0	241	Fcfa: 3850 US $: 8.19	Fcfa: 777 US $: 1.65	Fcfa: 4000 US $: 8.51	Motorcycle
Mopti (C)	CSREF Tenenkou (53)	Diguicire (55)	11.545	20	0	18	1400 US $: 2.98	808 US $: 1.72	2000 US $: 4.26	Motorcycle
Tombouctou (N)	Hospital Tombouctou (61)		10.857	150	0	91	Fcfa: 10,500 US $: 22.34	Fcfa: 760 US $: 1.62	Fcfa: 50,000 US $: 106.38	Camel
Tombouctou (N)	CSREF Goundam (62)		12.529	90	0	228	Fcfa: 6300 US $: 13.40	Fcfa: 877 US $: 1.87	Fcfa: 30,00 US $: 63.83	Camel
Tombouctou (N)	CSREF Goundam (62)	Tin Aicha (64)	67	110	0	7	Fcfa: 7700 US $: 16.38	Fcfa: 4690 US $: 9.98	Fcfa: 15,000 US $: 31.91	Chariot
Tombouctou (N)	CSREF Niafunke (63)		9.366	30	0	320	Fcfa: 2100 US $: 4.47	Fcfa: 656 US $: 1.39	Fcfa: 10,000 US $: 21.28	Camel
Tombouctou (N)	CSREF Niafunke (63)	Gounambougou (65)	9.133	27	0	15	Fcfa: 1890 US $: 4.02	Fcfa: 639 US $: 1.36	Fcfa: 1000 US $: 2.13	Chariot
Gao (N)	Hospital Gao (71)		11.2	85	0	72	Fcfa: 5950 US $: 12.66	Fcfa: 784 US $: 1.67	Fcfa: 30,000 US $: 63.83	Camel
Gao (N)	CSREF Ansongo (72)		11.747	60	0	151	Fcfa: 4200 US $: 8.94	Fcfa: 822 US $: 1.75	Fcfa: 20,000 US $: 42.55	Camel
Gao (N)	CSREF Ansongo (72)	Bara (74)	11	25	0	5	Fcfa: 1750 US $: 3.72	Fcfa: 770 US $: 1.64	Fcfa: 10,000 US $: 21.28	Camel
Gao (N)	CSREF Bourem (73)		17.8	85	0	145	Fcfa: 5950 US $: 12.66	Fcfa: 1246 US $: 2.65	Fcfa: 30,000 US $: 63.83	Camel
Gao (N)	CSREF Bourem (73)	Kermachoe (75)	3	5	0	3	Fcfa: 350 US $: 0.74	Fcfa: 210 US $: 0.45	Fcfa: 2000 US $: 4.26	Canoe
Kidal (N)	**CSREF** Kidal (81)		27	86	0	58	Fcfa: 6020 US $: 12.81	Fcfa: 1890 US $: 4.02	Fcfa: 30,000 US $: 63.83	Camel
Bamako (S)	U Hospital Gabriel Toure (91)		3	10	0	26	Fcfa: 700 US $: 1.49	Fcfa: 210 US $: 0.45	Fcfa: 4000 US $: 8.51	Taxi
Bamako (S)	CSREF Commune II (92)		2.833	5	0	6	Fcfa: 350 US $: 0.74	Fcfa: 198 US $: 0.42	Fcfa: 1000 US $: 2.13	Taxi
Bamako (S)	CSREF Commune II (92)	Benkady(94)	1.6	6	0	3	Fcfa: 420 US $: 0.89	Fcfa: 112 US $: 0.24	Fcfa: 2000 US $: 4.26	Taxi
Bamako (S)	CSREF Commune V (93)		4.4	10	0	10	Fcfa: 700 US $: 1.49	Fcfa: 308 US $: 0.66	Fcfa: 1000 US $: 2.13	Taxi
Bamako S)	CSREF Commune V (93)	Asacotoqua (95)	2.8	3	0	2	Fcfa: 210 US $: 0.45	Fcfa: 196 US $: 0.42	Fcfa: 1000 US $: 2.13	Taxi

Appendix G.

Frequency of socio-demographic characteristics of women

Characteristics	Number	Percent (%)
Occupation mum grouped into 4 groups		
1: Unemployed (4, 2, 13)	**3,305**	**85.18**
2: Officers (1, 3, 7)	177	4.56
3: Unskilled manual work (6, 9, 10, 11)	203	5.23
4: Tradeswomen (5,8, 12)	195	5.03
Occupation mother		
1: Executive/Technician/Manager	23	3.17
2: Pupil/Student	209	5.39
3: Health personnel	37	0.95
4: Housewife	**3,092**	**79.69**
5: Merchant	40	1.03
6: Agriculture/Animal husbandry/ Fishing	88	2.27
7: Employees (commercial agent, project officer)	17	0.44
8: Sales/Services (confectioner, bakery, braider...)	30	0.77
9: Unskilled manual work	34	0.88
10: Artisan (painter, dressmaker, shoemaker, dyer)	41	1.06
11: Housework (domestic, servant)	40	1.03
12: Sellers/Small business	125	3.22
13: Unemployed	4	0.10
Education		
0: None	**2,505**	**68.44**
1: Primary	666	18.20
2: Secondary	307	8.39
3: Tertiary	139	3.80
4: Others	43	1.17
under Others Education = 43		
1: French-Arabic	1	2.33
2: Koranic school	20	46.51
3: Literacy	1	2.33
4: Madrassah	**21**	**48.83**
Quintile		
1: Lowest	676	17.04
2: Low	278	7.01
3: Middle	561	14.14
4: Rich	832	20.97
5: Richest	**1,621**	**40.85**
Mean of transportation		
1: ambulance	781	20.42
2: Vehicle	548	14.33
3: Taxi	**998**	**26.10**
4: Motorbike	628	16.42
5: Public transportation	161	4.21
6: Others	708	18.51
Under Others mean of transportation = 708		
1. Already hospitalized	1	0.14
2. Bike	2	0.28
3. By foot	**549**	**77.54**
4. Camel	3	0.42
5. Canoe	10	1.41
6. Chariot	134	18.93
7. Civil protection vehicle	2	0.28
8. Pinnace	3	0.42
9. Not specified	4	0.5

Appendix H.

Access to health facility by women

Access to health facilities	Number	Percent(%)
Arriving from		
1: CSCom	988	25.06
2: Csref	175	4.44
3: Her home	**2,536**	**64.32**
4: Private medical clinic	69	1.75
5:Referred by a health personnel not in service in CSCom / CSRef	157	3.98
6: Others	18	0.46
under others "arriving from " = 18		
1: Mutual social health	3	16.67
2: Already hospitalized	2	11.11
3: Community center	1	5.56
4: Maternity camp/police	3	16.67
5: Maternity/nursing of Garnison	2	11.11
6: Rural maternity	**6**	**33.33**
7: OPD	1	5.55
Reason for admission		
1: Acute fetal distress	96	2.46
2: Excessive uterine volume	39	1.00
3: Fetus bigger than pelvis	86	2.20
4: Globally narrow pelvis (BGR)	58	1.49
5: Had caesarean in the past	176	4.51
6: Hemorrhages (from uterus)	219	5.61
7: Hypertension /Eclampsia	165	4.23
8: Painful uterine contraction	**2,134**	**54.68**
9: Programmed caesarean (prophylactic)	224	5.74
10: Prolapsed of the cord with heart bits	26	0.67
11: Prolonged labor	150	3.84
12: Retro-placenta hemorrhage (HRP)	45	1.15
13: Vicious presentation	166	4.25
14: Others	319	8.17

Appendix I.

The different medical indications of cesarean

Medical indications of cesarean	**Percentage**
Abruptioplacenta	6.64
Placenta previa	4.39
Beating prolapsed cord	1.72
Acute fetal distress	**12.63**
Scarred uterus + borderline pelvis	3.65
Bi-scarred uterus and more	**7.34**
contracted pelvis	**9.68**
Immature pelvis	1.72
Borderline pelvis	0.86
Borderline pelvis + loaded obstetric history	0.16
Extremely desired child	0.37
pre-rupture uterus syndrome	3.16
Uterine rupture	3.16
Old primipara	0.7
Prophylactic cesarean	**7.38**
Hypertension	0.49
Eclampsia/Preeclampsia	6.07
Dystocia	3.53
Failure of labor trial	0.78
Stationary cervical dilatation	2.67
Cephalo pelvic disproportion	**9.68**
Breech presentation + other reasons	3.53
Brow presentation	0.7
Presentation of mento-sacral face	0.41
Badly flexed vertex presentation	1.85
Transverse shoulder presentation	2.26
Unknown shoulder presentation	0.62
Transverse lie	3.36
Twin pregnancy + other reasons	0.49

Appendix J.

Socio-economic and demographic factors by mode of delivery

		Normal delivery		Elective delivery		Emergency delivery		Total delivery	
		Frequency	%	Frequency	%	Frequency	%	Frequency	%
Mother age	Age	1,488	M: 25.40 %: 37.76	1,502	M: 25.51 %:38.11	951	M: 26.20 %: 24.13	3,941	M: 25.64 %: 100
	[13 -15]	28	1.88	44	2.93	15	1.58	87	2.21
	[16 - 19]	308	20.70	323	21.50	202	21.24	833	21.14
	[20 – 24]	387	26.01	355	23.64	200	21.03	942	23.90
	[25 – 29]	335	22.51	312	20.77	207	21.77	854	21.67
	[30 – 34]	240	16.13	256	17.04	159	16.72	655	16.62
	[35 – 39]	152	10.22	164	10.92	127	13.35	443	11.24
	[40 – 51]	38	2.55	48	3.20	41	4.31	127	3.22
	Total	1,488	100	1,502	100	951	100	3,941	100
Mother Occupation	Occupation	1,472	37.94	1,478	38.09	930	23.97	3880	100
	1: Jobless	1,282	87.09	1,244	84.17	779	83.76	3,305	85.18
	2: Officers	33	2.24	87	5.89	57	6.13	177	4.56
	3: Unskilled manual work	102	6.93	58	3.92	43	4.62	203	5.23
	4: Tradeswomen	55	3.74	89	6.02	51	5.48	195	5.03
	Total	1,472	100	1,478	100	930	100	3,880	100
Mother education	Education	1,342	37.76	1,399	38.22	879	24.02	3,660	100
	0: None	1,036	74.96	892	63.76	577	65.64	2,505	68.44
	1: Primary	211	15.27	294	21.02	161	18.32	666	18.20
	2: Secondary	79	5.72	133	9.51	95	10.81	307	8.39
	3: Tertiary	49	3.55	59	4.22	31	3.53	139	3.80
	4: Koranic education	7	0.51	21	1.5	15	1.71	43	1.17
	Total	1,382	100	1,399	100	879	100	3,660	100
REGIONS	Regions	1,496	37.70	1,513	38.13	959	24.17	3,968	100
	1: Kayes	91	6.08	220	14.54	161	16.79	472	11.90
	2: Koulikoro	229	15.31	176	11.63	73	7.61	478	12.05
	3: Sikasso	202	13.50	210	13.88	80	8.34	492	12.40
	4: Segou	251	16.78	220	14.54	121	12.62	592	14.92
	5: Mopti	129	8.62	52	3.44	58	6.05	239	6.02
	6: Tombouctou	64	4.28	51	3.37	41	4.28	156	3.93
	7: Gao	47	3.14	46	3.04	59	6.15	152	3.83
	8: Kidal	0	0	8	0.53	5	0.52	13	0.33
	9: Bamako	483	32.29	530	35.03	361	37.64	1,374	34.63
	Total	1,496	100	1,513	100	959	100	3,968	100
Admission mode	Admission mode	1,484	37.78	1,494	38.03	950	24.19	3,928	100
	0: Came by themselves	1,430	96.36	714	47.79	332	34.95	2,476	63.03
	1: Referral	2	0.13	289	19.34	80	8.42	371	9.45
	2: Evacuation	3	0.20	490	32.80	537	56.53	1,030	26.22
	3: Referred by ATR	49	3.30	1	0.07	1	0.11	51	1.30
	Total	1,484	100	1,494	100	950	100	3,928	100

		Normal delivery		Elective delivery		Emergency delivery		Total delivery	
		Frequency	%	Frequency	%	Frequency	%	Frequency	%
Parity	Parity	1,494	37,76	**1,509**	**38.13**	954	24.11	3,957	100
	One parity	359	24.03	436	28.89	**290**	**30.40**	1,085	27.42
	Two-three parities	**511**	**34.20**	**546**	**36.18**	255	26.73	**1,312**	**33.16**
	Four-five parities	312	20.88	270	17.89	182	19.08	764	19.31
	More than five parities	312	20.88	257	17.03	227	23.79	796	20.12
	Total	**1,494**	**100**	**1,509**	**100**	**954**	**100**	**3,957**	**100**
Obstetricians	Obstetricians	1,496	Mean: 3.56 %: 37.70	**1,513**	Mean: 3.62 %: **38.13**	959	Mean: 3.30 %: 24.17	3,968	M:: 3.18 %: 100
	(1-2)	**1,492**	**99.73**	**567**	**37.48**	**362**	**37.75**	**2,421**	**61.01**
	(3-4)	3	0.20	429	28.35	249	25.96	681	17.16
	(7-21)	1	0.07	517	34.17	348	36.29	866	21.82
	Total	**1,496**	**100**	**1,513**	**100**	**959**	**100**	**3,968**	**100**
Medical indications of cesarean	Indications of cesarean			1,483	60.83	955	39.17	2,438	100
	Anomaly of placenta			102	6.88	167	17.49	269	11.03
	Placenta previa			102	6.88	5	0.52	107	4.39
	Abruptio Placenta			0	0	162	16.96	162	6.64
	Repeated cesarean			267	18	1	0.10	268	10.99
	Scarred uterus			89	6	0	0	89	3.65
	Bi-scarred uterus			178	12	1	0.10	179	7.34
	Anomaly of pelvis			288	19.42	11	1.15	299	12.26
	Contracted pelvis			233	15.71	3	0.31	236	9.68
	Immature pelvis			37	2.49	5	0.52	42	1.72
	Borderline pelvis			18	1.21	3	0.31	21	0.86
	Obstetric history			4	0.27	0	0	4	0.16
	Malpresentation			253	17.06	57	5.97	310	12.72
	Breech			86	5.80	0	0	86	3.53
	Brow			16	1.08	1	0.10	17	0.70
	Mento-sacral face			10	0.67	0	0	10	0.41
	Badly flexed vertex			38	2.56	7	0.73	45	1.85
	Transverse shoulder			47	3.17	8	0.84	55	2.26
	Unknown shoulder			0	0	15	1.57	15	0.62
	Transverse lie			56	3.78	26	2.72	82	3.36
	Cephalo-pelvic-dilatation			223	15.04	13	1.36	236	9.68
	Elderly primipara			17	1.15	0	0	17	0.70
	Desired child			8	0.54	1	0.10	9	0.37
	Twin pregnancy			11	79.10	1	0.10	12	0.49
	Prophylactic cesarean			169	11.40	11	1.15	180	7.38
	Acute fetal distress			0	0	308	32.25	308	12.63
	Beating prolapsed cord			0	0	42	4.40	42	1.72

		Normal delivery		Elective delivery		Emergency delivery		Total delivery	
		Frequency	%	Frequency	%	Frequency	%	Frequency	%
	Prolonged/obstructed labor			0	0	170	17.80	170	6.97
	Dystocia			0	0	86	9.01	86	3.53
	Failure of labor			0	0	19	1.99	19	0.78
	S. cervical dilatation			0	0	65	6.81	65	2.67
	Pre rupture uterine Sd			0	0	77	8.06	77	3.16
	Uterine rupture			0	0	77	8.06	77	3.16
	Hypertension /Eclampsia / pre eclampsia			141	9.51	19	1.99	160	6.56
	Hypertension			3	0.20	9	0.94	12	0.49
	Eclampsia/ Pre Ecl			138	09.31	10	1.05	148	6.07
	Total			**1,483**	**100**	**955**	**100**	**2,438**	**100**
Socio-economic status	**Quintile**	1,496	37.70	**1,513**	**38.13**	959	24.17	3,968	100
	Quin 1	397	26.54	167	11.04	112	11.68	676	17.04
	Quin 2	131	8.76	84	5.55	63	6.57	278	7.01
	Quin 3	222	14.84	206	13.62	133	13.87	561	14.14
	Quin 4	244	16.31	353	23.33	235	24.50	832	20.97
	Quin 5	**502**	**33.56**	**703**	**46.46**	**416**	**43.38**	**1,621**	**40.85**
	Total	**1,496**	**100**	**1,513**	**100**	**959**	**100**	**3,968**	**100**
Transportation mean	**Transportation mean**	1,433	37.47	**1,460**	**38.18**	931	24.35	3,824	100
	1: Ambulance	2	0.14	389	26.64	**390**	**41.89**	781	20.42
	2: Vehicle	150	10.47	263	18.01	135	14.5	548	14.33
	3: Taxi	263	18.35	**478**	**32.74**	257	27.6	**998**	**26.10**
	4: Motorbike	388	27.08	175	11.99	65	6.98	628	16.42
	5: Public transportation	42	2.93	84	5.75	35	3.76	161	4.21
	6: Others	**588**	**41.03**	71	4.86	49	5.26	708	18.51
	Total	**1,433**	**100**	**1,460**	**100**	**931**	**100**	**3824**	**100**
Others transportation mean	**Under others**	**588**	**83.05**	71	10.03	49	6.92	708	100
	1: Already hospitalized	0	0	1	1.41	0	0	1	0.14
	2: Bike	2	0.34	0	0	0	0	2	0.28
	3: By foot	**465**	**79.62**	**58**	**81.69**	**26**	**53.06**	**549**	**77.54**
	4: Camel	3	0.51	0	0	0	0	3	0.42
	5: Canoe	1	0.17	3	4.23	6	12.24	10	1.41
	6: Chariot	113	19.35	8	11.27	13	26.53	134	18.93
	7: Civil protection vehicle	0	0	0	0	2	4.08	2	0.28
	8: Pinnace	0	0	1	1.41	2	4.08	3	0.42
	9: not specified	4	0.60	0	0	0	0	4	0.58
	Total	**588**	**100**	**71**	**100**	**49**	**100**	**708**	**100**

Appendix K.

Binomial probit (after excluding Mef) and the correlation test

-

		LR chi2(21)	= 3517.00
		Prob > chi2	= 0.0000
Log likelihood = -597.02796		Pseudo R2	= 0.7465

ces	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_Ireg_2	.1073685	.1829772	0.59	0.557	-.2512602	.4659973
_Ireg_3	-.0051608	.1833958	-0.03	0.978	-.3646099	.3542884
_Ireg_4	.2540501	.1772068	1.43	0.152	-.0932688	.601369
_Ireg_5	-1.327377	.1938753	-6.85	0.000	-1.707366	-.9473882
_Ireg_6	-6.208064	.3188861	-19.47	0.000	-6.83307	-5.583059
_Ireg_7	-7.588094	1.713184	-4.43	0.000	-10.94587	-4.230315
_Ireg_8	(omitted)					
_Ireg_9	-1.629436	.2683336	-6.07	0.000	-2.15536	-1.103512
_Iocm_for_2	1.001621	.4198853	2.39	0.017	.1786613	1.824582
_Iocm_for_3	.0490384	.1973791	0.25	0.804	-.3378175	.4358943
_Iocm_for_4	.1115686	.2575036	0.43	0.665	-.3931292	.6162663
age	-.078435	.0439346	-1.79	0.074	-.1645452	.0076751
age2	.0015526	.0007929	1.96	0.050	-1.45e-06	.0031067
_Iedu_1	.3554281	.1195075	2.97	0.003	.1211976	.5896585
_Iedu_2	.093419	.2222843	0.42	0.674	-.3422503	.5290883
_Iedu_3	-.4585536	.5044533	-0.91	0.363	-1.447264	.5301567
_Iedu_4	1.460063	.3631365	4.02	0.000	.7483282	2.171797
bor	-.0095869	.0270487	-0.35	0.723	-.0626013	.0434276
quin	.1185453	.0331434	3.58	0.000	.0535854	.1835051
trc3	.0006457	.0000282	22.91	0.000	.0005905	.000701
_Iobsr_3_1	3.93407	.2889759	13.61	0.000	3.367687	4.500452
_Iobsr_3_2	5.669208	.3452104	16.42	0.000	4.992608	6.345808
_cons	-1.562209	.6072078	-2.57	0.010	-2.752315	-.372104

. correlate ces reg ocm_for age age2 edu bor quin trc3 obsr_3
(obs=3549)

	ces	reg	ocm_for	age	age2	edu	bor	quin	trc3	obsr_3
ces	1.0000									
reg	0.0250	1.0000								
ocm_for	0.0302	0.0331	1.0000							
age	0.0244	0.0009	0.0580	1.0000						
age2	0.0278	-0.0063	0.0550	0.9908	1.0000					
edu	0.1043	0.2443	0.1279	-0.0771	-0.0755	1.0000				
bor	-0.0240	-0.1196	0.0142	0.7580	0.7558	-0.2291	1.0000			
quin	0.2234	0.4617	0.1194	-0.0210	-0.0244	0.3453	-0.1541	1.0000		
trc3	0.2252	0.0002	-0.0818	-0.0723	-0.0659	0.0092	-0.0662	-0.0136	1.0000	
obsr_3	0.5806	0.4901	0.1054	0.0682	0.0605	0.1699	-0.0219	0.3534	-0.2014	1.0000

Appendix L.

Binomial probit (occupation of the father instead of the mother)

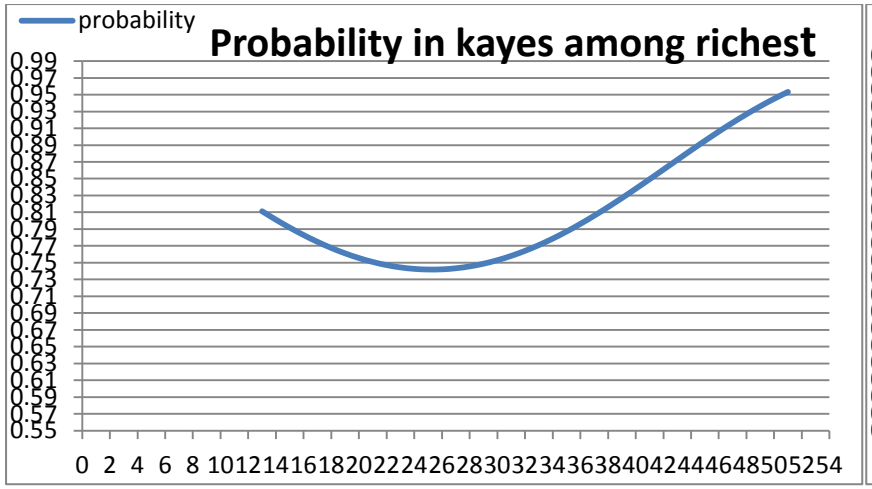
		LR chi2(22)	= 3459.40
		Prob > chi2	= 0.0000
Log likelihood = -596.44993		Pseudo R2	= 0.7436

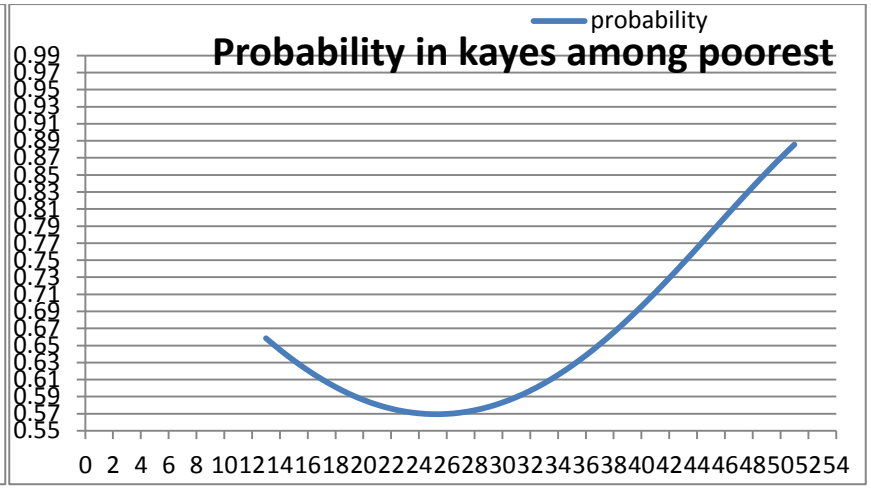
ces	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_Ireg_2	.1531808	.1774945	0.86	0.388	-.194702	.5010636
_Ireg_3	.0100333	.185099	0.05	0.957	-.352754	.3728207
_Ireg_4	.2994769	.177912	1.68	0.092	-.0492242	.6481781
_Ireg_5	-1.332004	.1954326	-6.82	0.000	-1.715045	-.9489628
_Ireg_6	-6.206777	.3180874	-19.51	0.000	-6.830217	-5.583337
_Ireg_7	-7.622791	2.053795	-3.71	0.000	-11.64816	-3.597427
_Ireg_8	(omitted)					
_Ireg_9	-1.530419	.264479	-5.79	0.000	-2.048788	-1.01205
_Iocf_fiv_2	.3886705	.3038519	1.28	0.201	-.2068683	.9842094
_Iocf_fiv_3	.0934632	.2699881	0.35	0.729	-.4357038	.6226302
_Iocf_fiv_4	.1489708	.2978462	0.50	0.617	-.4347971	.7327386
_Iocf_fiv_5	-.0639617	.616834	-0.10	0.917	-1.272934	1.145011
age	-.0563433	.0441568	-1.28	0.202	-.1428891	.0302024
age2	.0011591	.0007951	1.46	0.145	-.0003993	.0027175
_Iedu_1	.3253943	.1225038	2.66	0.008	.0852913	.5654973
_Iedu_2	.1862923	.2143475	0.87	0.385	-.2338211	.6064057
_Iedu_3	-.2048428	.5290243	-0.39	0.699	-1.241711	.8320258
_Iedu_4	1.441702	.3654451	3.95	0.000	.7254424	2.157961
bor	-.0041936	.0267695	-0.16	0.876	-.0566609	.0482736
quin	.1011326	.0339047	2.98	0.003	.0346807	.1675845
trc3	.0006528	.000028	23.30	0.000	.0005979	.0007078
_Iobsr_3_1	3.824108	.2852485	13.41	0.000	3.265032	4.383185
_Iobsr_3_2	5.59994	.3408087	16.43	0.000	4.931967	6.267912
_cons	-1.977901	.6506813	-3.04	0.002	-3.253213	-.7025893

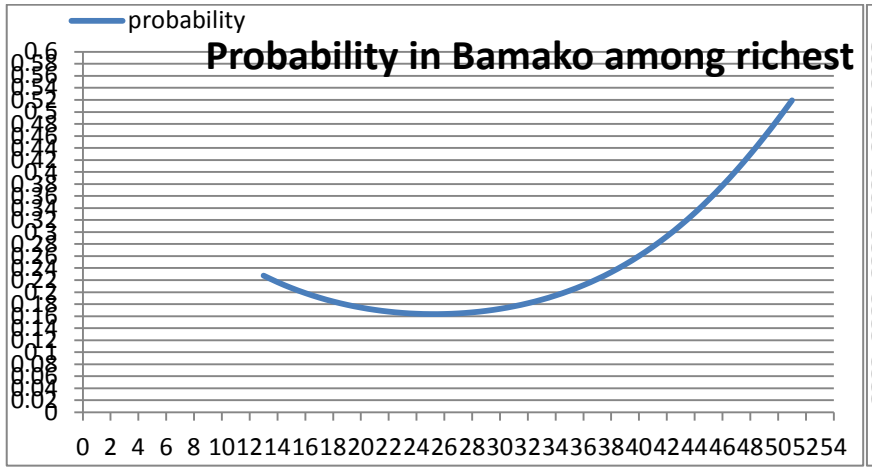
Appendix M.

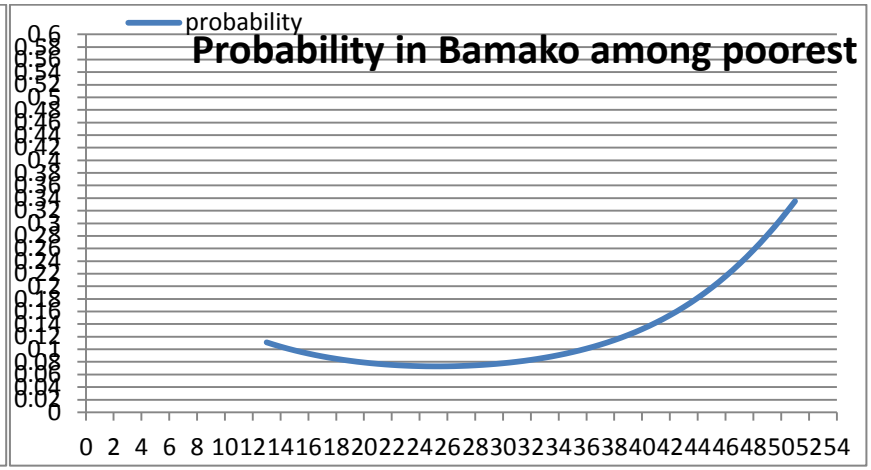
Age effect on cesarean depend on SES level in Kayes and Bamako

	Kayes / Richest		Kayes poorest			Bamako / Richest		Bamako / poorest	
Age	**Probability**	**Z score**	**Probability**	**Z score**		**Probability**	**Z score**	**Probability**	**Z score**
13	**0.811221586**	0.882407	**0.658445995**	0.408225661		**0.227522986**	-0.747029139	**0.111003**	-1.22121
14	0.801193519	0.845892	0.644945931	0.371710861		0.216653881	-0.783543939	0.104246	-1.25773
15	0.791742577	0.812482	0.632431913	0.338301261		0.20697749	-0.816953539	0.098328	-1.29113
16	0.782945032	0.782178	0.620957639	0.307996861		0.198425683	-0.847257939	0.093177	-1.32144
17	0.774869167	0.754979	0.610567201	0.280797661		0.190934676	-0.874457139	0.088727	-1.34864
18	0.767575258	0.730885	0.601296227	0.256703661		0.184445897	-0.898551139	0.084918	-1.37273
19	0.761115703	0.709896	0.593173031	0.235714861		0.178906613	-0.919539939	0.081701	-1.39372
20	0.755535248	0.692012	0.586219707	0.217831261		0.174270369	-0.937423539	0.079033	-1.4116
21	0.75087127	0.677234	0.580453142	0.203052861		0.170497289	-0.952201939	0.076879	-1.42638
22	0.747154085	0.665561	0.575885923	0.191379661		0.167554265	-0.963875139	0.075209	-1.43806
23	0.744407246	0.656993	0.572527101	0.182811661		0.16541507	-0.972443139	0.074001	-1.44662
24	0.742647811	0.65153	0.570382813	0.177348861		0.164060424	-0.977905939	0.073239	-1.45209
25	**0.741886545**	0.649172	**0.56945675**	0.174991261		**0.163478024**	-0.980263539	**0.072912**	-1.45444
26	0.74212807	0.64992	0.569750448	0.175738861		0.163662558	-0.979515939	0.073015	-1.4537
27	0.743370923	0.653773	0.571263424	0.179591661		0.164615712	-0.975663139	0.073551	-1.44984
28	0.745607535	0.660731	0.573993131	0.186549661		0.166346164	-0.968705139	0.074526	-1.44289
29	0.748824134	0.670794	0.577934747	0.196612861		0.168869578	-0.958641939	0.075954	-1.43282
30	0.753000565	0.683962	0.5830808	0.209781261		0.172208587	-0.945473539	0.077854	-1.41965
31	0.758110053	0.700236	0.589420624	0.226054861		0.176392739	-0.929199939	0.080252	-1.40338
32	0.76411892	0.719615	0.596939666	0.245433661		0.181458422	-0.909821139	0.083179	-1.384
33	0.77098628	0.742099	0.60561865	0.267917661		0.187448708	-0.887337139	0.086675	-1.36152
34	0.778663734	0.767688	0.615432622	0.293506861		0.194413119	-0.861747939	0.090786	-1.33593
35	0.787095115	0.796382	0.626349885	0.322201261		0.202407267	-0.833053539	0.095567	-1.30723
36	0.796216299	0.828182	0.638330881	0.354000861		0.211492325	-0.801253939	0.101078	-1.27544
37	0.805955144	0.863087	0.651327033	0.388905661		0.221734293	-0.766349139	0.10739	-1.24053
38	0.816231589	0.901097	0.665279621	0.426915661		0.233203004	-0.728339139	0.114581	-1.20252
39	0.82695796	0.942212	0.68011874	0.468030861		0.24597081	-0.687223939	0.122739	-1.16141
40	0.838039529	0.986432	0.695762414	0.512251261		0.260110902	-0.643003539	0.131958	-1.11718
41	0.849375359	1.033758	0.712115954	0.559576861		0.275695199	-0.595677939	0.142341	-1.06986
42	0.860859465	1.084189	0.729071634	0.610007661		0.292791777	-0.545247139	0.154	-1.01943
43	0.872382305	1.137725	0.746508787	0.663543661		0.311461781	-0.491711139	0.167049	-0.96589
44	0.883832597	1.194366	0.764294408	0.720184861		0.331755831	-0.435069939	0.181609	-0.90925
45	0.895099434	1.254112	0.782284332	0.779931261		0.353709931	-0.375323539	0.1978	-0.8495
46	0.906074664	1.316964	0.800325052	0.842782861		0.377340943	-0.312471939	0.215742	-0.78665
47	0.916655433	1.382921	0.818256218	0.908739661		0.402641743	-0.246515139	0.235548	-0.7207
48	0.926746815	1.451983	0.835913785	0.977801661		0.429576235	-0.177453139	0.257319	-0.65163
49	0.936264385	1.52415	0.853133785	1.049968861		0.45807446	-0.105285939	0.281137	-0.57947
50	0.945136618	1.599422	0.869756593	1.125241261		0.488028128	-0.030013539	0.307062	-0.50419
51	**0.953306931**	1.6778	**0.885631537**	1.203618861		**0.519286949**	0.048364061	**0.335121**	-0.42582


probability
Probability in kayes among richest


probability
Probability in kayes among poorest


probability
Probability in Bamako among richest


probability
Probability in Bamako among poorest

Appendix N.

Probit regression with interaction terms

```
                                                LR chi2(89)     =    3684.28
                                                Prob > chi2     =     0.0000
Log likelihood = -442.49086                     Pseudo R2       =     0.8063
```

ces	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_Ireg_2	.4539246	.8660685	0.52	0.600	-1.243539	2.151388
_Ireg_3	-.6076086	.8376255	-0.73	0.468	-2.249324	1.034107
_Ireg_4	1.000073	.9099209	1.10	0.272	-.783339	2.783485
_Ireg_5	-2.806805	.7743374	-3.62	0.000	-4.324478	-1.289131
_Ireg_6	-.5368185	1.873973	-0.29	0.775	-4.209738	3.136101
_Ireg_7	-10.43028	42.10378	-0.25	0.804	-92.95217	72.09161
_Ireg_8	(omitted)					
_Ireg_9	-2.475953	.7335313	-3.38	0.001	-3.913648	-1.038259
_Iocm_for_2	.2645937	.7035279	0.38	0.707	-1.114296	1.643483
_Iocm_for_3	.227301	.6895709	0.33	0.742	-1.124233	1.578835
_Iocm_for_4	.1745785	.5329093	0.33	0.743	-.8699046	1.219062
age	.0123356	.0659275	0.19	0.852	-.1168798	.1415511
age2	.0000874	.0011587	0.08	0.940	-.0021836	.0023584
_Iedu_1	.2544479	.3479732	0.73	0.465	-.427567	.9364627
_Iedu_2	.2273771	.4229422	0.54	0.591	-.6015744	1.056329
_Iedu_3	-.0154408	.7474422	-0.02	0.984	-1.480401	1.449519
_Iedu_4	1.530863	1.352256	1.13	0.258	-1.119509	4.181235
bor	.0411447	.0591937	0.70	0.487	-.0748728	.1571622
quin	.2510392	.1595075	1.57	0.116	-.0615897	.5636681
trc3	.0007866	.000038	20.68	0.000	.000712	.0008611
_Iobsr_3_1	4.246728	.2977135	14.26	0.000	3.663221	4.830236
_Iobsr_3_2	5.84565	.4020959	14.54	0.000	5.057557	6.633744
quin#edu						
1 1	-.0245433	.4847968	-0.05	0.960	-.9747275	.9256409
1 2	(empty)					
1 3	(empty)					
1 4	-1.763085	1.577038	-1.12	0.264	-4.854023	1.327853
2 0	.9655572	44.42935	0.02	0.983	-86.11436	88.04548
2 1	.8173811	44.43213	0.02	0.985	-86.268	87.90277
2 2	(empty)					
2 3	(empty)					
2 4	-.754614	44.46848	-0.02	0.986	-87.91123	86.402
3 0	.7955839	1.262626	0.63	0.529	-1.679117	3.270285
3 1	.7377118	1.304264	0.57	0.572	-1.818598	3.294022
3 2	-.1826496	1.789543	-0.10	0.919	-3.690089	3.32479
3 3	(empty)					
3 4	(empty)					
4 0	.361413	.8623979	0.42	0.675	-1.328856	2.051682
4 1	.5048535	.9173368	0.55	0.582	-1.293094	2.302801
4 2	-.2276456	1.000422	-0.23	0.820	-2.188436	1.733145
4 3	-.4571319	2.330597	-0.20	0.844	-5.025017	4.110753
4 4	-.900887	1.855508	-0.49	0.627	-4.537616	2.735842
5 0	(omitted)					
5 1	(omitted)					
5 2	(omitted)					
5 3	(omitted)					
5 4	(omitted)					

quin#reg						
1 2	-.1737404	.8873972	-0.20	0.845	-1.913007	1.565526
1 3	.8586826	.8566247	1.00	0.316	-.820271	2.537636
1 4	-1.040206	.9240512	-1.13	0.260	-2.851313	.7709008
1 5	2.07426	.7709934	2.69	0.007	.5631405	3.585379
1 6	1.004136	2.522742	0.40	0.691	-3.940347	5.94862
1 7	1.483551	39.63498	0.04	0.970	-76.19958	79.16668
1 8	(empty)					
1 9	(empty)					
2 1	.670242	44.43879	0.02	0.988	-86.42818	87.76867
2 2	-1.211067	44.43112	-0.03	0.978	-88.29446	85.87233
2 3	-.2034174	44.42473	-0.00	0.996	-87.27429	86.86745
2 4	-1.362811	44.43354	-0.03	0.976	-88.45095	85.72533
2 5	-.6167175	44.42907	-0.01	0.989	-87.6961	86.46267
2 6	.0921589	44.48029	0.00	0.998	-87.08761	87.27192
2 7	(omitted)					
2 8	(empty)					
2 9	(empty)					
3 1	-.5841799	1.03512	-0.56	0.573	-2.612979	1.444619
3 2	-1.288283	1.113213	-1.16	0.247	-3.470141	.8935743
3 3	-.0529897	1.075696	-0.05	0.961	-2.161316	2.055336
3 4	-2.32131	1.164133	-1.99	0.046	-4.60297	-.0396507
3 5	-.051199	1.044485	-0.05	0.961	-2.098352	1.995954
3 6	-7.094278	2.01418	-3.52	0.000	-11.042	-3.146558
3 7	-.0821433	38.64859	-0.00	0.998	-75.83199	75.66771
3 8	(empty)					
3 9	(omitted)					
4 1	-.4122524	.7263218	-0.57	0.570	-1.835817	1.011312
4 2	-1.096161	.8045818	-1.36	0.173	-2.673113	.4807902
4 3	(omitted)					
4 4	-.8100061	.8606387	-0.94	0.347	-2.496827	.8768148
4 5	-1.058838	.7729774	-1.37	0.171	-2.573846	.45617
4 6	-5.553939	1.864338	-2.98	0.003	-9.207975	-1.899904
4 7	(omitted)					
4 8	(empty)					
4 9	(omitted)					
5 1	(omitted)					
5 2	(omitted)					
5 3	(empty)					
5 4	(omitted)					
5 5	(omitted)					
5 6	(omitted)					
5 7	(empty)					
5 8	(empty)					
5 9	(omitted)					

quin#ocm_for						
1 2	(empty)					
1 3	-.0621868	.777674	-0.08	0.936	-1.5864	1.462026
1 4	-.4262743	1.217431	-0.35	0.726	-2.812395	1.959847
2 1	(omitted)					
2 2	(empty)					
2 3	(empty)					
2 4	(empty)					
3 1	.1846711	.9987953	0.18	0.853	-1.772932	2.142274
3 2	(empty)					
3 3	-.3302152	1.269223	-0.26	0.795	-2.817846	2.157416
3 4	(omitted)					
4 1	.0933431	.7316497	0.13	0.898	-1.340664	1.52735
4 2	.2183734	2.369534	0.09	0.927	-4.425828	4.862575
4 3	-.1934625	1.012657	-0.19	0.848	-2.178235	1.79131
4 4	(omitted)					
5 1	(omitted)					
5 2	(omitted)					
5 3	(omitted)					
5 4	(omitted)					
borr#reg						
0 2	.770355	.5045805	1.53	0.127	-.2186047	1.759315
0 3	.3960522	.5103573	0.78	0.438	-.6042297	1.396334
0 4	.7692342	.5018144	1.53	0.125	-.2143041	1.752772
0 5	1.055433	.5437515	1.94	0.052	-.0103006	2.121166
0 6	-1.80341	.8190737	-2.20	0.028	-3.408765	-.1980552
0 7	.6129328	22.67804	0.03	0.978	-43.8352	45.06107
0 8	(empty)					
0 9	1.100106	.5902365	1.86	0.062	-.0567361	2.256949
1 1	-.422992	.4534871	-0.93	0.351	-1.31181	.4658265
1 2	.3853041	.4046997	0.95	0.341	-.4078928	1.178501
1 3	.2948781	.4166143	0.71	0.479	-.521671	1.111427
1 4	.6513498	.4009705	1.62	0.104	-.134538	1.437238
1 5	.7680406	.475764	1.61	0.106	-.1644397	1.700521
1 6	-3.132304	.7437294	-4.21	0.000	-4.589987	-1.674621
1 7	.5186699	27.80155	0.02	0.985	-53.97137	55.00871
1 8	(empty)					
1 9	.9613571	.5207343	1.85	0.065	-.0592634	1.981978
2 1	-.0634868	.6669804	-0.10	0.924	-1.370744	1.243771
2 2	-.0414697	.3593033	-0.12	0.908	-.7456912	.6627517
2 3	.0793483	.3722865	0.21	0.831	-.6503198	.8090164
2 4	.2635288	.3509374	0.75	0.453	-.4242959	.9513535
2 5	.4084724	.4580202	0.89	0.372	-.4892306	1.306176
2 6	-2.330624	.8000393	-2.91	0.004	-3.898673	-.7625762
2 7	.459398	23.54388	0.02	0.984	-45.68576	46.60455
2 8	(empty)					
2 9	.7686567	.54309	1.42	0.157	-.2957802	1.833094
3 1	-.3829056	.6405998	-0.60	0.550	-1.638458	.8726468
3 2	(omitted)					
3 3	(omitted)					
3 4	(omitted)					
3 5	(omitted)					
3 6	(omitted)					
3 7	(omitted)					
3 8	(empty)					
3 9	(omitted)					
_cons	-4.009966	1.13459	-3.53	0.000	-6.233721	-1.786212

Appendix O.

Marginal effect after the multinomial probit regression between medical and non-medical factors

```
. mfx, predict (p outcome(0))

Marginal effects after mprobit
      y  = Pr(mef==normal_delivery) (predict, p outcome(0))
         =  .01461503
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
_Ireg_2*	-.003236	.00837	-0.39	0.699	-.019642	.01317	.12141
_Ireg_3*	-.0027469	.00842	-0.33	0.744	-.019259	.013766	.133068
_Ireg_4*	-.0108209	.00656	-1.65	0.099	-.02368	.002038	.140176
_Ireg_5*	.2025557	.07996	2.53	0.011	.045828	.359283	.064828
_Ireg_6*	.9923295	.00356	278.52	0.000	.985346	.999313	.039807
_Ireg_7*	.9929006	.00314	316.01	0.000	.986742	.999059	.038385
_Ireg_8*	.9861426	.00587	168.12	0.000	.974646	.997639	.002559
_Ireg_9*	.2446757	.09492	2.58	0.010	.058634	.430717	.342906
Iocm~2*	-.0143834	.00706	-2.04	0.042	-.028215	-.000551	.046062
Iocm~3*	.000602	.01283	0.05	0.963	-.024548	.025752	.052886
Iocm~4*	-.0058361	.00939	-0.62	0.534	-.024249	.012577	.052317
age	-.001463	.00252	-0.58	0.562	-.006402	.003476	25.6531
age2	3.43e-06	.00004	0.08	0.939	-.000085	.000092	706.134
_Iedu_1*	-.0160088	.00654	-2.45	0.014	-.028826	-.003192	.181973
_Iedu_2*	-.0087266	.00722	-1.21	0.227	-.022886	.005433	.083025
_Iedu_3*	-.0008182	.02629	-0.03	0.975	-.052348	.050711	.038101
_Iedu_4*	-.0152918	.00635	-2.41	0.016	-.027743	-.002841	.011658
bor	.0020789	.0017	1.23	0.220	-.001244	.005402	3.48081
quin	-.0106076	.00397	-2.67	0.008	-.01839	-.002825	3.59283
trc3	-.0000234	.00001	-2.84	0.005	-.00004	-7.3e-06	4037.05
_Iobsr~1*	-.0651859	.02101	-3.10	0.002	-.106361	-.02401	.171169
_Iobsr~2*	-.2664399	.04728	-5.64	0.000	-.3591	-.17378	.220074
_Imode_1*	-.0298384	.01094	-2.73	0.006	-.051276	-.008401	.098379
_Imode_2*	-.1038073	.02582	-4.02	0.000	-.154405	-.053209	.254763
_Imode_3*	.0012898	.01742	0.07	0.941	-.032858	.035438	.013932

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx, predict (p outcome(1))

Marginal effects after mprobit
      y  = Pr(mef==emergency) (predict, p outcome(1))
         =  .37872509
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
_Ireg_2*	-.1616151	.04124	-3.92	0.000	-.242453	-.080777	.12141
_Ireg_3*	-.1237257	.03701	-3.34	0.001	-.196271	-.05118	.133068
_Ireg_4*	-.0950055	.0385	-2.47	0.014	-.170466	-.019545	.140176
_Ireg_5*	-.0039515	.06202	-0.06	0.949	-.125518	.117615	.064828
_Ireg_6*	-.3768558	.01571	-23.99	0.000	-.407643	-.346069	.039807
_Ireg_7*	-.3718195	.01559	-23.85	0.000	-.402369	-.34127	.038385
_Ireg_8*	-.3783917	.0156	-24.26	0.000	-.408961	-.347823	.002559
_Ireg_9*	.0299295	.07703	0.39	0.698	-.121049	.180908	.342906
Iocm~2*	.0012963	.05834	0.02	0.982	-.113039	.115632	.046062
Iocm~3*	.0641207	.0555	1.16	0.248	-.044666	.172908	.052886
Iocm~4*	-.0066193	.04696	-0.14	0.888	-.098659	.08542	.052317
age	.0124712	.01137	1.10	0.273	-.00981	.034753	25.6531
age2	-.0001669	.0002	-0.81	0.415	-.000568	.000235	706.134
_Iedu_1*	.0142498	.02897	0.49	0.623	-.042526	.071026	.181973
_Iedu_2*	.0990125	.04517	2.19	0.028	.010475	.18755	.083025
_Iedu_3*	.0002214	.06685	0.00	0.997	-.130794	.131237	.038101
_Iedu_4*	.0770263	.08812	0.87	0.382	-.095688	.24974	.011658
bor	.0102105	.00667	1.53	0.126	-.002853	.023274	3.48081
quin	.0000127	.00967	0.00	0.999	-.018933	.018958	3.59283
trc3	4.24e-06	.00000	0.95	0.342	-4.5e-06	.000013	4037.05
_Iobsr~1*	-.0035672	.0335	-0.11	0.915	-.069232	.062098	.171169
_Iobsr~2*	-.0540873	.06086	-0.89	0.374	-.173362	.065187	.220074
_Imode_1*	-.100494	.03087	-3.26	0.001	-.160997	-.039991	.098379
_Imode_2*	.2565448	.02511	10.22	0.000	.207329	.305761	.254763
_Imode_3*	.3157553	.21527	1.47	0.142	-.106158	.737668	.013932

```
. mfx, predict (p outcome(2))

Marginal effects after mprobit
      y  = Pr(mef==elective) (predict, p outcome(2))
         =  .60665988
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
_Ireg_2*	.1648511	.04137	3.98	0.000	.083763	.245939	.12141
_Ireg_3*	.1264726	.03705	3.41	0.001	.05386	.199086	.133068
_Ireg_4*	.1058264	.03851	2.75	0.006	.030349	.181304	.140176
_Ireg_5*	-.1986042	.06329	-3.14	0.002	-.322651	-.074557	.064828
_Ireg_6*	-.6154737	.01583	-38.89	0.000	-.646491	-.584456	.039807
_Ireg_7*	-.6210812	.01569	-39.58	0.000	-.651836	-.590326	.038385
_Ireg_8*	-.6077509	.01585	-38.34	0.000	-.638818	-.576684	.002559
_Ireg_9*	-.2746052	.07912	-3.47	0.001	-.429686	-.119525	.342906
Iocm~2*	.0130871	.05843	0.22	0.823	-.101434	.127608	.046062
Iocm~3*	-.0647227	.05476	-1.18	0.237	-.172041	.042596	.052886
Iocm~4*	.0124554	.04656	0.27	0.789	-.078804	.103714	.052317
age	-.0110082	.01131	-0.97	0.330	-.033173	.011157	25.6531
age2	.0001635	.0002	0.80	0.423	-.000236	.000563	706.134
_Iedu_1*	.001759	.02893	0.06	0.952	-.054952	.05847	.181973
_Iedu_2*	-.0902859	.04505	-2.00	0.045	-.178584	-.001987	.083025
_Iedu_3*	.0005969	.06788	0.01	0.993	-.132444	.133637	.038101
_Iedu_4*	-.0617346	.08817	-0.70	0.484	-.234541	.111072	.011658
bor	-.0122894	.00664	-1.85	0.064	-.025302	.000723	3.48081
quin	.010595	.00972	1.09	0.276	-.008465	.029655	3.59283
trc3	.0000192	.00001	3.50	0.000	8.4e-06	.00003	4037.05
_Iobsr~1*	.0687531	.03456	1.99	0.047	.001026	.13648	.171169
_Iobsr~2*	.3205272	.06475	4.95	0.000	.193618	.447437	.220074
_Imode_1*	.1303325	.03115	4.18	0.000	.069285	.19138	.098379
_Imode_2*	-.1527376	.02829	-5.40	0.000	-.208177	-.097298	.254763
Imode 3*	-.317045	.21666	-1.46	0.143	-.741682	.107592	.013932

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