2018

Cesarean section deliveries in Egypt: Trends, practices, perceptions, and cost

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Recommended Citation

Abdel-Tawab, Nahla G., Doaa Oraby, Nevine Hassanein, and Shatha El-Nakib. 2018. "Cesarean section deliveries in Egypt: Trends, practices, perceptions, and cost." Cairo: Population Council.

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CESAREAN SECTION DELIVERIES IN EGYPT: TRENDS, PRACTICES, PERCEPTIONS, AND COST

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The Population Council confronts critical health and development issues—from stopping the spread of HIV to improving reproductive health and ensuring that young people lead full and productive lives. Through biomedical, social science, and public health research in 50 countries, we work with our partners to deliver solutions that lead to more effective policies, programs, and technologies that improve lives around the world. Established in 1952 and headquartered in New York, the Council is a nongovernmental, nonprofit organization governed by an international board of trustees.

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Foreword

Over the past decade Egypt has achieved significant gains in the area of maternal and child health and survival. In 2016, the maternal mortality ratio (MMR) dropped to 45.9 deaths per 100,000 live births—less than the MDG5 target of 58 deaths per 100,000 live births. Coverage of maternity care has markedly increased with nine out of 10 women reporting having received ANC care from a doctor, and more than eight in 10 pregnant women received four or more antenatal care visits. Regarding delivery care, 92 percent of deliveries were attended by a skilled birth attendant and around 87 percent took place in a health facility. The Ministry of Health and Population (MOHP) takes great pride in the above achievements, however there is still more to be done to achieve Egypt's Vision for 2030 and help all Egyptians enjoy a healthy and safe life. The dramatic increase in the use of cesarean sections which Egypt has witnessed over the last decade is a challenge as it poses a risk to the health of mothers and newborns. Based on a strong belief in the value of research evidence in guiding policies and programs, MOHP supported this study which showed that the increase in cesarean section rates is a result of a multitude of provider, client, and institutional factors. As the overseer of health care in Egypt, MOHP will take every possible measure to reduce unnecessary cesarean sections and to make all deliveries safe for mothers and newborns. Results of this study will help MOHP in achieving its goals of providing the highest quality of health care and making it accessible to all Egyptians.

Professor Ahmed Emad Eldin Rady
Minister of Health and Population

A handwritten signature in blue ink, consisting of a stylized 'A' followed by a large, sweeping loop that extends to the right.

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Acknowledgments

We are grateful to all the individuals and institutions that made this study possible. Our deep appreciation and gratitude go to H.E. Professor Emad Eldin Rady, Minister of Health and Population, for providing his support to the study and to reducing unnecessary cesarean sections in Egypt. Dr. Emad Ezzat, former Head of Primary Health Care Sector, together with senior officials at the Sector provided instrumental guidance in conceptualization of the study and its implementation. Dr. Mona Hafez El-Naka, current Head of Primary Health Care Sector, provided valuable feedback on the study report and has shown keen interest in utilization of its results.

We are also grateful to UNFPA and WHO for initiating the study and for providing financial and technical assistance. We would also like to acknowledge the contribution and special interest of the Royal Norwegian Embassy in Egypt in supporting this study. Special thanks go to members of the advisory group for their feedback on research methodology, data collection instruments, and interpretation of study results. The assistance we received from officials at the health directorates in Cairo, Alexandria, Beheira, and Assiut is deeply acknowledged. Our appreciation goes to the consultants and data collection team for their commitment and high-quality work.

Finally, we express our appreciation and gratitude to the study participants who openly shared their views and experiences and to the healthcare providers and managers at study hospitals for their cooperation and support in facilitating data collection.

Abbreviations and Acronyms

ANC	Antenatal Care
BEOC	Basic Essential Obstetric Care
CEOC	Comprehensive Essential Obstetric Care
CS	Cesarean Section
EDHS	Egypt Demographic and Health Survey
EGP	Egyptian Pound
EmOC	Emergency Obstetric Care
FGD	Focus Group Discussion
IRB	Institutional Review Board
KI	Key Informant
KII	Key Informant Interview
MCH	Maternal and Child Health
MDG	Millenium Development Goal
MMR	Maternal Mortality Ratio
MOHP	Ministry of Health and Population
NGO	Nongovernmental Organization
NMMS	National Maternal Mortality Study
TOLAC	Trial of Labor after Cesarean
UNFPA	United Nations Population Fund
USD	United States Dollar
VBAC	Vaginal Birth after Cesarean
WHO	World Health Organization

Executive Summary

Cesarean section (CS) is an important lifesaving operation when vaginal delivery might pose a risk to a mother or baby. However, if not medically indicated or if performed under suboptimal conditions, CS can cause maternal and fetal complications, including death. According to the World Health Organization (2015), at the population level, CS rates higher than 10 percent are not associated with reductions in maternal and newborn mortality rates. In Egypt, the past decade has witnessed a sharp increase in the prevalence of CS with the most recent Egypt Demographic and Health Survey (EDHS) documenting a CS rate of 52 percent, which suggests that cesarean delivery might be overused or used for inappropriate indications.

This study aimed to explore trends, practices, and costs associated with CS deliveries to women, their families, and the health system. In addition, the study attempted to understand client, provider and system factors that may contribute to increased use of CS in Egypt. Sources of data for this study included: (1) secondary analysis of EDHS data for 2005, 2008, and 2014; (2) review of medical records of vaginal and cesarean deliveries in 13 hospitals; (3) case reviews of 484 CS deliveries that took place in 16 public and private hospitals in Cairo, Alexandria, Assiut and Beheira; (4) structured interviews with 325 Ob/Gyn physicians in 16 study hospitals; (5) 12 focus group discussions (FGDs) with pregnant and postpartum women seeking services at primary healthcare centers; and (6) cost analysis of CS and vaginal deliveries in four of the study hospitals.

Secondary analysis of EDHS data showed that rates of CS have been steadily increasing since 2000 and have more than doubled between EDHS 2008 and 2014, reaching a staggering 67 percent of hospital-based births in 2014. Analysis of EDHS 2014 data revealed that women who gave birth with a private provider, those with high socioeconomic status, and those who lived in urban areas, particularly urban lower Egypt, were most likely to deliver by CS. Additionally women receiving four or more antenatal care visits

and women who were having their first delivery and those who were having multiple babies were more likely to deliver by CS.

Data collected from study hospitals revealed that a previous CS delivery is a strong predictor of having subsequent CS deliveries. Following Robson classification, the profile of a woman who had a CS is most likely to be a multiparous woman, with at least one previous uterine scar, with single cephalic pregnancy that is 37 or more weeks of gestation.⁵ Interviews with women who delivered by CS in the study hospitals indicated that women do not receive complete information in order to make an informed decision about mode of delivery. Focus group discussions with pregnant and postpartum women revealed that the main reason some women prefer a CS is not to feel pain. However, it was clear that those women have incomplete information about the risks associated with CS versus vaginal delivery.

Participating physicians and key informants unanimously agreed that the CS mode of delivery was over-used in Egypt. Perceived reasons underlying increased CS deliveries were: financial incentive, doctors' desire to have better control over their time, doctors' fear of medical litigation, vagueness of medical protocols regarding indications for use of CS, limited opportunities for junior doctors to practice vaginal deliveries, shortage of pain relief drugs in public hospitals, and shortage of anesthesiologists who are trained in administration of epidural anesthesia which could be used to relieve pain in vaginal deliveries.

Over-use of CS is posing a financial burden to women, their families, and the health system. On average, a CS at a private facility costs a woman and her family EGP 2000–5000 as opposed to EGP 1000–2000 for a vaginal delivery.⁶ On the other hand, an analysis of direct costs (i.e., staff time, medicines, supplies, and equipment) associated with a CS versus vaginal delivery revealed that on average a CS costs EGP 1,076 while an average vaginal delivery costs EGP 664. Over-use of CS in 2014 is estimated to have cost the Egyptian healthcare system over 900 million Egyptian pounds.

⁵ Robson classification system is described under the methodology section.

⁶ At the time of collection of this data 1 USD= EGP 8.8.

The following recommendations are proposed to rationalize the use of CS deliveries in Egypt:

1. Evidence-based protocols for deliveries should be updated and should provide clear criteria for when a CS should be performed and how to manage cases with previous CS scarring;
2. Nurse-midwives should be assigned to hospital maternity wards to monitor the progress of labor and to manage women who will deliver vaginally;
3. House officers and Ob/Gyn residents should receive sufficient information about the risks of CS and adequate training in vaginal delivery as well as vaginal birth after cesarean (VBAC);
4. The decision to perform a CS should be made by a senior doctor after physically assessing the woman's condition and after discussing with her the pros and cons of a CS versus vaginal delivery or VBAC;
5. Senior doctors should use staff rounds/meetings more effectively to investigate every case that was delivered by CS and should question physicians who perform a CS without apparent medical justification;
6. Antenatal care counseling should include a discussion of the advantages of vaginal deliveries and an explanation of available pain management options;
7. Pain relief drugs should be made available in public hospitals and more anesthesiologists who are trained in administration of epidural anesthesia should be assigned to public hospitals;
8. Medical audits of CS deliveries should be periodically conducted in public and private hospitals and findings should be communicated to providers;
9. The public sector should work on reclaiming women, especially those from lower socioeconomic groups, who have switched to the private sector for antenatal and delivery services; and
10. Public awareness should be raised, especially among women and their families, about the merits of vaginal delivery and the risks of unnecessary CS.

Introduction

Cesarean section (CS) is a surgical procedure in which one or more incisions are made through a mother's abdominal layers and uterus to deliver one or more babies. A CS is supposed to be performed when a vaginal delivery would put the baby's or mother's life or health at risk (Glasier et al. 2006). Accepted medical reasons for performing a CS include: failure of labor to progress, pelvic abnormalities, problems with the placenta, multiple gestation pregnancy, active herpes simplex, nonreassuring fetal heart rate, malpresentation of the fetus, and any serious medical condition that requires emergency treatment (ACOG 2015). If a CS is performed for any other reason, then it is considered nonmedically indicated and thus avoidable. A nonmedically indicated CS may additionally be referred to as a maternal-request elective cesarean delivery if it has two properties: 1) cesarean delivery prior to start of active labor, and 2) cesarean delivery in the absence of medical conditions presenting a risk for labor.

In 1985, the World Health Organization (WHO) put the acceptable rate of CS as between 10 and 15 percent of all births. There is "no justification for any region to have cesarean section rates higher than 10–15 percent" (WHO 1985). In 2015, WHO issued another statement indicating that at population level, CS rates⁷ higher than 10 percent are not associated with reductions in maternal and newborn mortality rates (WHO 2015). Higher CS rates do not confer additional health gain but may increase maternal risks, adversely impact future pregnancies, and overstretch health systems (Thomas and Paranjothy 2001). As with all types of abdominal operations, a CS is associated with risks of postoperative adhesions, incisional hernias, and wound infections. Other serious health risks include severe blood loss and post-dural puncture spinal headaches (Silver et al. 2006). Adhesions of the uterus, bowel, and bladder can result in trauma at surgery, while abnormal placentation and uterine rupture can be catastrophic for both mother and baby.

Despite the lack of evidence supporting improved maternal and perinatal outcomes, over-medicalization of childbirth is a growing problem in middle- and high-income countries (Miller et al. 2016). As revealed in the map below, CS is over-used in many high- and middle-income countries such as Dominican Republic, Brazil, and Egypt (Figure 1). At a rate of 52 percent Egypt stands out among countries with the highest CS delivery rates in the world, following Dominican Republic (56.4 percent) and Brazil (55.6 percent) (Betrán et al. 2016). Within the Arab region, rates of CS are far higher in Egypt than any other Arab country. Table 1 shows distribution of CS rates in the Arab region, where the second highest rate is recorded in Jordan (28 percent) and the lowest was recorded in Yemen (5 percent).

The rate of 52 percent that was recorded in Egypt in EDHS 2014 is almost double that reported at the time of the 2008 EDHS (28 percent) and 2.5 times the level observed at the time of the 2005 EDHS (19.9 percent) (El-Zanaty and Way, 2015). The above increase underscores the need for a study of provider, client, and system factors that may be contributing to increased use of CS in Egypt. The current study was conducted by the Population Council, Egypt upon request of Ministry of Health and Population (MOHP) and with funds from UNFPA and WHO to support evidence-based programming to rationalize the use of CS in Egypt.

Study objectives

1. To determine trends and associations of CS deliveries with women and provider characteristics through in-depth analysis of EDHS 2005, 2008 and 2014 and population-based studies.
2. To identify circumstances and reasons underlying CS deliveries, including provider, client, and health system factors in public and private hospitals (whenever feasible) in Egypt.
3. To examine the cost of CS for clients, families, and the health system, including methods of payment and possible financial incentives for providers.

⁷ The CS rate is defined as the number of cesarean deliveries over the total number of live births, and is usually expressed as a percentage.

FIGURE 1: Latest available data on cesarean section rates by country

Source of data: Betrán et al. 2016

TABLE 1: Percentage of CS deliveries in Arab countries per the World Health Statistics 2015 (WHO 2015) and Betrán 2016

Country	Percentage of births by CS 2007-2014
Algeria	16
Bahrain	26
Djibouti	NA
Egypt	52
Jordan	28
Iraq	22
Kuwait	NA
Lebanon	23.2
Libya	NA
Mauritania	10
Morocco	16
Oman	17 (deliveries in MOH institutions only)
Qatar	20
Saudi Arabia	22 (deliveries in MOH institutions only)
Somalia	NA
Sudan	7
Syria	NA
Tunisia	27
United Arab Emirates	24
Yemen	5

Study Methodology

The study used a combination of qualitative and quantitative research methods as follows:

1. A **secondary analysis** of Egypt Demographic and Health Survey (EDHS) 2005, 2008, and 2014 data sets to detect trends and associations of mode of delivery with women's sociodemographic and obstetric characteristics as well as institutional factors (based on EDHS respondents' reports). Women's sociodemographic characteristics included age, residence (i.e. rural/urban), region (i.e., Upper Egypt, Lower Egypt, urban governorates), education level, and wealth quintile. Obstetric characteristics included birth order and number of fetuses (single or multiple). Institutional factors included place of delivery (public or private) as well as utilization of antenatal care. These variables were analyzed for association with the outcome variable which comprised women's mode of delivery of last birth. The methodology used for analysis is similar to that used in previous studies on CS (Khawaja, Kabakian-Khasholia, and Jurdi, 2004; Mishra and Ramanathan 2002). To minimize recall bias and prevent over-representation of women with multiple deliveries in the period covered by the survey, the analysis was restricted to last births occurring in a hospital setting.
2. Collection of primary data from 13 public and three private hospitals in the governorates of Cairo, Alexandria, Assiut, and Beheira. The above governorates were selected because they have various levels of CS rates.⁸ Four general, three district, three university, two teaching, one health insurance, and three private hospitals were selected based on the caseload of deliveries. Total number of deliveries in each hospital per year ranged from 1,474 deliveries to 18,647 annually. Following is a brief description of the types of data collected from the study hospitals.
 - **Extracting medical records of all deliveries (vaginal or CS)** that took place during the month of April 2016 in 13 public study hospitals to identify medical characteristics of women who gave birth by CS versus vaginal delivery. A total of 4,357 medical records were reviewed.⁹
 - **Case analysis of 484 CS deliveries** that took place in the study hospitals over a one-week period: This analysis involved an in-depth review of patient medical records, provider interviews, and interviews with postpartum women before discharge from the hospital to identify medical characteristics of women who undergo CS, motivations of providers who perform CS, as well as contextual factors surrounding performance of CS. **Robson Classification** of the 484 CS deliveries was undertaken. The study team classified all cases into one of 10 groups based on five basic obstetric characteristics routinely collected in all maternities.
 - **Structured interviews** with a total of 325 physicians working in the Ob/Gyn ward of the study hospitals to understand physicians' preferences regarding mode of delivery and to identify provider and system factors related to the performance of CS in that hospital.
 - **Documenting actual costs** associated with CS versus vaginal deliveries in four public hospitals in Cairo. Costs included provider time, equipment, supplies, drugs, blood transfusion, and lab tests.
3. Conducting **12 focus group discussions** (FGDs) with pregnant and postpartum women to understand their preferences for mode of delivery, perceptions of advantages of CS versus vaginal delivery, and costs associated with each. FGDs were conducted for each group of women separately to avoid causing undue distress to pregnant women if they heard about the difficult experiences of postpartum women. FGDs took place in the

⁸ The CS rate in Cairo is 58.6 percent, 68 percent in Alexandria, 34.8 percent in Assiut, and 56 percent in Beheira.

⁹ Private hospitals did not allow extraction of patient medical records.

four study governorates (Cairo, Alexandria, Beheira, and Assiut). Pregnant women were primiparous women (i.e., had no previous deliveries) in their third trimester while postpartum women were those who had delivered a living baby within the last six weeks to six months. Both groups of women were recruited among clients who attended the MOHP primary healthcare unit for antenatal or postnatal care services or for child immunization. Eight FGDs (two per governorate) were conducted with a total of 67 postpartum women who delivered either vaginally or via CS. In addition, four FGDs (one per governorate) were conducted with a total of 29 women who were pregnant for the first time and who were in their third trimester so they would have had a chance to discuss delivery options with their doctor and/or their family.

4. Conducting **in-depth interviews with 12 key informants** (e.g., senior Ob/Gyn physicians, hospital directors, heads of insurance companies) to further understand provider, client, and system factors that may promote increased use of CS.

Ethical Considerations

Both the study protocol and data collection instruments were reviewed and approved by the Population Council's Institutional Review Board (IRB) and the Ethics Committee of MOHP. Informed consent was obtained from all study participants before case reviews, FGDs, or Key Informant Interviews (KIIs) were conducted. As for medical records, hospital staff were assigned to review medical records and extract data relevant to the study. Data from medical records were recorded anonymously. No personal identifiers were recorded on captured medical data; instead, identification code numbers were used.

To ensure protection of women who had recently delivered, only women who were in stable physical and emotional condition, with no complications, not in pain, and ready to be discharged were recruited for the study. Participants were interviewed in a place that guarantees auditory and visual privacy. For FGD participants, separate FGDs were conducted for pregnant and postpartum women to safeguard against causing undue stress to pregnant women from hearing of bad experiences of other postpartum women.

Data Management

KIIs and FGDs were transcribed by the same data collectors who conducted them. The transcripts were then reviewed by PC staff who coded them manually and categorized patterns or themes found in the data, followed by thematic analysis by theme such as decision-making to undergo CS, costs of undergoing CS, and women's knowledge of risks and benefits of CS.

Quantitative data were analyzed using SPSS version 20. Univariate analysis was conducted using key indicators such as medical and socioeconomic characteristics of clients who undergo CS and characteristics of providers who perform CS. Bivariate analysis examined factors associated with conduct of CS (e.g., medical risk factors, woman's age, birth order, and hospital characteristics). For each woman who completed a hospital interview, data from various sources were matched using ID numbers and presented as case studies.

Maternal Health in Egypt

Egypt has made significant advances in maternal health over the past 20 years. In 1998, the MOHP launched a National Five-Year Plan, spanning the period 1998 to 2002, which aimed to reduce maternal mortality by capitalizing on the findings of the National Maternal Mortality Study (NMMS). The NMMS was the first national study of maternal mortality to take place in Egypt, and it shed light on several avoidable drivers of maternal mortality and failures in clinical care. Among the findings of the study was a lack of or poor quality antenatal care, in addition to substandard care on the part of obstetricians during delivery.

Several recommendations followed from the study, including the need for standardized protocols for the management of common obstetric emergencies, in-service training for obstetricians, and review and reevaluation of postgraduate programs so that more emphasis can be placed on practical as opposed to theoretical training. The study also found that many junior obstetricians and physicians with limited experience handled deliveries unsupervised which contributed to substandard care and avoidable maternal and neonatal deaths.

As such, interventions to improve maternity care were a critically important part of the agenda of the National Five-Year Plan, and were largely built upon the recommendations and conclusions of the NMMS. For example, an administrative decree was issued requiring that a senior doctor be present during deliveries. Clinical obstetric management protocols and new training curricula were also developed, published, and disseminated. At the same time, the Directorate of Maternal and Child Health Care (MCH) defined and introduced a package of MCH services which included the comprehensive essential obstetric care (CEOC) package for normal delivery and management of obstetric complications (MOHP, El-Zanaty Associates, and ORC Macro 2005). CEOC comprises basic essential obstetric care (BEOC) as well as emergency obstetric care (EmOC). BEOC refers to preventive services and medical interventions that can be delivered by a primary care physician or a nonphysician provider such as antenatal care, management of simple problems of pregnancy, as well as first aid for pregnancy and labor complications. EmOC, on the other hand, covers lifesaving procedures which include blood transfusion and operative

interventions and as such requires secondary care or tertiary care specialty hospitals. CEOC was rolled out in many facilities and as part of this effort, more than 170 maternity centers and neonatal care units in addition to 75 postnatal care units were upgraded to provide safe normal delivery services and refer cases with complications.

According to the latest estimates, the maternal mortality ratio (MMR) in Egypt has dropped to 45.9 deaths per 100,000 live births – less than the MDG5 target to reduce MMR to 58 deaths per 100,000 live births (MOHP 2016). Coverage of maternity care has markedly increased along with care-seeking behavior. EDHS 2014 indicates that antenatal care (ANC) coverage has significantly expanded, with nine out of 10 women reporting having received ANC from a doctor, and more than eight in 10 women having received regular antenatal care (4 or more visits) for their last live birth (El-Zanaty and Way 2015).

Regarding delivery care, around 87 percent of live births occurring in the five years preceding the 2014 EDHS took place in a health facility. Delivery care is highly medicalized in Egypt with 88 percent of births being assisted by a doctor and 3 percent of births assisted by a nurse or nurse-midwife. Most of the remaining births are assisted by dayas (traditional birth attendants). To date, dayas continue to assist with delivery. In fact, EDHS 2014 reveals that 8 percent of births were assisted by dayas, while in rural Upper Egypt this figure reaches 15 percent.

As to the source of maternity care, EDHS 2014 indicates that eight in 10 women in Egypt seek ANC from the private sector, and only 14 percent receive ANC from a public-sector facility. Similarly, the private sector is the principal source of delivery care in Egypt, with 60 percent of babies delivered in a private facility and only one quarter delivered in a public facility.

Health System in Egypt

Egypt has a highly heterogeneous healthcare system with a wide range of public, private non-profit, and private for-profit healthcare institutions and facilities. The public sector is composed of many entities providing healthcare services,

such as the Ministry of Health and Population¹⁰, Ministry of Higher Education and Ministries of Defense and Interior. MOHP is primarily responsible for governing the health system and setting the regulatory framework for health care. With respect to funding, public providers have various funding sources such as government budgets and grants, and they are allowed to generate their own income by instituting user fees in special units or economic departments.

A combination of for-profit and nonprofit organizations make up the private sector, including private doctors, clinics, pharmacies, and hospitals of all sizes in addition to dayas. The private sector also encompasses nongovernmental organizations (NGOs) involved in healthcare service delivery—including faith-based organizations and other charitable clinics. These are traditionally registered with the Ministry of Solidarity and Social Affairs (MOHP, El-Zanaty Associates, and ORC Macro, 2005).

The MOHP is the largest institutional provider of hospital services in Egypt, with around 660 inpatient facilities and 93,267 beds (CAPMAS 2015). Inpatient facilities include district, general, and specialized hospitals. District hospitals are located in governorate district capitals, have 100 to 200 beds each and offer specialized medical services, while general hospitals have more beds, have all medical specialties, and are located in the capital city of each governorate. In addition, there are specialty hospitals such as eye, chest, fever, and gynecology and obstetrics hospitals which are located in capital cities of selected governorates (MOHP, El-Zanaty Associates, and ORC Macro 2005). In 2017, MOHP had a total of 62 general hospitals and 186 district hospitals (MOHP 2016).

With respect to the private sector, there are around 1000 private hospitals with a total of 31,094 beds (CAPMAS 2015), accounting for nearly 25 percent of the total inpatient bed capacity in Egypt.

¹⁰ Within MOHP, there are facilities that are affiliated with the Teaching Hospitals Organization, the Health Insurance Organization, and the Curative Care Organization.

Cesarean Section: Trends and Associations

To detect trends and associations of mode of delivery with maternal social, demographic, and obstetric characteristics, a secondary analysis of EDHS 2005, 2008, and 2014 data sets was conducted. The EDHS is one of many demographic and health surveys conducted in developing countries since the mid-1980s with fairly standardized instruments, training, and interviewing procedures, and high-quality demographic data. In the EDHS, all ever-married women aged 15–49 at the time of the survey are eligible for interview. Women interviewed are asked about the type of delivery they underwent, place of delivery, childbirth weight and birth order, and number of gestations—for each live birth occurring in the five years preceding the survey. The 2014 EDHS included a nationally representative sample of 28,175 households.

Trends

Trend analysis of 2005–14 EDHS data revealed that deliveries by CS have more than doubled between 2005 and 2014 such that 19.9 percent of all live births occurring in the five

years preceding the 2005 EDHS were via CS compared to 51.8 percent in 2014 (Figure 2). This increase was accompanied by an increase in hospital-based delivery—particularly deliveries occurring in private facilities—and a simultaneous decrease in home births (Figure 3).

The increase in hospital-based deliveries and in particular deliveries occurring in private facilities throughout the period 2000–2014 has been accompanied by a dramatic increase in CS rates. Although deliveries in private and public facilities witnessed an increase in CS rates since 2008, the increase in private facilities has been more dramatic. Also, more pronounced has been the increase among younger women (<20 years), women who live in rural Lower Egypt and Frontier governorates, as well as women who were delivering their first child.

FIGURE 2: Trend of CS and vaginal deliveries in Egypt (2005–14)

Source of data: EDHS 2005, 2008, 2014

FIGURE 3: Place of delivery by year of birth (2000–14)

Source of data: EDHS 2005, 2008, 2014

FIGURE 4: Trend of CS deliveries in public and private hospitals (2000–2014)

Source of data: EDHS 2005, 2008, 2014

Upon examining the rates of hospital-based CS (after excluding home-based deliveries from the analysis)—by year of delivery, using merged data from the three surveys—a consistent increase in rates of CS is noted, albeit with occasional decreases in intervening years. In the year 2000, CS accounted for 27 percent of all last births that took place in a hospital¹¹ but increased to a staggering 67 percent in 2014 (Figure 4).

Although CS rates were persistently higher in private facilities in the period 2000–14, a considerable increase is also evident in public facilities over time. Figure 4 demonstrates the increase in CS rates in both public and private facilities. In the year 2000, CS rates were higher in public (28 percent) compared to private hospitals (25.5 percent). However, a divergence in CS rates can be noted starting in the year 2001 in which 33 percent of deliveries taking place in private facilities were via CS compared to 30 percent in public hospitals. Across the following years, CS rates continued to be more pronounced in private compared to public

hospitals. Notwithstanding this observed divergence, the increase in CS remains consistent across both public and private hospitals.

As illustrated in Figure 5, over the years, the rates of CS were more pronounced in urban areas, among the richest wealth quintiles, and among women aged 35 years and higher as well as for first-order pregnancies. The disparities in age can be explained by higher risk of complications among women aged 35 years and higher—although in the period 2010–14, CS rates converge, indicating an increase in prevalence of CS that is independent of an increase in risk for complications. The figure also shows CS trends by geographical grouping from 2000–14. Urban Lower Egypt which started off with the highest CS rates (42 percent) in 2000–04 is also the region with the highest CS rates in 2010–14 (75 percent). The second highest CS rates are evident in urban governorates where an increase from 39 percent to 67 percent took place across the period. The lowest CS rates in 2000–04 were in rural Upper Egypt and

FIGURE 5a: Percent of CS deliveries by place of residence 2000–14

Source of data: EDHS 2005, 2008, 2014

¹¹ This variable relies on women's responses to one EDHS survey question on mode of delivery of last birth (whether by CS or vaginal).

frontier governorates at around 23 percent (Figure 5a). However, both regions experienced substantial increases in CS rates, reaching 51 percent and 53 percent respectively in 2010–14. Moreover, the rates of primary cesarean section have increased twofold throughout the study period, from 35 percent in 2000–04 to 70 percent in 2010–14. The increase in CS rates across time is also evident—although weaker in magnitude—for other birth orders (Figure 5d).

FIGURE 5b: Percent of CS deliveries by wealth quintile 2000–14

Source of data: EDHS 2005, 2008, 2014

FIGURE 5c: Percent of CS deliveries by maternal age 2000–14

Source of data: EDHS 2005, 2008, 2014

FIGURE 5d: Percent of CS deliveries by birth order 2000–14

Source of data: EDHS 2005, 2008, 2014

Determinants of a cesarean section

Using EDHS 2014, several sociodemographic, obstetric, and institutional factors were found to be associated with CS delivery. Sociodemographic factors such as education, wealth, and place and type of residence predicted CS mode of delivery. Institutional factors—such as place of delivery and number of antenatal visits—and obstetric characteristics such as birth order and multiple gestations were important determinants of CS.

This section presents data on CS deliveries from the 2014 EDHS and examines medical and nonmedical determinants of CS over the five years preceding the survey.

Several dependent variables were examined for association with mode of delivery. These can be broadly divided into sociodemographic characteristics, institutional as well as obstetric factors. *Sociodemographic characteristics* included in the analysis were maternal age at birth, wealth, education, and place and type of residence.

In addition to the maternal, social, and demographic characteristics, *institutional factors* relevant to the availability and utilization of health services were selected. These include use of antenatal care and the type of institution where the

delivery took place—whether it belonged to the public or private sector. The number of antenatal care visits was used to capture utilization of healthcare services, and is hypothesized to increase the proportions of CS since visits provide an opportunity for the identification of women who are at high risk for complications.

In addition, *obstetric factors*—such as child’s birthweight, birth order, and whether the birth was a single or multiple birth—were considered in the analysis.

The analysis revealed that CS accounts for an alarming 62 percent of all last births that took place in a hospital in the five years preceding the 2014 EDHS. Table 2 presents the characteristics of respondents in addition to factors associated with CS mode of delivery.

Given the relatively high cost of CS in comparison to vaginal delivery, several proxies for higher socioeconomic status were found to be important determinants of CS. Women residing in urban areas were more likely to deliver via CS compared to their rural counterparts (odds ratio [OR] 1.31). Specifically, the odds of CS were 2.8 times higher for women residing in urban Lower Egypt, followed by women residing in urban governorates (OR 2.0), compared to women in rural Upper Egypt. Such noted disparities can also be the result of unequal distribution of facilities across the country or regional variations in quality of maternity care.

Moreover, a clear association was evident among both the wealth and education categories and the proportion of women undergoing CS. Women belonging to the “richest”, “richer”, and “middle” wealth quintiles were 2.12, 1.66, and 1.45 times more likely to undergo CS compared to women belonging to the “poorest” quintile. However, there was no significant difference in CS rates between women belonging to the “poorest” and the “poorer” quintiles. Similarly, the higher the level of education of respondents, the higher was the likelihood of a CS delivery; in fact, women with secondary or higher education were 1.30 and 1.89 times, respectively, more likely to undergo CS compared to women with no education. No significant difference in CS rates was noted between women with no education and women with primary education.

In contrast to other studies, however, there was no association found between maternal age and CS. This finding is consistent with trend analysis which has pointed to a convergence in CS rates across all age groups throughout the period.

As hypothesized, institutional factors were found to impact mode of delivery. Women delivering in private facilities were 2.17 times more likely to deliver via CS compared to those delivering in public facilities. Moreover, women who received four or more ANC visits were 2.5 times more likely to undergo a CS compared to women with no ANC visits. One hypothesis for this observed association is that doctors who provide more antenatal care visits are more inclined to recommend a CS for financial motivation. There is also a possibility that women who make more ANC visits are the ones with high-risk pregnancies and hence need to be delivered by CS.

Among the obstetric characteristics investigated in this analysis, multiple birth and low birth order were found to be associated with CS. A CS was 1.88 times more likely to occur to women delivering multiples (e.g., twins or triplets). On the other hand, higher birth order babies (second to fourth and fifth or higher) had a lower likelihood (OR = .66 and .41) of being born through a CS compared to first-order pregnancies.

TABLE 2: Percent distribution of CS hospital-based deliveries by selected characteristics (using data on last births from EDHS 2014)

Selected Characteristic	N	% (n)	OR (95% CI)
I. Sociodemographic characteristics			
Maternal Age			
<20	564	60 (339)	.93 (0.76 – 1.16)
20-35	8,672	62 (5,358)	Reference
>35	905	63 (573)	1.07 (0.90 – 1.26)
Wealth quintile*			
Poorest	1,409	53 (740)	Reference
Poorer	1,676	56 (935)	1.12 (0.96 – 1.32)
Middle	2,454	61 (1,508)	1.45 (1.24 – 1.69)*
Richer	2,223	65 (1,439)	1.66 (1.42 – 1.94)*
Richest	1,795	71 (1,271)	2.12 (1.80 – 2.49)*
Education*			
No education	1,503	55 (834)	Reference
Primary	852	55 (468)	.98 (.8 – 1.2)
Secondary	5,975	62 (3,696)	1.30 (1.14 – 1.5)*
Higher	1,1811	70 (1,272)	1.89 (1.6 – 2.2)*
Urban–rural residence*			
Urban	3,238	66 (2,133)	1.31 (1.18 – 1.45)*
Rural	6,319	60 (3,761)	Reference
Place of residence*			
Upper Egypt – Rural	2,397	50 (1,197)	Reference
Lower Egypt – Rural	3,885	66 (2,547)	1.91 (1.7 – 2.15)*
Upper Egypt - Urban	1,101	58 (635)	1.35 (1.16 – 1.58)*
Lower Egypt – Urban	985	74 (727)	2.8 (2.32 – 3.30)*
Urban governorates	1,100	67 (740)	2.0 (1.72 – 2.41)*
Frontier governorates	88	52 (46)	1.05 (0.86 – 1.29)
II. Institutional Factors			
Place of delivery*			
Public	2,868	48 (1,390)	Reference
Private	7,273	67 (4,880)	2.17 (1.95 – 2.40)*
Antenatal visits*			
None	741	42 (314)	Reference
1–3	617	49 (301)	1.3 (1.01 – 1.67)*
4+	8,743	64 (5,630)	2.5 (2.05 – 2.94)*
III. Obstetric considerations			
Birth order*			
1	2,470	70 (1,728)	Reference
2–4	6,860	60 (4,146)	.66 (.58 – .74)*
5+	811	49 (397)	.41 (.34 – .50)*
Singleton*	9,898	62 (6,088)	Reference
Multiple	243	75 (183)	1.91 (1.34 – 2.7)*
Birthweight of child			
Normal (2500–3999 g)	5,247	65 (3422)	Reference
High risk (<2500g; ≥4000g)	1,408	67 (946)	1.09 (.94 – 1.27)
Total	10,141	61.83 (6,270)	

*Denotes P value < 0.05

Physicians' Practices

This section examines clinical determinants of conducting CS, decision-making process for the performance of CS, and women's involvement in the decision-making process. The section is based on results of review of medical records of 4,357 vaginal and CS deliveries that took place in 13 public study hospitals, as well as results of case analysis of 484 CS deliveries that took place in all 16 study hospitals.

Review of medical records

Review of the patient medical records revealed that previous CS was the most commonly listed indication for performing CS and was a strong predictor of the CS mode of delivery.

This cross-sectional substudy aimed to further understand determinants of CS delivery and to identify the obstetric profile of women who undergo CS, using data from medical

records. Medical records provide detailed information on factors related to patient obstetric characteristics—such as pregnancy complications and malpresentation—and are more accurate and up to date compared to the 2014 EDHS self-reported data.

A total of 4,357 records of women who gave birth during the month of April 2016 in the 13 public study hospitals in Cairo, Alexandria, Beheira, and Assiut were reviewed. None of the three private study hospitals were included in this exercise as they refused to allow review of medical records. Also, it is noteworthy that many of the 4,357 medical records that were reviewed had missing data. Around 2 percent of medical records had missing data on mode of delivery and almost 10 percent of records had no medical indication for CS listed.

FIGURE 6: Percent distribution of mode of delivery in 13 study hospitals (n=4,357 deliveries)

Source of data: Patient medical records

FIGURE 7: Cesarean section rates in each of the 13 study hospitals (April 2016)

Source of data: Patient medical records

Of the 4,357 records that were reviewed in 13 public hospitals, CS delivery accounted for more than half of deliveries (52.9 percent) (Figure 6). However, significant variations were noted among those hospitals with hospital-specific rates ranging from a low of 22.9 percent to a high of 94.3 percent (Figure 7). Some variation should be reasonably expected considering inherent differences in patient populations at each hospital and the size and nature of each hospital (e.g., district versus teaching or university hospital).

Who delivers by CS and who delivers vaginally?

Analysis of medical records in 13 public hospitals demonstrates a strong association between maternal age and CS deliveries (p-value<0.0001) (Table 3). Women aged 35 years and older were 1.6 times more likely to undergo a CS compared to women under 35 (OR=1.6; 95 percent CI [1.3–1.9]). Not surprisingly, the odds of CS were also higher among women who had premature births (gestational age <37 weeks) compared to those with gestational age ≥37 weeks.

Additionally, the likelihood of a CS delivery for a multiple birth was 50 percent higher than that of a singleton birth (OR=1.53; 95 percent CI [1.3–2.2]). This analysis also found a strong association between obstetric presentation and mode of delivery. The odds of CS significantly increased

among women with breech and transverse presentations at birth (OR=3.16 and 12.4, respectively).

This study found no association between induced labor and mode of delivery, in contrast to studies which have shown lower incidence of cesarean deliveries among women whose labor was induced (Caughey et al. 2009; Wood, Cooper, and Ross 2014). However, the data reveal that women who experienced no labor pains were 60 times more likely to deliver by CS compared to women with spontaneous labor. The association between lack of labor pains and CS delivery could indicate that many CS were scheduled/elective.

Notably strong was the association between previous CS and CS mode of delivery. The odds of CS among women who had a prior CS were 60 times the odds of CS among women who had no previous CS delivery (OR=59.8; 95 percent CI: 45.3–79.3). This finding indicates that CS is routinely offered to women with a previous cesarean, lending support to the popular dictum “once a cesarean section, always a cesarean section.”

Physicians’ recorded indications for a CS

The medical records were additionally checked for listed medical indication underlying the decision to deliver by CS. Almost one tenth (9 percent) of the medical records did

not have a medical indication documented. The remaining records of women who delivered via CS had the following medical indications: maternal causes, previous CS (70 percent), followed by severe preeclampsia (5 percent), and obstructed labor (3 percent); 12 percent of medical records had “other” listed, and fetal causes including fetal distress (30 percent), abnormal lie (18 percent), oligohydramnios (17 percent), multiple pregnancy (8 percent); 20 percent had “other” listed. It is noteworthy that several of the listed reasons (such as fetal distress and suspected macrosomia) are subjectively defined indicators that depend largely on clinicians’ judgment. For example, the term fetal distress mostly encompasses fetuses with a nonreassuring heartrate—the interpretation of which is highly subjective with large variability among physicians. In this climate of overmedicalization, physicians may be inclined to resort to CS whenever they detect any suspicious signs. In addition, several of these listed medical conditions do not necessarily require that a CS be performed. Examples include previous CS—for which a trial of labor after cesarean (TOLAC) could first be attempted, breech presentation—for which an external cephalic version is a safe and effective procedure that can preclude a CS. With respect to investigations informing choice of mode of delivery, a partogram, which is designed to help obstetricians make the right decision for intervention in the right time was only done for 13 percent of CS cases.

Notably, around 70 percent or 1,235 CS deliveries were undertaken because of a “previous CS” indication. Only 11 percent of those deliveries were of preterm babies (<37 weeks) and only 207 births had another medical indication listed. After accounting for preterm deliveries and other medical indications, we identified a total of 941 births (41 percent) by women who delivered a full-term (≥ 37 weeks) singleton baby without any medical indications listed. Those cases could be classified as avoidable cesarean sections.

TABLE 3: Profile of women undergoing a CS versus a vaginal delivery: Selected demographic and obstetric characteristics (from 4,357 medical records)

Selected characteristic	Cesarean sections		Vaginal births		OR (95 percent CI)
	N	Percent	N	Percent	
Age*					
<35	1872	85	1678	90	Reference Group
≥35	322	15	184	10	1.57 (1.3 – 1.9)
Gestational age*					
<37 weeks	365	16.9	188	10.8	1.68 (1.39 – 2.03)*
≥37 weeks	1799	83.1	1559	89.2	Reference Group
Number of babies					
Singleton*	2035	92	1766	95	Reference Group
Multiple	181	8	92	5	1.77 (1.36 – 2.31)*
Presentation *					
Cephalic	1853	86	1773	95.5	Reference Group
Breech	264	12	80	4	3.16 (2.44-4.1)*
Transverse/oblique	26	1.2	2	0.1	12.4 (2.95 – 52.4)*
Labor Pains*					
No labor pains	954	49	29	2	60.4 (41.0 – 88.0)*
Spontaneous	908	47	1668	90	Reference Group
Induced	86	4	155	8	1.019 (0.8-1.3)
Previous CS*					
Yes	1432	65.2	56	3	59.89 (45.26 – 79.25)*
No	763	34.8	1787	97	Reference Group
Listed Medical Indication – Fetal causes					
Fetal Distress	225	29.7	14	11	
Abnormal Lie	137	18.1	5	4	
Polyhydramnios	33	4.4	0	0	
Oligohydramnios	127	16.8	12	10	NC
Macrosomia	29	3.8	0	0	
Multiple pregnancy	58	7.7	12	10	
Other	148	19.6	82	66	
Listed Medical Indication – Maternal causes					
Obstructed labor	51	3	1	0.3	
Prolonged labor	29	2	6	1.8	
Previous CS	1235	70	7	2	
Cervical dystocia	9	.5	0	0	
Severe pre-eclampsia	83	5	8	2.4	
Eclampsia	18	1.0	2	0.6	
Diabetes Mellitus	23	1.3	6	1.8	NC
Heart problems	7	.4	2	0.6	
Hypertension	29	2	12	3.6	
Liver	0	0	1	0.3	
Renal disease	3	.2	0	0	
Infection & fever	5	.3	6	1.8	
Placenta previa	22	1.2	1	0.3	
Antepartum hemorrhage	36	2	6	1.8	
Other	220	12.4	279	82.8	
<i>Investigations</i>					3.88 (3.35-4.49)* (ref: no ultrasound)
Ultrasound*	1940	84.5	1094	58.4	
Partogram completed	222	13	127	11.2	0.84 (0.67-1.1) (ref: no completed partogram)
Total	2,304	52.9	1,880	43.1	

*Denotes P value < 0.05 using X2 P value

NC: not calculated because the count assumption does not hold (More than 20 percent of expected counts<5)

Case Reviews

To further understand circumstances underlying CS deliveries, a sample of postpartum women who had undergone CS in public and private study hospitals within one week of data collection was selected; their medical records were reviewed (after obtaining their informed consent) and their medical information was triangulated with data obtained through short structured interviews with the women before hospital discharge as well as with their attending physicians. Subsequently, we used Robson ten-group classification to group the women according to their obstetric characteristics to understand which clinically relevant groups were contributing to the noted CS rate. This substudy allowed for analysis of client and provider factors associated with CS delivery such as the medical and sociodemographic

characteristics of women who undergo CS and motivations of providers who perform CS deliveries.

Profile of women who received a CS

The sample size for this sub-study was 484 women who had undergone a CS, selected from a total of 16 public and private study hospitals in the governorates of Cairo, Alexandria, Beheira, and Assiut. Most women (85 percent) were below 35 years of age. The obstetric profile of women who underwent CS in this sample was similar to that of the sample of women described in Section I. According to the medical records of those women, most of them had a singleton birth (94 percent) while 91 percent had cephalic

TABLE 4: Selected characteristics of women undergoing CS (n=484 from case reviews)

Selected characteristic	N	Percent
Age		
<35	411	85
≥35	70	15
Singleton	431	94.3
Multiple	26	5.7
Presentation		
Cephalic	330	90.9
Breech	27	7.4
Transverse/oblique	6	1.7
Labor Pains		
No labor pains	193	57.3
Spontaneous	136	40.3
Induced	8	2.4
Previous CS		
Yes	312	64.7
No	170	35.3
ANC		
Yes	342	94.5
No	20	5.5
Source of ANC		
Private clinic	291	79.3
Clinic of the study hospital	29	7.9
Clinic of a different hospital	18	4.9
Health unit	26	7.1
Other	3	0.8
Total	484	NA

presentation. Nearly two-thirds of those women (65 percent) had undergone a previous CS. More detailed information on the characteristics of the women is listed in Table 4.

When asked about ANC received, 95 percent of interviewed women reported receiving ANC. Of those, the majority (79 percent) reported receiving ANC from a private clinic, 8 percent received it from the clinic of the hospital where they delivered, and 12 percent received it from another hospital clinic or health unit (Table 4).

Around half (55 percent) of women interviewed either stated that their delivery was an elective CS or that they had presented with no signs at delivery. Consistent with medical record data, around 59 percent of the women reported feeling no labor pains before delivering, indicating that the CS was possibly scheduled/elective. However, when asked the same question, only 31 percent of attending physicians stated that the deliveries were elective, with the woman showing no labor signs at delivery.

Reasons for performing a CS

More than half of CS cases (55 percent) were delivered by residents, followed by consultants (15 percent) and assistant specialists (15 percent) (Figure 8). Almost three-quarters of attending physicians were male (72 percent).

When the attending doctors were asked about the medical reasons underlying their decision to conduct a CS delivery,

most cited previous CS delivery (56 percent). A detailed list of reasons provided is cited in Table 5. As revealed in the table, previous CS delivery accounted for more than half of the medical reasons (58 percent) listed by doctors for conducting a CS, followed by fetal distress (12.8 percent) and oligohydramnios (11 percent).

CS decision-making

Around 97 percent of the residents who delivered cases stated that they had consulted others; mostly they reported consulting assistant lecturers/specialists (54 percent). This proportion decreased with more highly ranked physicians. The mode of consultation, however, was not ascertained. In fact, physician anecdotes suggest that most of the consultation is done by phone.

When probed about the basis of the diagnosis on which the CS decision was made, attending doctors stated one or more of the following investigations: ultrasound (79 percent), vaginal examination (50 percent), general examination (42 percent), cardiotocogram (CTG) (16 percent) and partogram (2.1 percent). Case reviews revealed that the decision-making process for some of the listed indications for conducting CS (failure to progress, fetal distress) were not well documented in the reviewed medical forms of interviewed women.

Attending doctors were also asked about the percentage of CS deliveries that could have been delivered vaginally. They

FIGURE 8: Distribution of CS cases according to the title/rank of attending doctor (N=484)

TABLE 5: Percent distribution of reasons for conducting CS delivery as listed by attending doctors (multiple responses)

Reason	Percent of Cases N=484
Previous CS delivery	58%
Fetal distress	12.8%
Oligohydramnios i.e., an insufficient amount of amniotic fluid	11.1%
Abnormal lie	10.3%
Polyhydramnios i.e., an excessive amount of amniotic fluid	5.6%
Macrosomia i.e., excessive birth weight in a neonate	5.1%
Multiple pregnancy	3.6%

Source of data: Case reviews

stated that around 10 percent of cases could have been delivered vaginally had the woman been given the chance to do so. When asked why they did not attempt vaginal delivery for these cases, they attributed resorting to CS to women's requests, cases specifically referred for CS delivery and limited resources (e.g., a shortage of anesthetists).

Women's involvement in CS decision

Interviewed women were asked about the counseling they received preoperatively. Around 68 percent of them report-

Current CS practice reveals that initial cesarean delivery drives subsequent ones. Women do not receive adequate preoperative counseling on the risks of CS or the reasons why they will be undergoing CS delivery.

ed receiving a reason from their physician for performing a CS, including reasons attributed to their health status or that of the fetus. However, when the attending physicians were asked the same question, 83 percent reported that they provided justification to the women for their decision to perform the procedure. Further, when asked if their physicians provided counseling on the drawbacks of CS, only six percent of the interviewed women reported receiving any counseling on the disadvantages and health risks of a CS mode of delivery. These findings reveal: 1) discrepancy between provider and client perceptions of what constitutes pre-operative counseling; 2) absence of an informed consent process in which a thorough explanation of the relative risks of a CS takes place; and 3) limited involvement of women in the decision-making process concerning their delivery.

Robson classification of CS cases

WHO proposed the Robson classification system as a global standard for assessing, monitoring and comparing CS rates within and among health facilities and countries. According to this classification every woman admitted for delivery can be immediately classified into one of 10 groups that are mutually exclusive and comprehensive. These 10 groups (Annex I) are based on five basic obstetric characteristics routinely collected in all maternities (WHO 2015):

1. parity (nulliparous, multiparous with and without previous cesarean section);
2. onset of labor (spontaneous, induced, or pre-labor cesarean section);
3. gestational age (preterm or term);
4. fetal presentation (cephalic, breech, or transverse); and
5. number of fetuses (single or multiple).

Applying Robson classification to the 484 CS cases that we analyzed, we found that Robson group 5 (women with single cephalic, full-term pregnancy, who have already undergone at least one CS) accounted for more than half of cases (51 percent) (Table 6). Group 10 (all single cephalic, preterm, including previous CS) made the second highest contribution (14 percent) to the CS rate. Group 2 (Nullipara, full-term, elective CS or after failed induction) made the third highest contribution at 12 percent. As shown, the two main contributing groups to the overall CS rate in the study hospitals were previous CS groups 5 and 10, underscoring the impact of previous CS on driving subsequent CS deliveries in this context.

TABLE 6: Distribution of CS deliveries at study hospitals according to Robson classification

Robson 10-group classification		Contribution of each group to overall CS cases (n=484)
1	Nulliparous, single cephalic, >37 weeks in spontaneous labor	4.5%
2	Nulliparous, single cephalic, >37 weeks, induced or CS before labor	11.8%
3	Multiparous (excluding previous CS), single cephalic, >37 weeks in spontaneous labor	3.9%
4	Multiparous (excluding previous CS), single cephalic >37 weeks, induced or CS before labor	4.3%
5	Previous CS, single cephalic, >37 weeks	51.0%
6	All nulliparous breeches	2.3%
7	All multiparous breeches (including previous CS)	2.9%
8	All multiple pregnancies (including previous CS)	4.1%
9	All abnormal lies (including previous CS)	1.2%
10	All single cephalic, <36 weeks (including previous CS)	13.6%
	Total	100.0%

Source of data: Case reviews

The Hospital Environment

This section examines the hospital environment where CS are performed to identify system factors that may responsible for increased CS rates in Egypt. Examples of system factors explored in this section are training of physicians, availability of guidelines for obstetric care, adequacy of existing systems of supervision, and hospital-based incentive structures. Results presented in this section are based on structured interviews with 325 physicians who worked in the 16 study hospitals. Characteristics of participating physicians are attached in Annex IV.

Provider competence

Physicians were asked who in their hospitals was doing most of the CS. Table 7 shows that CS were mostly performed by assistant specialists/lecturers (74.5 percent) followed by residents (65.5 percent). To perform cesareans on their own, residents must achieve full proficiency in CS delivery and must follow standardized practice guidelines. Upon probing whether residents are expected to perform a minimum number of supervised cesarean sections before

operating independently, only 39 percent of participants indicated that their hospitals specify a minimum number of CS cases that a resident must perform under supervision before s/he is allowed to work independently. This may suggest that young doctors have the liberty to opt for cesarean delivery without supervision or consultation with more experienced physicians. When asked how the skills to perform a CS were acquired in their hospitals, more than four-fifths of physicians (82.5 percent) indicated that it was through on-the-job training, while a smaller proportion mentioned training workshops (25.8 percent).

Protocols for CS

More than half of physicians (58 percent) indicated that their hospitals had protocols for performing CS. However, when asked how a case with previous CS would be delivered in their hospital there was no agreement among physicians as more than one-third (37 percent) said they would most likely deliver by CS while 7 percent said they would attempt vaginal delivery under supervision (Figure 9).

FIGURE 9: Management of cases with previous CS according to interviewed Ob/Gyn (n=325 physicians)

Source of data: Ob/Gyn interviews

TABLE 7: Who performs most CS in study hospitals?*

Provider type	Percent
Resident	65.5 percent
Assistant specialist/assistant lecturer	74.5 percent
Specialist/lecturer	62.5 percent
Consultant/professor/assistant professor	45.5 percent

* Multiple responses were allowed

Quality Assurance

Staff rounds provide an important venue for senior physicians to medically audit cases that were delivered in the hospital; rectify any inadequate procedures and mentor junior physicians to improve their performance. Also, Medical audits by a higher authority are important for ensuring quality of services. Only 55 percent of interviewed physicians indicated that senior staff in their hospital held daily or weekly meetings to discuss deliveries. An equal percentage of physicians indicated that their hospitals receive medical audits or supervisory visits from higher-level agencies. It is noteworthy that all the above physicians are affiliated with public hospitals as private hospitals do not receive routine supervisory visits from any agency.

Monetary Incentives

Patients are usually charged a higher fee for CS than vaginal delivery which may drive some private providers to perform more CS. However, it is not clear how an incentive system could play out in public hospitals when physicians are paid a fixed salary. One-fifth of physicians (20.6 percent) in the present study indicated that staff in public hospitals received incentives for performing CS. However, according to hospital directors the revenue from CS does not go directly to the doctor who performed a CS, but goes partly to the hospital budget and hospital staff.

The current hospital environment may be contributing to increased conduct of CS as there are no clear guidelines for CS delivery, and there is insufficient monitoring and supervision of residents who perform CS while the incentive system in public hospitals may indirectly motivate some doctors to perform the procedure.

Women's Preferences and Choices

This section presents results of 12 FGDs that were conducted with pregnant and postpartum women in the four study governorates to understand their experiences with the healthcare system, their preferences, and their degree of involvement in the decision-making process regarding mode of delivery.

Preferences for Antenatal Care and Place of Delivery

Interviewed women at FGDs reported that they mostly receive ANC from a private provider and that they mostly access public health units for tetanus toxoid immunization and occasionally for dental care. According to those women, private doctors are more experienced, have modern equipment such as ultrasound, and provide more information. In addition, many women reported that private providers tend to be more attentive to their fears and concerns. However, when asked about the delivery advice that they receive during ANC, women predominantly agreed that public providers encourage them to opt for a vaginal delivery while private providers are more likely to be in favor of CS.

"The doctor (at the healthcare unit) told me God made normal delivery, CS involves abdominal surgery. You may suffer during normal delivery but after delivery you will be relieved immediately." (Pregnant woman, 25 years old, Alexandria)

Like reasons offered by women for seeking ANC at the private sector, women stated that they prefer private facilities for delivery because they provide better quality of care, are cleaner, and have more understanding providers. One woman added that she likes the private sector because the same doctor who provides ANC is the one who attends the delivery. Although there is a substantial difference between delivery cost at public and private sectors (described later), women stated they would do all that they could to deliver at a private facility, to ensure quality of care for themselves and their newborn.

"Every woman wants to deliver her first baby in a private facility because she is worried, wants care and cleanliness. Doctors care more because we pay a lot of money.

In subsequent deliveries, she can deliver in public facilities." (Pregnant woman, 17 years old, Cairo)

"I would borrow money from anyone to deliver in a private hospital. I am afraid of public hospitals which are for free." (Postpartum woman, 30 years old, Alexandria)

Availability and Accessibility of Delivery Services

Women cited accessibility and availability issues when asked about their choice for mode of delivery. Both postpartum and first-time pregnant women stated that CS deliveries are becoming more available than vaginal deliveries and even noted that they know of private physicians who refuse to deliver women vaginally.

"I went to a female doctor to deliver normally but she told me I deliver only by cesarean because I cannot handle normal deliveries." (Postpartum woman, 36 years old, Cairo)

"I know a doctor who has put a sign indicating that he delivers only cesarean." (Postpartum woman, 30 years old, Beheira)

Notwithstanding the expanded availability of CS, some pregnant women noted that the accessibility and ease of vaginal delivery made it a superior choice, because it does not require technical sophistication or complicated sterilization techniques and therefore is available at any time—specifically for women who have their labor pains after midnight.

Preferences for Mode of Delivery

Women may be pushed to have a CS by their preference of private-sector doctors for ANC and delivery, their desire to better control their time, fear of feeling pain, misinformation about risks associated with vaginal delivery, and their desire to ensure sexual satisfaction of their husbands.

When asked about their preferred mode of delivery and their reasons for such a preference, concerns around pain during delivery were most prominent in participants' accounts. In addition, few women noted that vaginal delivery carries multiple risks to the mother and baby while others referred to the painful episiotomy associated with vaginal delivery. One woman said she prefers a CS because she does not want to witness the birthing procedure.

"I was afraid of normal delivery because labor pains could be very strong, but with cesarean delivery I would be sleeping and would not feel pain." (Postpartum woman, 30 years old, Beheira)

"I have two sisters-in-law who almost died of pain during vaginal delivery...One of them had stitches underneath which took almost one month to heal...that's why I developed a mental block against vaginal deliveries." (Postpartum woman, 32 years old, Assiut)

"Sometimes we hear of cases where the doctor pulled the baby in a wrong way and hence causing brain damage but with a CS you are sure your baby is coming out in a proper manner" (Postpartum woman, 25 years old, Assiut)

Women's accounts also revealed a desire to control the timing of delivery which could only be achieved by an elective CS. Those women wanted to manage household chores before going into delivery or plan for family members and relatives to accompany them during delivery.

"A woman will not wait for labor pains that may start at midnight and then start looking for a doctor. She wants to be prepared for everything including the location and having her family ready to accompany her." (Postpartum woman, 36 years old, Cairo)

Nonetheless, discussions with first-time pregnant women revealed that despite their fear of labor pains, most of them preferred a vaginal delivery to avoid the risks of abdominal surgery, and to regain their strength and ability to take care of their babies faster.

"First no abdominal surgery, second will recover faster, will take care of my baby. No surgery so will not stay long in bed." (Pregnant woman, 26 years old, Alexandria)

Regarding their families' perceived preferences, discussions with women demonstrated their belief that their husbands prefer CS because it does not result in widening of the vaginal opening and hence does not reduce sexual satisfaction. However, one woman noted that husbands would abide by the doctor's decision and another noted that husbands prefer vaginal delivery because it costs less.

"The husband prefers a cesarean because after normal delivery, the woman is not like what she used to be (wider vaginal opening)." (Pregnant woman, 31 years old Assiut)

On the other hand, women in the FGDs stated that their mothers and mothers-in-law were in favor of vaginal delivery as it is "God's way" and allows them to avoid the abdominal surgery and its long recovery.

"My mother advised me to deliver normally because CS involves cutting of many abdominal layers and takes long recovery time. Normal delivery takes a short recovery time and the women is able to lead her normal life." (Postpartum woman, 36 years old, Alexandria)

Informed decision-making

Evident in women's accounts was a striking lack of knowledge of the risks of CS. When asked whether doctors provided women with information on the health risks and drawback of CS, women stated that their providers refrained from informing them of the associated risks. The FGDs revealed that women had inaccurate or incomplete knowledge regarding the risks of CS compared to vaginal delivery and that in many cases they are not explicitly informed about the mode of delivery until last minute. A few women added that doctors never discussed risks of CS delivery with them in order not to frighten them.

"Normal delivery could be risky to mother and baby. It could be prolonged, thus affecting oxygen supply to baby's brain. Also, the uterus could rupture as a result of the contractions. Cesarean deliveries only carry risk of anesthesia which in some places is used for normal deliveries as well." (Postpartum woman, 37 years old, Alexandria)

Physician and Key Informant Perspectives of Increased Cesarean Section Rates

This section presents results of structured interviews with 325 Ob/Gyn physicians in the 16 study hospitals in addition to in-depth interviews with 12 key informants (KI). Ob/Gyn physicians who completed structured interviews included residents, assistant specialists, specialists, and consultants. Characteristics of the interviewed physicians are listed in Annex (III). Key informants (KIs) who completed in-depth interviews included senior Ob/Gyn physicians, hospital directors, and heads of insurance companies.

Perceptions of Increased CS rates

According to physicians and key informants the dramatic increase in CS rates could be attributed to an increase in number of cases with previous CS along with nonclinical system factors including lack of standardized protocols and inadequacy of existing systems of supervision, in addition to provider-specific factors such as the profitability incentive, the convenience factor, and fear of medical litigation.

Most physicians (88 percent) affirmed that they observed a dramatic increase in CS rates in their respective hospitals. Moreover, 63 percent of interviewed physicians indicated that some cases that are delivered by CS in their respective hospitals could have been delivered vaginally if given a chance. On the other hand, all key informants confirmed an increase in CS rates as well as overuse of CS.

Why have CS rates increased?

Physicians mainly attributed the increase in CS to a rise in cases with medical indications (68 percent) followed by maternal request for elective cesarean (49 percent), physician's personal preference (24 percent), and lastly reasons related to hospital systems and resources (10 percent).¹² When asked specifically if doctors in their hospital preferred a CS to vaginal delivery, 45 percent of respondents answered affirmatively. Main reasons for preferring a CS were doctors' ability to exercise greater control over their time, CS

takes less of a doctor's time, inadequate training of physicians in vaginal delivery, and financial incentive.

KIs unanimously agreed that CS have increased dramatically over the last five years and that CS was being overused or misused. The main reasons given by KIs for increased use of CS are described below.

Lack of clinical guidelines

Discussions with key informants underscored the absence of standardized protocols as a potential reason for the dramatic increase in CS. The decision to perform CS is mostly guided not by protocols but rather by personal judgment and not subject to questioning unless complications arise, in which case the rationale for conducting CS is investigated.

"There aren't any medical guidelines or professional rules to be followed as in other countries of the world; hence, the doctor's decision is subjective and not based on medical regulations that are binding to the doctor and the employers at the hospital." (Professor of Ob/Gyn)

In addition, one KI referred to the vague term "failure to progress" which was listed as an indication for CS delivery in many of the reviewed medical records throughout our current study. He clarified that the term is based on clinical judgment when it should be based on a completed partogram. Another frequent indication for CS that almost all the KIs criticized during the interviews was "fetal distress." They clarified that the term is based mainly on the use of intermittent auscultation and observing the nature of amniotic fluid as a mean of fetal monitoring during labor. There are no facilities for electronic monitoring of fetal heart rate for all women or fetal blood acid-base study whenever needed. Hence, fetal distress diagnosis largely depends on clinical signs which are very subjective.

"The protocols are there but they are not clear; for example, one of the indications is 'failure of progress' which is a vague term....How long do you wait before you say there is no progress?" (Professor of Ob/Gyn)

¹² Multiple answers were allowed.

A related point is lack of documentation and hence inability of supervisor to hold subordinates accountable for unnecessarily delivering a woman by CS. It was clear from the KIs' reports that attending physicians are not expected to provide supporting evidence to justify their decision to perform a CS, as seen from the below quote by one hospital director.

"If a doctor is worried about a case, i.e. that a vaginal delivery carries a risk to the mother or the baby, I cannot ask him why he delivered her by CS. A doctor can write any indication in the medical record; I cannot hold him responsible." (Director at Public Hospital)

Limited Resources

KIs who work as Ob/Gyn professors in teaching or university hospitals¹³ added that institutional factors such as the inability to support prolonged inductions with limited resources and high caseload along with the urgent need to address other high-risk cases encourage attending physicians to perform a CS.

On a related note, almost all KIs cited fear of pain as a motivating factor for women to ask for a CS and hence underscored the need for greater supplies of pain-relief drugs that could be used during vaginal delivery. They similarly conceded that the insufficient number of anesthetists who are needed to monitor the pain-relief process (e.g., epidural anesthesia) throughout the vaginal delivery which may extend for long hours presented another obstacle. On the other hand, a CS could be completed in less than one hour and hence an anesthetist could assist in delivering more cases.

"The woman has a right not to feel pain, but to give her epidural anesthesia, she needs to be observed by an anesthesiologist whom we have a shortage of.... In the meantime, inhalation drugs to relieve pain are hardly available (at public facilities)." (Professor of Ob/Gyn)

Fear of medical litigation

Other reasons cited by KIs for rising CS rates is fear of medical litigation. KIs stated that the CS decision might be more favorable to physicians to safeguard against potential medical litigation that is centered on fetal damage and on

withholding rather than performing CS. All the KIs pointed to the fact that the current medical legal climate has also made waiting for a vaginal delivery less attractive to many physicians when labor is not proceeding smoothly. Hence, the number of CS performed for nonreassuring fetal status has increased. The condition is aggravated by the absence of standardized protocols that providers can rely on to support their decision along with vague lines of authority between various levels of physicians.

"CSs have increased in the public sector because doctors are afraid that some complications might happen for which they are held legally responsible, thus they take a defensive stand and go for CS." (Director at Public Hospital)

Maternal request

Around 50 percent of interviewed Ob/Gyns cited maternal request as contributing to the expansion of CS rates in study hospitals. However, in contrast to providers who believed that the increase in CS could be attributed to women's requests, KIs believed that women have no influence on the decision and that they are indirectly influenced by providers to deliver via CS. On the contrary KIs asserted that had women received comprehensible and clear information on the risks of CS, they would likely have opted for a vaginal delivery. In fact, KIs underscored the importance of provision of counseling on CS risks to women in favor of CS if medical indications were absent.

"In many cases, women would have had normal delivery if they were given a chance to decide and if the doctor had waited for natural labor; however sometimes Ob/Gyn physicians decide on CS delivery at the check-up one week before the time of delivery and for very trivial reasons.... In most of the cases or at least half of them, if given the chance, the woman could have delivered vaginally. Hence, this is misjudgment from the doctor's side and lack of experience in handling difficult cases." (Professor of Ob/Gyn)

Insufficient training in vaginal deliveries

Four of the key informants referred to the insufficient training of junior doctors in vaginal deliveries which drives them

¹³ These serve as tertiary centers and referral hospitals that accept and treat high-risk cases with limited beds and resources.

to resort to CS. As residents are seeing their seniors mostly performing CS they have no chance to practice vaginal deliveries and hence are less skilled in performing them. KIs also pointed out that residents are seldom, if ever, trained in VBAC and hence cases with a previous CS scar are almost inevitably delivered by CS.

“As doctors are delivering more cases by CS than vaginally, they have become less capable of making a proper assessment (i.e., determining whether a woman needs a CS or a vaginal delivery) and also have lost the art of assisting normal deliveries.” (Director of a Public Hospital)

Financial incentives

KIs referred to the financial rewards of CS and the leisure incentive of doctors being able to plan their schedule as tilting the scale toward more CS deliveries in both public and private facilities. As articulated by the KIs:

“A CS costs more and consumes less time while for a vaginal delivery you could get a phone call at dawn and spend all day waiting by the woman but still a client would pay less....It is a strange system.” (Director of a Public Hospital)

“Doctors nowadays find it easier to perform CS since it is more profitable, technically easier, and has a limited duration. Women who have insurance that covers delivery costs would not bother since there won't be a direct financial burden on them if the insurance policy covers the cost 100 percent.” (Professor of Ob/Gyn)

Even though doctors in public facilities may not be financially rewarded for performing CS, some may find it an opportunity to upgrade their skills and hence enhance their private practice.

“Young doctors feel that they need more learning and training in CS, .. thus their need for more training is what motivates them to perform more CS. ...” (Ob/Gyn physician in a public hospital)

Cost of Cesarean Section

This section examines monetary costs associated with CS for women and their families as well as the health system. Data on expenses paid by women and their families were obtained through interviews with women who delivered in the study hospitals (as part of the case analysis process) as well as FGDs with pregnant and postpartum women. Costs to the health system were calculated through documentation of costs associated with CS versus vaginal delivery. All costs associated with each type of delivery (e.g., provider time, equipment, supplies, among others) were documented. Given the fact that documentation of cost is a very laborious process, these data were collected only in four public study hospitals in Cairo.

To collect these data, the Population Council convened a panel of experts including senior Ob/Gyn doctors and other medical staff at public and teaching hospitals to estimate various percentages, rates, and costs based on their experience with CS and vaginal delivery. Thirteen anesthesiologists, Ob/Gyns and nurses from the four study hospitals were interviewed and asked about consumed time and salaries as well as drugs, blood products, and laboratory test quantities and unit prices. They were asked questions regarding the time spent by medical personnel on delivery procedures, patterns and standards of treatment, physical items used in the various procedures, including drugs, supplies, and other materials. Four panel sessions were also held, one at each of the study hospitals including Ob/Gyn specialists, head nurses, supervising nurses, and medical residents.

Documentation of costs associated with CS and vaginal delivery included cost analysis of equipment, supplies, and staff time involved in CS and vaginal deliveries. Additionally, the administrative records and salary schedules of one of the study hospitals were used to collect data on the labor inputs of six cadres of medical professionals involved in CS cases at public and teaching hospitals: Ob/Gyn consultants, Ob/Gyns, anesthesiologists, general practitioners, medical residents, nurses, and the receptionist. Prices of drugs and other materials were obtained from the administrative documents at one of the study hospitals. If a drug was not included in administrative documents, an estimated price was calculated using the market prices and was ascer-

tained from the “Al Dawaa El Masry” Handbook published in 2015, which contains a list of all drugs available in the Egyptian market. Prices of laboratory tests from one of the study hospitals were used to reflect general costs of lab tests. The direct cost of labor was computed based on the medical staff time spent on each procedure (measured in minutes) and estimated salary per minute (obtained from salary schedules). The direct cost of drugs and materials was computed using unit cost, number of units used, and percentage of patients receiving this drug in each procedure. The direct cost of laboratory tests was computed by unit cost of test weighted by the frequency of using this test in each procedure. The direct cost of blood products was computed by unit cost, the number of units of the product used, weighted by frequency of using this product per mode of delivery.

Estimated costs did not include depreciation cost of machines, costs of neonatal intensive care, or time away from work for women. Also, indirect costs that support the provision of health care were not measured with the assumption that they would be equal for both procedures. These indirect costs are generally capital and overhead costs, and include, for example, administrative, infrastructure, and operating costs.

Costs to women and their families

Women who delivered via CS and were interviewed for case reviews (N=484) in the 16 study hospitals were asked about all the costs incurred to CS including hospital fees, medications, tips, among others. More than half of the interviewed women stated that they did not know the cost of the CS they had (65.5 percent) because their husband was in charge of payment and he did not inform her. The rest (34.5 percent) mentioned a figure that ranged from as low as EGP 10 (in public hospitals) to as high as EGP 6000 (in private hospitals).

On the other hand, pregnant and postpartum women who attended the FGDs indicated that a CS costs around double or triple the cost of vaginal delivery. They added that the cost of CS in public hospitals is around EGP 150 while in the self-funding economic section of public hospitals it ranges from EGP 400–500. In private hospitals, the range

mentioned by women was EGP 2000–5,000 depending on governorate and seniority level of the physician. In contrast, they reported that a vaginal delivery costs EGP 50 at health centers, EGP 200–300 in a public hospital, and EGP 1000–2000 in a private hospital.

Costs to the health system

Table 8 aggregates the direct cost components of CS and vaginal delivery based on findings for the individual cost components. With respect to medical staff time spent on each procedure, average time (measured in minutes) spent by Ob/Gyns, nurses, anesthesiologists, as well as other staff members was estimated in addition to salary per minute (obtained from salary schedules) to yield a total cost estimate. This estimate was EGP 346 for CS versus EGP 181 for vaginal delivery. A detailed breakdown of staff time cost is presented in Annex IV.

Moreover, the cost of drugs and supplies was estimated and compared between procedures. Antibiotics, drugs for labor induction and lactation, analgesics, drugs to control bleeding, and other medication used in the delivery process such as Vitamin K were identified and costed. Similarly, quantities of medical supplies and devices used for each procedure (e.g., syringes, gloves, saline, cannula, and other items) were compared across procedures. A full list of drugs and medical materials included is attached in Annex V. On average a CS procedure required more anesthesia, additional drugs to control bleeding, and involved routine use of antibiotics to reduce risk of infection. Likewise, a CS

required more medical devices and supplies compared to vaginal delivery. Together, these physical inputs cost EGP 320 for CS vs EGP 196 for vaginal delivery.

As for lab tests conducted, these included urine analysis, blood tests, as well as liver and kidney tests. The cost of each individual test was estimated in addition to the percentage of patients receiving the test in each procedure. The average cost of lab tests was found to be EGP 85 and EGP 62 for CS and vaginal delivery respectively (Annex VI).

Blood transfusions—to compensate for blood loss during delivery—were also estimated for each procedure. On average, the cost of blood transfusions was EGP 325 for CS versus EGP 224 for vaginal delivery given that in CS, more units of blood, plasma, and platelets were given per patient and the percent of patients receiving transfusions was higher (Annex VII).

From the provider/hospital side, the total cost per case for CS is EGP 1076 versus EGP 663 for vaginal delivery.

Costs of overuse of CS deliveries in 2014

The average actual cost of CS is 60 percent higher than that of a vaginal delivery as calculated in public hospitals. Overuse of CS poses a financial burden to women, their families, and the healthcare system in Egypt.

TABLE 8: Average cost of various components of CS versus vaginal delivery in public hospitals

Item		Average cost per cesarean section EGP	Average cost per vaginal delivery EGP
Staff time		345.55	180.72
Drugs	Antibiotics	30.36	12.27
	Labor induction drugs	22.64	31.27
	Analgesics	2.69	2.64
	Anesthesia drugs	37.32	4.00
	Drugs to control bleeding	6.42	0.00
	Other	11.49	1.58
Medical Devices and Supplies		208.97	144.32
Lab Tests		85.00	62.25
Blood Transfusions		325.67	224.87
Total Cost		1076.11	663.91

Further calculation was conducted to assess the costs of overuse of CS. The calculation was based on number of deliveries—around 2.7 million in 2014 per CAPMAS statistics, a CS rate of 52 percent per 2014 EDHS, and calculated cost of CS of EGP 1076 per the current study, and using 20 percent as the threshold rate to define overuse of CS (Gibbons et al. 2010). This exercise revealed that in 2014, overuse of CS deliveries cost the Egyptian healthcare system EGP 929,664,000 (51,820,800 USD).

Conclusion and Recommendations

EDHS analysis revealed an alarming increase in CS rates across the period 2000–14. In the five years preceding the 2014 EDHS, CS accounted for 51.8 percent of all live births. By 2014, the CS rate had increased to 67 percent of hospital-based deliveries occurring in that year. Our analysis reveals that a host of clinical and nonclinical factors, spanning the level of the provider, hospital, and client, are contributing to the noted expansion in CS rates in Egypt. We found compelling evidence for the “once a cesarean section, always a cesarean” practice suggesting that previous CS deliveries are feeding into repeat cesareans and causing women to undergo potentially avoidable surgical procedures with distinct risks.

The increasing prevalence of a history of CS combined with the decrease in vaginal births after cesarean can be critically important drivers of the excessive CS rates noted. Client factors include socioeconomic background, increased preference for use of the private sector for both ANC and delivery care, along with incomplete knowledge of the risks and benefits of vaginal delivery versus CS. Provider-specific factors found to be implicated in the increase in CS rates include lack of physician training in vaginal delivery, fear of medical litigation, and perceptions of time convenience. Hospital factors found to contribute to the high rates of CS deliveries included absence of standardized delivery guidelines with clear criteria for when a CS should be performed as well as guidelines on when VBAC should be attempted, insufficient numbers of anesthesiologists, and lack of a medical audit system for CS cases.

In addition to exposing women and their newborns to unnecessary risk, the widespread use of CS has considerable economic implications for the healthcare system in Egypt. Cost analysis demonstrated that in 2014, excess CS deliveries cost the Egyptian healthcare system a staggering EGP 929,664,000. Considering limited resources and an already overstretched health system, unnecessary CS deliveries divert substantial human and financial resources from medically necessary and higher-priority procedures.

Over-medicalization of the birth process in Egypt as manifested in overuse of cesarean delivery constitutes a critical public health issue that merits immediate action. The follow-

ing are recommendations that require concerted effort on the part of healthcare providers, institutions, policymakers, and the public:

1. Evidence-based protocols for deliveries should be updated and should provide clear criteria for when a CS should be performed and how to manage cases with previous CS scarring. Delivery protocols and practice guidelines have the potential to assist providers and institutions in initiating practice changes that may ultimately reduce the incidence of nonmedically indicated cesarean delivery. These guidelines should outline when a CS should be performed and in cases where women have undergone a previous CS, when VBAC is deemed appropriate.
2. Nurse-midwives or midwives should be trained and assigned to hospital maternity wards to monitor the progress of labor and to manage women who will deliver vaginally. The expanded use of midwives and trained nurse-midwives has potential to assist in promoting changes in prevailing medical practice in Egyptian hospitals. Midwives and trained nurses can be mobilized to take on proactive roles in the delivery process—including providing counseling to women about options for delivery, performing vaginal deliveries, and giving support to women during the birth process especially throughout labor.
3. House officers and Ob/Gyn residents should receive sufficient information about risks of CS and adequate training in vaginal delivery as well as VBAC. There is urgent need for awareness-raising among providers about the appropriate indications for CS, the host of risks associated with CS delivery, and the importance of advocating for vaginal delivery among eligible women—including those with a previous CS. Moreover, physicians should receive adequate theoretical and practical training in performing vaginal delivery and in management of cases with previous CS.
4. The decision to perform a CS should be made by a senior doctor after physically assessing the woman's condition and after discussing with her the pros and

cons of a CS versus vaginal delivery. Implementation of guidelines that require physicians to seek a second opinion from a senior doctor before carrying out a CS should be introduced. Before deciding on mode of delivery, a thorough assessment of the woman's condition combined with adequate provision of preoperative counseling are vital to ensure sound decision-making and informed choice. Further, women with a previous CS delivery should be assessed for risk of complications and if determined to be eligible for VBAC, should be counseled on the merits of vaginal birth and offered a TOLAC.

5. Senior doctors should use staff rounds/meetings more effectively to investigate every case that was delivered by CS and should question physicians who perform a CS without apparent medical justification. Staff rounds and meetings offer an opportunity for the review of cases delivered and the provision of individual feedback to providers. They can be used to institutionalize a system of routine monitoring of physicians' practices while serving as an mechanism to hold those who perform unjustified CS accountable.
6. Antenatal care counseling should include a discussion of the advantages of vaginal deliveries and an explanation of available pain management options. ANC should be used as an opportunity to educate women about the advantages of vaginal delivery and the adverse effects of medically unjustified CS. Women who request a CS out of fear of labor pains and pain during delivery should be counseled on options for pain relief that are available to them. Concerns around damage to the perineum and postpartum reduction in sexual pleasure should be adequately addressed by health providers.
7. Pain relief drugs should be more readily available in public hospitals and more anesthesiologists who are trained in administration of epidural anesthesia should be assigned to public hospitals. Lack of coverage of pain relief in vaginal delivery fuels preference for CS delivery. Pain management options should be available to women delivering in both public and private hospitals.
8. Medical audits of CS deliveries should be periodically conducted in public and private hospitals and findings should be communicated to providers. The introduction of a medical audit process in public and private hospitals can be an effective mechanism to reduce unneces-

sary CS deliveries and increase provider accountability. Institutionalizing an audit process in hospitals should be coupled with a process for communicating findings and providing detailed feedback to health providers on their CS rates and measures they can take to improve their clinical practice.

9. More clients from lower socioeconomic groups should be attracted to the public sector. Many women are switching to the private sector with the assumption that quality of services is better. Use of the private sector by women from lower socioeconomic groups poses a financial burden on them and their families and exposes them to risks of unnecessary CS. On the other hand, the public sector needs to improve the quality of its services especially with regard to counseling, interpersonal communication, respectful care, and pain management.
10. Public awareness should be raised, especially among women and their families, about the merits of vaginal delivery and the risks of unnecessary CS. Informed consent statements which women are expected to sign before undergoing CS should include an explanation of risks of CS.

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Annexes

- I. Robson classification
- II. Profile of postpartum and pregnant women who participated in FGDs
- III. Profile of physicians who completed structured interview
- IV. Average cost of medical staff time by mode of delivery
- V. Average quantities and cost of drugs and medical supplies consumed by mode of delivery
- VI. Average cost of laboratory tests by mode of delivery
- VII. Cost of blood transfusions by mode of delivery

Annex I: Robson classification

Box 1: Robson classification

Previous caesarean section

Spontaneous labour

Source: World Health Organization (WHO), Human Reproduction Programme. 2015. WHO Statement on Caesarean Section Rates. Geneva, Switzerland: World Health Organization http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/cs-statement/en/

Annex II: Profile of postpartum and pregnant women who participated in FGDs

Postpartum	Cairo	Alexandria	Beheira	Assiut
Number of women	17	14	19	17
Age of women				
Mean	30.2	33.0	27.5	26.5
Range	21-43	18-40	17-38	18-34
Mode of last delivery				
Vaginal	5	8	6	6
CS	12	6	13	11
Education				
Illiterate	2	1	1	3
Read and Write	2	0	0	1
Primary	1	1	2	1
Elementary	3	2	2	0
Intermediate	0	0	0	2
Secondary or higher	9	10	14	10
Employment				
Housewives	16	10	19	12
Working for cash	1	4	0	5
First time pregnant women				
Number of women	5 women	6 women	10 women	8 women
Age of women				
Mean	21.6	26.8	24.2	22.2
Range	17-28	25-30	20-28	18-31
Education				
Illiterate	0	0	1	0
Read and Write	0	0	0	0
Primary	0	0	0	0
Elementary	2	0	1	3
Intermediate	0	0	0	0
Secondary or higher	3	6	8	5
Employment				
Housewives	5	5	7	6
Working for cash	0	1	3	1
Student	0	0	0	1

Annex III: Profile of physicians who completed structured interview

Characteristic	N=325
Sex (%)	
Male	62
Female	38
Age (%)	
20–29	22
30–39	41
40–49	16
50–59	16
60+	5
Highest degree attained (%)	
MBBCH	34
Diploma	15
Master	32
Fellowship	6
PhD	13
Title (%)	
Resident	39
Assistant specialist/lecturer	19
Specialist/lecturer	26
Consultant/Professor	16
Years of experience (mean)	
Overall	8 years
In study hospital	4 years
Average number of deliveries attended per shift (mean)	5 deliveries
Physician's role in deliveries (%)¹⁴	
Delivers by him/herself	61
Assists in deliveries	41
Supervises deliveries	37
Participates in delivery of critical cases	30

¹⁴ Multiple answers were allowed thus the total is more than 100 percent.

Annex IV: Average cost of medical staff time by mode of delivery

Amount of time spent in cesarean section and time cost by each category of medical personnel			
	Salary	Average time spent	Time Cost (EGP)
	EGP/minute		
Ob/Gyn consultant	1.9	58.0	107.7
Ob/Gyn specialist	0.7	70.8	46.7
Ob/Gyn assistant	0.3	99.5	27.2
Medical resident	0.2	232.1	52.8
Anesthesiologist	0.5	78.2	42.5
Nurse	0.2	315.1	64.2
Other employees (receptionist, lab technician etc.)	0.2	28.1	4.5
Total		881.9	345.6

Amount of time spent in vaginal delivery and time cost by each category of medical personnel			
	Salary	Average time spent	Time Cost (EGP)
	EGP/minute		
Ob/Gyn consultant	1.9	10.5	19.5
Ob/Gyn specialist	0.7	50.4	35.3
Ob/Gyn assistant	0.3	72.7	19.9
Medical resident	0.2	217.3	49.4
Anesthesiologist	0.5	3.0	1.6
Nurse	0.2	252.5	51.4
Other employees (receptionist, lab technician etc.)	0.2	23.0	3.7
Total		632.4	180.7

Annex V: Average quantities and cost of drugs and medical supplies consumed by mode of delivery

Average quantities and cost of drugs and supplies used in cesarean sections														
	Drug name	Unit	Unit price	Labor ward			Operating theater			Postpartum ward			Total	
				Quantity	%	Average cost	Quantity	%	Average cost	Quantity	%	Average cost	Quantity	Cost
Antibiotic	Flumox	Vial 1 gm	4.95	1.00	100.00	7.32	0.00	0.00	12.35	1.50	100.00	10.69	2.50	30.36
	Cefotax 1 gm	Vial 1 gm	8.13	1.00	83.33		0.00	0.00		2.00	100.00		3.00	
	Uniclam 1 gm	Vial 1.5 gm	6.75	1.00	100.00		2.00	100.00		0.00	0.00		3.00	
	Ceporex 1 gm	1 Tablet	1.38	0.00	0.00		0.00	0.00		0.00	0.00		0.00	
	Ceporex 1 gm	Vial 1000	5.04	0.00	0.00		0.00	0.00		0.00	0.00		0.00	
	Cefazone 1 gm Vial	Vial 1 gm	5.60	0.00	0.00		2.00	100.00		1.50	100.00		3.50	
Labor & lactation	Ampectam 1500	Vial	7.40	1.50	60.00	0.00	0.00	0.00	6.36	0.00	0.00	4.95	1.50	11.31
	Syntocinon 5 IU	Ampoule	1.65	0.00	0.00		3.86	100.00		3.00	100.00		6.86	
	Oxytocin	Ampoule 5 IU	1.65	4.50	100.00		0.00	0.00		0.00	0.00		4.50	
	Methergine 2 ml	Ampoule	1.50	0.00	0.00		1.00	100.00		1.60	100.00		2.60	
Analgesics	Declophen 75mg/3ml	Ampoule	0.95	0.00	0.00	0.60	0.00	100.00	0.00	0.00	100.00	2.40	3.00	3.90
	Neuril	Ampoule	0.60	1.00	10.00		0.00	100.00		0.00	0.00		1.00	
	Voltaren 75mg/3ml	Ampoule	2.76	0.00	0.00		0.00	100.00		1.00	100.00		1.00	
	EpicotyI 20mg/2ml	Vial 20mg/2ml	1.95	0.00	0.00		0.00	100.00		1.50	100.00		1.50	
	Midazolam (Midathetic or Dormicum)	1 ml 5 mg	1.89	0.00	0.00		0.00	100.00		0.00	0.00		0.00	2.69
	Profenid 100mg	Suppository	0.35	0.00	0.00		0.00	100.00		1.83	100.00		1.83	
	Ketofan	Ampoule 100mg/2ml	0.64	0.00	0.00		0.00	100.00		2.00	100.00		2.00	
	Kapron 100mg/1ml	Ampoule	2.14	0.00	0.00		1.00	100.00		2.00	100.00		3.00	
For bleeding	Glycerine Suppository	Suppository	1.13	0.00	0.00	0.00	100.00	0.00	0.00	3.25	100.00	3.67	3.67	
Other	Picolax 7.5mg/ml	Tablet	1.30	0.00	0.00	0.00	0.00	100.00	0.00	1.00	100.00	1.30	1.30	
	Flagyl Tablet	Tablet 500mg	0.11	0.00	0.00	0.00	0.00	100.00	0.00	6.50	100.00	0.72	0.72	
	Vitamin K	Ampoule	0.54	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	
	Dicynone 250mg/2ml	Ampoule	0.95	0.00	0.00	0.00	0.00	100.00	0.00	2.00	100.00	1.90	1.90	
	Misotac tablets	100gm tablets	0.98	0.00	0.00	0.00	0.00	100.00	0.00	4.00	100.00	3.90	3.90	

Average quantities and cost of drugs and supplies used in cesarean sections

Drug name	Unit	Unit price	Labor ward			Operating theater			Postpartum ward			Total	
			Quantity	%	Average cost	Quantity	%	Average cost	Quantity	%	Average cost	Quantity	Cost
Primperan 10mg/2ml	Ampoule	0.85	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
IV Cannula	1 pcs	1.00	1.32	100.00	1.32	1.50	100.00	1.50	0.00	0.00	0.00	2.82	2.82
IV infusion set	1 pcs	1.00	1.00	96.00	0.96	1.29	100.00	1.29	3.50	100.00	3.50	5.79	5.75
Saline	Bottle	3.95	0.00	0.00	0.00	2.00	100.00	7.90	1.50	100.00	5.93	3.50	13.83
Ringer lactate	Bottle	4.20	1.40	96.00	5.64	3.17	100.00	13.30	1.81	100.00	7.61	6.38	26.56
Glucose 5 percent	Bottle	3.60	0.00	0.00	0.00	0.00	100.00	0.00	1.83	100.00	6.60	1.83	6.60
Glucose 10 percent	Bottle	4.50	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Betadin 7.5	1 litre	26.13	0.00	0.00	0.00	0.00	100.00	0.00	0.60	100.00	15.68	0.60	15.68
Plaster	Reel	9.85	0.20	100.00	1.97	0.20	100.00	1.97	0.20	100.00	1.97	0.60	5.91
Syringe 3 cm	1 pcs	0.26	0.00	0.00	0.00	0.00	100.00	0.00	3.00	100.00	0.78	3.00	0.78
Syringe 5 cm	1 pcs	0.28	1.67	100.00	0.47	5.25	100.00	1.47	3.63	100.00	1.02	10.54	2.95
Syringe 10 cm	1 pcs	0.39	1.67	100.00	0.65	2.00	100.00	0.78	2.83	100.00	1.11	6.50	2.54
Foley catheter	1 pcs	3.70	1.00	50.00	1.85	1.00	100.00	3.70	0.00	0.00	0.00	2.00	5.55
Urine bag	1 pcs	1.15	1.00	50.00	0.58	1.00	100.00	1.15	0.00	0.00	0.00	2.00	1.73
Latex gloves	1 pcs	0.23	3.00	100.00	0.68	3.75	100.00	0.84	10.00	100.00	2.25	16.75	3.77
Surgical gloves	1 pcs	1.80	2.00	50.00	1.80	4.88	100.00	8.78	0.00	0.00	0.00	6.88	10.58
Surgical dressing	1 packet	1.75	0.00	0.00	0.00	1.56	100.00	2.73	1.00	100.00	1.75	2.56	4.48
Towels	1 packet	11.00	0.00	0.00	0.00	1.36	100.00	14.93	0.00	0.00	0.00	1.36	14.93
Surgical suture facryl	Ampoule	12.00	0.00	0.00	0.00	3.25	100.00	39.00	0.00	0.00	0.00	3.25	39.00
Surgical blades	1 pcs	0.30	0.00	0.00	0.00	1.19	100.00	0.36	1.00	80.00	0.24	2.19	0.60
Sterile cotton	1 kg	32.00	0.00	0.00	0.00	0.20	100.00	6.40	0.20	100.00	1.28	0.40	7.68
ECG electrode	1 pcs	0.47	0.00	0.00	0.00	5.00	100.00	2.33	0.00	0.00	0.00	5.00	2.33
Airway tube	1 pcs	2.20	1.00	20.00	0.44	1.00	100.00	2.20	0.00	0.00	0.00	2.00	2.64
Neilton catheter	1 pcs	0.52	1.00	20.00	0.10	1.00	100.00	0.52	0.00	0.00	0.00	2.00	0.62
Ready vac	1 pcs	13.00	0.00	0.00	0.00	1.00	100.00	13.00	0.00	0.00	0.00	1.00	13.00
Oxygen mask	1 pcs	2.75	0.00	20.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Endotracheal tube	1 pcs	3.75	1.00	0.00	0.00	1.00	100.00	3.75	0.00	0.00	0.00	2.00	3.75
Spinal needle	1 pcs	5.30	1.00	80.00	4.24	1.17	100.00	6.18	0.00	0.00	0.00	2.17	10.42
Surgical suture proline	Ampoule	4.50	0.00	0.00	0.00	1.00	100.00	4.50	0.00	0.00	0.00	1.00	4.50
Total drugs and supplies cost			36.04			160.93			85.60				282.57

Medical devices

Average quantities and cost of drugs and supplies used in vaginal deliveries															
	Drug name	Unit	Unit price	Labor ward			Operating theater			Postpartum ward			Total		
				Quantity	%	Average cost	Quantity	%	Average cost	Quantity	%	Average cost	Quantity	Cost	
Medical devices	IV Cannula	1 pcs	1.00	1.44	100.00	1.44	1.00	100.00	1.00	100.00	1.00	1.00	100.00	2.00	3.44
	IV infusion set	1 pcs	1.00	1.56	100.00	1.56	1.00	100.00	1.00	100.00	1.00	1.00	93.33	2.00	3.50
	IV solution	Bottle	3.95	1.75	60.00	4.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.15
	IV solution	Bottle	4.20	1.94	100.00	8.17	1.00	100.00	4.20	1.20	95.00	4.79	2.00	17.15	
	Glucose 5%	Bottle	3.60	2.00	100.00	7.20	1.00	100.00	3.60	1.25	100.00	4.50	0.00	15.30	
	Glucose 10%	Bottle	4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Betadin 7.5	1 liter	26.13	0.00	0.00	0.00	0.60	100.00	15.68	0.00	0.00	0.00	1.17	15.68	
	Plaster	Reel	9.85	0.20	100.00	1.97	0.00	0.00	0.00	0.20	100.00	1.97	6.80	3.94	
	Syringe 3 cm	1 pcs	0.26	0.00	0.00	0.00	1.00	100.00	0.26	0.00	0.00	0.00	10.00	0.26	
	Syringe 5 cm	1 pcs	0.28	2.83	100.00	0.79	1.90	100.00	0.53	2.00	100.00	0.56	2.69	1.89	
	Syringe 10 cm	1 pcs	0.39	0.00	0.00	0.00	1.25	100.00	0.49	0.00	0.00	0.00	1.00	0.49	
	Foley catheter	1 pcs	3.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Urine bag	1 pcs	1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
	Latex gloves	1 pcs	0.23	0.00	0.00	0.00	3.00	100.00	0.68	0.00	0.00	0.00	0.00	0.00	0.68
	Surgical gloves	1 pcs	1.80	2.00	100.00	3.60	2.80	100.00	5.04	0.00	0.00	0.00	1.00	8.64	
	Surgical dressing	1 packet	1.75	0.00	0.00	0.00	1.00	100.00	1.75	0.00	0.00	0.00	1.00	1.75	
	Towels	1 packet	11.00	1.00	100.00	11.00	2.00	100.00	22.00	0.00	0.00	0.00	2.00	33.00	
	Surgical suture faeryl	Ampoule	12.00	0.00	0.00	0.00	1.43	100.00	17.14	0.00	0.00	0.00	0.00	17.14	
	Surgical blades	1 pcs	0.30	0.00	0.00	0.00	1.00	100.00	0.30	0.00	0.00	0.00	0.00	0.30	
	Sterile cotton	1 kg	32.00	0.00	0.00	0.00	0.20	100.00	6.40	0.23	100.00	7.36	0.00	13.76	
	ECG electrode	1 pcs	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00
	Airway tube	1 pcs	2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Neilton catheter	1 pcs	0.52	0.00	0.00	0.00	1.00	100.00	0.52	0.00	0.00	0.00	1.00	0.52	
	Ready vac	1 pcs	13.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Oxygen mask	1 pcs	2.75	0.00	0.00	0.00	1.00	100.00	2.75	0.00	0.00	0.00	1.00	2.75	
	Endotracheal tube	1 pcs	3.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Spinal needle	1 pcs	5.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Surgical suture Proline	Ampoule	4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total drugs and supplies cost				50.02			92.34			49.72			192.08		

Cost of anesthesia drugs used in cesarean and vaginal deliveries												
Drug name	Cesarean section											
	General			Spinal			Epidural			Vaginal delivery		
	Amount	Unit price	Cost	Amount	Unit price	Cost	Amount	Unit price	Cost	Amount	Unit price	Cost
Thiopental 500mg	1.00	3.58	3.58		3.58	0.00		3.58	0.00		3.58	0.00
Prostigmine VIAL	1.10	6.00	6.60		6.00	0.00		6.00	0.00		6.00	0.00
Diprivan 1 percent	1.17	12.00	14.00		12.00	0.00		12.00	0.00		12.00	0.00
Atropine	1.50	1.85	2.78	1.17	1.85	2.16	1.00	1.85	1.85		1.85	0.00
Isoflurane	40.00	0.70	28.00		0.70	0.00		0.70	0.00		0.70	0.00
Marcaine spinal heavy		5.60	0.00	1.00	5.60	5.60		5.60	0.00		5.60	0.00
Marcaine solution		0.10	0.00		0.10	0.00	20.00	0.10	2.10		0.10	0.00
Tracrium 25mg/2.5ml	1.25	6.59	8.24		6.59	0.00		6.59	0.00		6.59	0.00
Ephedrine solution		2.00	0.00	1.00	2.00	2.00	2.00	2.00	4.00		2.00	0.00
Xylocaine		0.40	0.00	2.33	0.40	0.93	10.00	0.40	4.00	10.00	0.40	4.00
Succinyl choline	1.00	1.00	1.00		1.00	0.00		1.00	0.00		1.00	0.00
Atracurium	2.00	7.75	15.50		7.75	0.00		7.75	0.00		7.75	0.00
Fentanyl	1.13	7.00	7.88	1.00	7.00	7.00		7.00	0.00		7.00	0.00
Lidocaine amp		0.39	0.00	1.50	0.39	0.59		0.39	0.00		0.39	0.00
Ephedrine amp		2.00	0.00	1.25	2.00	2.50		2.00	0.00		2.00	0.00
Ketamine vial		7.50	0.00		7.50	0.00		7.50	0.00		7.50	0.00
%		0.27			0.72			0.07			1.00	
Cost		87.56			20.78			11.95			4.00	
Weighted cost					37.32						4.00	

Annex VI: Average cost of laboratory tests by mode of delivery

Cost of laboratory tests						
	Cesarean section			Vaginal delivery		
	% of patients receiving test	Cost per test (EGP)	Cost of performed tests	% of patients receiving test	Cost per test (EGP)	Cost of performed tests
Complete blood count	100.0%	25.00	25.00	25.0%	25.00	6.25
Blood grouping and RH	100.0%	20.00	20.00	100.0%	20.00	20.00
Kidney (renal) function test (urea, creatinine)	30.0%	30.00	9.00	25.0%	30.00	7.50
Bleeding, coagulation, clotting time	100.0%	10.00	10.00	100.0%	10.00	10.00
Liver function test	30.0%	30.00	9.00	25.0%	30.00	7.50
Prothrombin time and activity (PT, PTT)	20.0%	40.00	8.00	20.0%	40.00	8.00
Albumin in urine	50.0%	5.00	2.50	40.0%	5.00	2.00
Blood glucose (FBS)	15.0%	10.00	1.50	10.0%	10.00	1.00
Total cost		85.00			62.25	

Annex VII: Cost of blood transfusions by mode of delivery

Cost of blood transfusions								
	Cesarean section				Vaginal Delivery			
	Average no. of units given per patient	% of patients receiving transfusions	Unit price	Average cost of transfusion	Average no. of units given per patient	% of patients receiving transfusions	Unit price	Average cost of transfusion
Blood	1.70	22.0%	123.75	46.28	1.38	15.0%	123.75	25.52
Packed red cells	1.75	38.3%	175.00	117.40	2.07	27.9%	175.00	100.98
Platelets	9.00	13.6%	86.80	106.02	6.38	11.3%	86.80	62.25
Plasma	3.88	21.7%	66.67	55.97	3.33	16.3%	66.67	36.11
Total cost of transfusions	325.67				224.87			