Effective Perinatal Care
Cost Impact Study
2008

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Final Report

Healthy Women in Georgia
JSI Research & Training Institute, Inc.
United States Agency for International Development (USAID)

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HEALTHY WOMEN IN GEORGIA PROGRAM

The Healthy Women in Georgia Program, funded by the United States Agency for International Development (USAID), seeks to improve women's health in Georgia through increased provision and use of quality health services.

JSI Research & Training Institute, Inc. implements the Healthy Women in Georgia Program in collaboration with CLARITAS XXI, Curatio International Foundation, Fund Orthos, Save the Children, HERA, and McCann Erickson.

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List of Acronyms

CIS	Cost Impact Study
EPC	Effective Perinatal Care
EPCCIS	Effective Perinatal Care Cost Impact Study
JSI	John Snow Research and Training Institute, Inc
HWG	Healthy Women in Georgia
WHO	World Health Organization
WIN	Women and Infant Health Project (Russia)
MIHP	Maternal and Infant Health Project (Ukraine)
NCDC	National Center for Disease Control
USAID	United States Agency for International Development
ANC	Antenatal Care
FP	Family Planning
OB/GYN	Obstetrician/Gynecologist
IEC	Information, Education and Communication
KOGH	Kutaisi Obstetric and Gynecological Hospital
VD	Vaginal Delivery
CS	Caesarean Section

Executive Summary

In 2003, John Snow Research and Training Institute, Inc. (JSI) was funded by the United States Agency for International Development (USAID) to implement the Healthy Women in Georgia (HWG) Project to encourage increased provision and use of quality health services with its partners CLARITAS XXI, Curatio International Foundation, Fund Orthos, Save the Children, HERA, and McCann Erickson. Since its inception as a small family planning operations research project in one region, HWG has grown in size, scope and geographic coverage. In early 2006, HWG commenced the Effective Perinatal Care (EPC) component of its program with the launching of the first EPC training.

The HWG-provided EPC trainings, based on newly revised WHO/EURO/JSI training package, taught health providers about evidence-based practices to improve delivery outcomes for mothers and newborns. Techniques such as use of a partograph, active management of the third stage of labor (AMTSL), warm chain, overall de-medicalization of care, and evidence-based management of major obstetric and neonatal conditions were included in the EPC interventions.

Studies conducted by JSI's WIN Project in Russia and JSI's MIHP in Ukraine found substantial cost reductions as a result of the implementation of a set of interventions similar to those promoted by HWG's EPC program component. HWG decided to conduct a similar study to determine if the application of the EPC intervention had a similar effect on delivery costs in Georgia.

The HWG Cost Impact Study (CIS), conducted in 2007-2008, was designed to assess if the target maternities had experienced a reduction in delivery costs after the implementation of EPC techniques between 2004 and 2007. Two maternity hospitals in the Imereti Region of Georgia, one in Zestaponi and one in Kutaisi were selected for the study. A data collection instrument was designed, based on the MIHP project study in Ukraine and then providers in the two selected facilities were trained on data abstraction. The collected data were analyzed using SAS version 9.1.3.

The current report presents the findings of this study. The study found that there were significant reductions in labor stimulation, routine use of amniotomies, episiotomies, birth canal examinations after labor, drug use and excessive bleeding. Significant increases in partograph use, AMTSL and immediate breastfeeding were also found. There were positive trends in reducing the number of newborns who were admitted for intensive monitoring.

The changes in delivery practices between 2004 and 2007 resulted in a reduction in costs for both facilities. Adjusted for effects of hospital and delivery type, the average overall delivery cost after EPC was 25%

($p<0.0001$) lower than before. In Kutaisi, the average overall delivery cost after EPC training was 23.8% ($p<0.0001$) lower, and in Zestaponi, the cost reduction reached a maximum of 27.0% ($p<0.0001$). The average total cost of vaginal deliveries reduced by 42% ($p<0.0001$), while the total average charges for c-section were 19.6% ($p<0.0001$) lower after EPC intervention.

Study provides evidence to Georgian policymakers and public and private health care providers that investments in modernizing delivery care are cost efficient.

Introduction

Georgia has made considerable economic and social progress since independence from the Soviet Union in 1991, and the later Rose Revolution of 2003. Despite this progress, the health sector in Georgia continues to struggle with the legacies of Soviet medicine, particularly in regards to maternal and infant health.

While the trends are encouraging, there still is room for continued improvement. In 2005, the maternal mortality ratio in Georgia was 23.4 maternal deaths per 100,000 live births.[1] Although this is a decrease from the 2000 statistic, where 49.2 maternal deaths occurred per 100,000 live births, it is still considerably higher than the ratio found in most developed countries, where fewer than 10 maternal deaths occur for every 100,000 live births.[2] The neonatal mortality rate in 2005 was also higher than desired, with 12.4 neonatal deaths per 1,000 live births, representing 69% of all infant morality in Georgia.[1] Unfortunately, both types of mortality likely remain underreported. These unnecessarily high rates of mortality are due in part to considerable gaps in the perinatal system in Georgia in terms of availability of resources. Human resources play a key role in these gaps in terms of outdated knowledge, skills and attitudes, as do the lack of supplies and commodities.

Georgia's high abortion rate and low contraception use, particularly in rural areas, further complicate the situation. In 1999, there were 3.7 abortions per woman; in 2005, the number had decreased to 3.1 abortions per woman.[3] Although forty-two percent of Georgian women of reproductive age use contraception, only twenty-nine percent of those utilizing contraception use modern methods.[3]

Maternal and infant health care in Georgia are similar to most health services in the former Soviet Union in that they follow a strict medical model. Typically, women deliver alone without the support of partners or family members, and ambulation during labor is discouraged. Mothers are often separated from their babies after birth, delaying the initiation of breastfeeding, and possibly reducing breastfeeding. This separation also results in a decreased opportunity for maternal-child bonding, and may contribute to the hypothermia of neonates in low-resource settings.

In 2003, John Snow Research and Training Institute, Inc. (JSI) was funded by the United States Agency for International Development (USAID) to implement with its partners CLARITAS XXI, Curatio

1 NCDC Georgia. 2006. Health and Health Care in Georgia 2005 (Statistical Yearbook)

2 World Development Indicators. Maternal Mortality. The World Bank Group. http://devdata.worldbank.org/wdi2006/contents/Section1_1_5.htm

3 Serbanescu F, Imnadze P, Bokhua Z, Nutsubidze N, Jackson DB, Morris L. Reproductive Health Survey Georgia 2005. Atlanta, GA (USA)

International Foundation, Fund Orthos, Save the Children, HERA and McCann Erickson, the Healthy Women in Georgia (HWG) Project to encourage increased provision of and use of quality health services. Since its inception as a small family planning operations research project in one region, HWG has grown in size, scope and geographic coverage to encompass the following components in six regions in Georgia:

- Modernization of maternity care;
- Expanding access to family planning and;
- Development of informed health consumers.

With regard to the modernization of maternity care, HWG promotes a more client-focused approach than what existed in the past in Georgia. The new approach includes best practices in health care that are proven to decrease maternal and neonatal morbidity and mortality. Using World Health Organization (WHO) technical guidelines and learning from JSI's Women and Infant Health (WIN) Project in Russia, and its Maternal and Infant Health Project (MIHP) in Ukraine, the HWG team has:

- Improved the delivery rooms in intervention facilities to make them "family friendly";
- Trained OB/GYNs, nurse/midwives, neonatalogists in effective perinatal care (EPC);
- Introduced and adapted evidence-based standards and guidelines for delivery services, management of complicated pregnancies, infection prevention and control, and neonatal resuscitation and basic neonatology services including warm chain;
- Conducted regular supportive supervision with intervention sites;
- Trained OB/GYNs and primary heath care providers in family planning service provision and counseling;
- Reinforced ANC skills and services of OB/GYNs and primary health care providers and;
- Launched Parents' Schools and increased public awareness of evidence-based practices and improved maternal and neonatal health care through Parents' Schools and other information, education and communication (IEC) approaches.

The EPC component of HWG started in early 2005. Providers were taken on a study tour to Ukraine in November 2005 and the first evidence-based EPC training in Georgia took place in February 2006.

Objectives

The overall goal of the Effective Perinatal Care Cost Impact Study (EPCCIS) was to provide health facilities and health policy makers with practical information to inform decision making and improve financial management of health care interventions. Specifically, the objective of the study was to understand and quantify the financial impact of the EPC interventions that HWG promoted in its pilot maternity hospitals. This information is particularly relevant in Georgia because health sector reform is currently a priority issue of the Government.

By introducing rational and effective maternal and infant care based on evidence-based medicine and principles of maternal and newborn care promoted by WHO, HWG's EPC interventions were expected to improve the health outcomes of women and infants. Studies conducted by HWG's sister projects (the JSI WIN Project in Russia and the JSI MIHP in Ukraine) found substantial cost reductions as a result of the implementation of a set of interventions similar to those promoted by HWG. Informal reports from maternal and child health leaders in pilot HWG sites and internal project calculations indicated that potentially significant savings had resulted due to reductions in supplies and medicines required for maternity services.

The underlying hypothesis of this study was that savings could be accrued from the reduced use of analgesics and anesthetic drugs, antibiotics and intravenous solutions, laboratory tests, syringes and other supplies. Routinely collected project data suggested that the reductions in the number of episiotomies and operative deliveries routinely performed in maternity hospitals/departments would also have an impact on reducing hospital costs. Based on these observations, the study sought to answer the following questions:

1. How has the cost of caring for pregnant and delivering women and their neonates changed as a result of implementing the HWG EPC interventions?
2. What are the major drivers of the change in costs?

A broader objective of the study was to provide information and guidance for managing the financial impact of the interventions when the EPC interventions are applied nationally as part of new national health policies. It is expected that facilities and government will be able to use the results of this study to anticipate, plan for, and maximize the financial benefits of implementing the EPC interventions.

In an effort to keep the study relatively simple and feasible in the available time frame, the analysis focuses primarily on quantifying the costs – i.e., inputs/resources spent or saved – associated with the HWG EPC interventions. Financial benefits may also be experienced by patients' families, and the hospitals due to improved quality of care. However, all these aspects of the intervention are considered outside the scope of this study.

Methods

Strategies

Two major strategies were applied to address the key questions in the study:

1) A retrospective, before-and-after cohort analysis of delivery-related care costs based on a review of patient records of women who delivered in the study sites and their newborns; and
2) A more in-depth analysis of findings from the above step based on informational interviews with hospital decisions makers.

The tools used to implement these strategies can be found in Appendices A, B and C.

The types and costs of care may vary between facilities due to individual and sometimes collective behaviors of clinical staff, as well as depending on hospital type (public versus private). The controlling of hospital and delivery type is done efficiently in the analysis using Proc GLM. The informational interviews with hospital decision makers made it possible to gather more information about the effects of the intervention on costs and fill in any gaps that were left by the record abstraction.

Facility Selection

The main criteria for facility selection were implementation of EPC intervention since 2005 and an adequate number of deliveries (approximately 700) per year. The cost impact study was conducted at two of the original HWG pilot sites where the EPC component of the HWG program was implemented: the Zestaponi Maternity and the Kutaisi Obstetric and Gynecological Hospital. These sites were selected because they had both successfully implemented HWG EPC interventions during the pilot project phase, and had complete and accessible information required for the study.

The Kutaisi Obstetric and Gynecological Hospital (KOGH) is one of four maternity hospitals in the city of Kutaisi (population 296,000). This private hospital sees on average, approximately 800 deliveries per year and serves the urban and sub-urban areas of Kutaisi. The facility primarily specializes in care of full-term

pregnancies and deliveries and rarely manages pre-term deliveries.

Zestaponi Maternity Hospital is a publicly owned hospital. It is the only maternity in the small town of Zestaponi (population 120,000), which is located approximately 40 minutes from Kutaisi. This maternity hospital serves the urban population of Zestaponi, as well as inhabitants of villages surrounding Zestaponi and in the district of Terjola. The hospital sees, on average, 700 deliveries per year, the majority of which are full term pregnancies.

Table 1 presents the total number of vaginal deliveries and caesarean sections at each maternity in 2004 and 2007. Overall, information regarding vaginal deliveries and caesarean sections was extracted and analyzed for this study.

Table 1. Total Number of Deliveries Before and After EPC Intervention by Maternity Hospital

	Zestaponi		KOGH	
TYPE OF DELIVERY	**BEFORE ('04)**	**AFTER ('07)**	**BEFORE ('04)**	**AFTER ('07)**
Vaginal	624	609	483	659
Caesarean Section	114	109	302	379
Total Number of Deliveries	**738**	**718**	**785**	**1038**

Sample Size

The first sample size calculation was based on being able to detect 0.20 difference between two proportions (of delivery care practices before and after EPC training) as statistically significant, since this calculation does not need a declared standard deviation. By taking the 0.20 difference in the middle of the distribution (the difference between 0.60 and 0.40), the maximum sample size needed per group was calculated to be 97, using a significance level of 0.05, a power of 0.80, and a two-sided test.

Without having a good estimate of the standard deviation of total delivery costs per patient, the relationship between the difference of two means (of delivery costs before and after EPC training) and the standard deviation was used for the second sample size calculation. A sample size of 99 per group is needed to be able to detect a statistically significant difference between means that have a standard deviation that is as large as 2.5 times that difference, using a significance level of 0.05, a power of 0.80, and a two-sided test. So whether the difference between means is 4 and the standard deviation is as large as 10 or the difference between means is 8 and the standard deviation is as large as 20, a sample size of 99 per group is sufficient to be able to detect that difference between means as statistically significant. The sample size was rounded to 100 and 100 records were abstracted from each facility for each time period for a total of 400 records.

Data Collection

Borrowing generously from the protocols used in Ukraine and Russia to assess the financial impact of EPC interventions, the methodology used in Georgia can be broken down into three phases: 1) Patient Medical Records Review, 2) Pricing, and 3) Key Informant Interviews. Detailed data collection tools exist for each phase. These include the Patient Medical Record Review Form (Appendix A), Pricing Tables (Appendix B), and the Key Informant Interview Guide (Appendix C).

Patient Medical Records Review

The study was conducted in the period of 2007-2008. The first phase of data collection consisted of a review of patient records at the target facilities. The Patient Medical Record Review Form (Appendix A) was used for information extraction and was developed in such a way that it corresponds with the information available in the in-patient medical records in Georgia. It covered topics which apply to mother and newborn care such as admission and discharge times, types of delivery, types of medical procedures, lab tests performed and medicines used, in addition to other information which was helpful for comparing delivery-related practices before and after HWG EPC interventions. The Patient Medical Record Review Form covered the stages of delivery care for mothers and newborns, as well as procedures which characterize both caesarean sections (CS) and vaginal deliveries (VD). The actual form used to extract information was in Georgian and all data were extracted in Georgian.

The study covers the six month period "before" and "after" the HWG EPC interventions. Two hundred mothers' records were randomly sampled from each facility—100 records were selected from the first six months of 2004 (the "before" period); and 100 were selected from the first six months of 2007 (the "after" period), that is 12-18 months after the training of facility staff and project implementation. Three 2004 medical records, and one 2007 medical record were missing from the Zestaponi samples, whereas one 2004 record was missing from the Kutaisi sample. This could be explained by poor record management and archiving systems existing in Georgia. Additional random sampling was performed to select records to replace the missing ones. Overall, 400 maternal records were abstracted and analyzed.

KOGH and Zestaponi Maternity Hospital staff members were trained by HWG staff on how to extract all relevant data from patient records using the Patient Medical Record Review Form. This training also served as a pre-test for the Patient Medical Record Review Form. Four staff members were trained from each facility and were given 10 days to review the records. Facility staff members were used to extract data to ensure patient confidentiality as these staff members already had access to records and also were familiar with how information is recorded in the patient histories.

Pricing

Phase 1 provided a wide variety of information on the types and quantities of resources used for the practices promoted and likely influenced by HWG EPC interventions. These types of resources included:

- Drugs: analgesics, anesthetics, and antibiotics, IV solutions;
- Supplies;
- Laboratory tests (blood, urine, culture) and diagnostic procedures; and
- Infant formula.

Table 2 provides information regarding cost calculations for different resource types. Assumptions were established for injection supplies. These assumptions can be found in Appendix B. Cost for HIV testing, which, based on the revised state standards for maternity care, became obligatory for all women in labor upon admission to the Maternity Hospitals since 2007, were excluded from the cost analysis to make "before" and "after" data comparable. Infant formula was also excluded from the cost analysis due to the fact that only one infant received formula and, most importantly, the national standards discourage formula use.

Table 2. Cost Calculations for Different Resource Types

RESOURCE TYPE	WAYS IN WHICH TOTAL COST WAS CALCULATED
Pharmaceuticals	▪ The total number of doses of each drug and solution used was extracted from the medical records for each delivery ▪ The total number of doses of each drug and solution used was then multiplied by the corresponding 2007 lowest available wholesale unit price to obtain the total cost of each drug and solution used for each delivery ▪ The total costs of each drug and solution used for each delivery were then summed for each drug cost category: labor induction, labor stimulation, pain relief during labor, other drugs during labor, C-section, postpartum, newborn drugs, and newborn cord care ▪ The total costs for each drug cost category were then summed to obtain the total maternal drug cost and the total newborn drug cost for each delivery ▪ The total maternal drug cost and the total newborn drug cost were then summed to obtain the total drug cost for each delivery
Injection Supplies	▪ The total number of injection and solution supplies for each drug and solution (for IV/IM/SC/local use) used per delivery was calculated based on information obtained through key informant interviews ▪ The total number of injection and solution supplies was then multiplied by the corresponding 2007 lowest available wholesale unit price to obtain the total supply cost for each drug and solution used per delivery ▪ The total supply costs for each drug and solution used per delivery were then summed for each drug cost category: labor induction, labor stimulation, pain relief during labor, other drugs during labor, C-section, postpartum, and newborn drugs, plus catgut ▪ The total supply costs for each drug cost category and catgut were then summed to obtain the total maternal supply cost and the total newborn supply cost for each delivery ▪ The total maternal supply cost and the total newborn supply cost were then summed to obtain the total supply cost for each delivery
Lab tests and exams	▪ The total number of times each test was done was extracted from the medical records for each delivery ▪ The total number of times each test was done was then multiplied by the unit price estimate to obtain the total cost of each test used for each delivery. The price for the majority of tests was obtained from the State Standards for Maternal and Newborn Care. The prices for those not included in the State Standards were estimated from the Internal Standards in each facility during Key Informant Interviews ▪ The total costs of each test used for each delivery were then summed for each test cost category: labor, C-Section, postpartum, and newborn. ▪ The total costs for each maternal test cost category were then summed to obtain the total maternal test cost for each delivery ▪ The total maternal test cost and the total newborn test cost were then summed to obtain the total test cost for each delivery

Unit prices on these resources were collected during Phase 2 of the study (Annex B). A list of all pharmaceuticals, injection supplies and types of lab tests identified was established which summarizes all possible quantities used during care and wholesale price quotes for each resource. Wholesale prices were collected for the most part from the three largest distributors of pharmaceuticals and medical supplies in Georgia. Additionally, the State Standards for the vaginal and CS were used to obtain information on test types and corresponding prices. The prices of drugs no longer available on the market were estimated based on information received from key informant interviews and recall from several private pharmacies. Test prices were established through the Key Informant Interviews.

Only wholesale unit prices from 2007 were used for analysis. This allowed the analysis to focus on changes in costs which are attributable to changes in resource use and medical practices, as opposed to changes in cost due to price fluctuations.

The lowest available wholesale price was used as the price for each item. The lowest price was chosen to avoid overestimation of cost savings. Facilities or patients may purchase resources from local pharmacies at prices higher than the lowest available wholesale price. The study describes overall changes in cost but does not identify or address payment sources.

Lastly, the calculated costs do not represent the full costs of caesarean-section and vaginal deliveries. The calculated costs are for specific practices and resources such as drugs, supplies and tests, which are hypothesized to be influenced by the implementation of the EPC interventions promoted by HWG. Differences in overhead were outside the scope of the study as the link between them and EPC interventions would be tenuous and difficult to prove at best.

Key Informant Interviews

Key informant interviews were conducted to expand on the record reviews and fill in any gaps related to costs of resources and provision of services. A total of seven senior OB-GYNs, seven midwives, seven neonatologists and six nurses at the two HWG pilot facilities were interviewed using a specially developed Key Informant Interview Guide (Appendix D). The key informants were asked to confirm the practices, drugs, and supplies identified during the medical record reviews. The interviews also addressed under-reporting, over-reporting, miss-reporting and findings that need further clarification. Test prices were collected based on information obtained from the state standards and facility internal standards provided by key informants. A list of the key informants interviewed can be found in Appendix E.

Data Processing and Analysis

A layout was created for data entry in Epi Info version 3.3.2. Two Georgian medical students with English language skills were trained on how to enter data into the Epi Info layout. The information from the 400 maternal records was translated into English, edited and then entered into the Epi Info database.

Due to time restrictions, it was only possible to double enter ten percent of the records into Epi Info. Twenty records from 2004 and twenty records from 2007 were randomly selected, double entered and then

compared with the original entries. No major errors were identified during the double data entry process. The data was then exported to Excel and cleaned. The final analysis was performed using SAS version 9.1.3.

The study sample included one delivery with twins (in Zestaponi maternity in 2004) and two deliveries that resulted in stillbirth (one from each facility in 2007). To calculate the average newborn costs per delivery, the total costs for both twins together was used in the numerator, though they were counted as one delivery in the denominator. Although the newborn costs for each stillbirth was $0.00, these deliveries were still included in the denominator for calculating the average newborn costs per delivery. The reason for this is that the study focused on costs per delivery, which includes both maternal and newborn cost components, and required a consistent denominator for each cost component. With regard to determining proportional changes in newborn medical practices, the twins were counted separately and the two stillbirths were excluded from the analyses because they did not require medical care.

Proc GLM was used to analyze the changes in cost. This SAS procedure fits general linear models using the method of least squares allowing for the performance of an unbalanced, 3-way ANOVA (analysis of variance). A final model was run with the three main factors (independent variables): EPC training, hospital, and delivery type, and all possible interactions: EPC training X hospital, EPC training X delivery type, hospital X delivery type, and EPC training X hospital X delivery type. This allows for the estimation of the lsmeans for all those partitions and to do multiple group comparisons with the benefit of Tukey-Kramer's Adjustment for Multiple Comparisons. This final model is a full model.

The costs of care provided were looked at in three ways: 1) all sampled deliveries (CS and VD combined); 2) sampled VD; and 3) sampled CS. The cost of resources such as pharmaceuticals, injection supplies, laboratory tests and exams, was calculated on a per delivery basis. The total care costs per delivery were analyzed to obtain the average (lsmean) of total care costs per delivery, and the averages were compared.

Results

Demographic Characteristics

All sampled patients were Georgian except for one Moldovan, two Russians and three patients with unknown ethnicity due to missing information. The majority of patients were between 20-24 years of age. The age range was from 14 to 45 years old. The majority of Zestaponi patients were living in a rural area for both time periods, while the majority of KOGH patients were living in an urban area for both time periods. More than half of all patients (both Zestaponi and KOGH) had a secondary education. The occurrence of higher education ranged from 22.0% for both 2004 and 2007 at KOGH to 27.0% and 31.0% for 2004 and 2007 at Zestaponi. Approximately 10.0% of patients had a secondary technical education for both facilities for both time periods. More than half of all patients at both facilities for both 2004 and 2007 were married and registered. Parity—the number of births per woman including stillbirths and current delivery, ranged from one to five with the majority of women in a total sample having a parity of one. The number of total abortions ranged from zero to eleven. The majority of women for both facilities for both years had no abortions. Please see Appendix F for a table with the specific demographic information of the sampled patients.

Practices

Types of Deliveries

The majority of births at both facilities, before and after EPC interventions, were vaginal deliveries. Table 3 presents the number of vaginal deliveries and caesarean sections in the sample before and after interventions by maternity hospitals and total. In both hospitals the number of c-sections was slightly higher in the 2007 sample.

Table 3. Number of Vaginal Deliveries and Caesarean Sections in the Sample by Maternity Hospital and Total Before and After EPC Intervention

TYPE OF DELIVERY	ZESTAPONI		KOGH		TOTAL	
	Before ('04)	After ('07)	Before ('04)	After ('07)	Before ('04)	After ('07)
	n=100	n=100	n=100	n=100	n=200	n=200
Vaginal	84	82	68	59	152	141
Caesarean Section	16	18	32	41	48	59

Occurrence of Key Procedures

Tables 4, 5 and 6 include information on the occurrence of key medical procedures performed before and after EPC interventions in each facility.

*Table 4. Distribution of Key Procedures for Vaginal Deliveries by Maternity Hospital and Total Before **

INTRA- AND POSTPARTUM PROCEDURES FOR VAGINAL DELIVERIES	ZESTAPONI		KOGH		TOTAL	
	Before ('04)	After ('07)	Before ('04)	After ('07)	Before ('04)	After ('07)
	n=84 %	n=82 %	n=68 %	n=59 %	n=152 %	n=141 %
Labor induction	0.00	2.44	1.47	0.00	0.66	1.42
Labor stimulation	78.57	10.98	45.59	8.47	**63.82**	**9.93**
Amniotomy	0.00	2.44	26.47	3.39	**11.84**	**2.84**
Partograph use	0.00	79.27	0.00	81.36	**0.00**	**80.14**
Active management of the 3rd stage of labor	0.00	100.00	0.00	100.00	**0.00**	**100.00**
Any episiorraphy performed**	86.90	25.61	75.00	28.81	**81.58**	**26.95**
To repair episiotomy	85.71	4.88	52.94	5.08	**71.05**	**4.96**
To repair tear	1.19	20.73	11.76	22.03	**5.92**	**21.28**
Received birth canal exam after VD	17.86	2.44	94.12	25.42	**51.97**	**12.06**
Received at least one anesthetic, analgesic, or spasmolytic drug during labor	8.33	0.00	76.47	6.78	**38.82**	**2.84**
Received at least one analgesic or spasmolytic drug during labor	8.33	0.00	76.47	6.78	**38.82**	**2.84**
Received at least one other drug during labor	91.67	3.66	77.94	5.08	**78.29**	**14.18**
Received at least one drug post-partum	29.76	13.41	95.59	84.75	**51.21**	**43.26**
Received at least one test during labor	0.00	10.98	100.00	88.14	44.74	43.26
Received at least one test post-partum	98.81	100.00	100.00	100.00	99.34	100.00

* Results presented in bold face in the columns for the combined sample are statistically significant ($p \leq 0.05$)
** Includes episiorraphies to repair episiotomies, tears and uterine revisions

Table 5. Distribution of Key Procedures for Caesarean Sections by Maternity Hospital and Total Before and After EPC Interventions

INTRA- AND POSTPARTUM PROCEDURES FOR CAESAREAN SECTIONS	ZESTAPONI		KOGH		TOTAL	
	Before ('04)	After ('07)	Before ('04)	After ('07)	Before ('04)	After ('07)
	n=17 %	n=18 %	n=32 %	n=41 %	n=48 %	n=59 %
Received at Least One Test Prior to CS	31.25	22.22	93.75	97.56	72.92	74.58
Received At Least One Drug Post-Partum	100.00	100.00	100.00	100.00	100.00	100.00
Received At Least One Test Post-Partum	100.00	100.00	93.75	95.12	95.83	96.61

Delivery and Postpartum Procedures

Labor Induction, Labor Stimulation and Use of the Partograph

HWG encouraged the use of WHO-developed partograph, or graphic depiction of the labor, which is used to assess the progress of the labor and to identify when intervention is necessary. Studies have shown that using the partograph is highly effective in preventing prolonged labor, C-section and labor stimulation.

Use of the partograph significantly increased from 0% in 2004 to 80.14% ($p<0.0001$) in 2007 for the combined hospital data (Table 4). No deliveries were being monitored with partograph at either facility in 2004, while in 2007, 79.27% and 81.36% of deliveries ($p<0.0001$) at the Zestaponi Maternity and KOGH respectively were tracked using this very effective tool.

The study also showed a dramatic overall decrease in labor stimulation from 63.82% in 2004 to 9.93% in 2007 ($p<0.0001$). In Zestaponi percentage of this procedure decreased from 78.57% to 10.98%, while in KOGH it decreased from 45.59% to 8.47% after EPC intervention ($p<0.001$) (Table 4).

Drugs Given During Labor and Postpartum

Table 4 shows a significant decrease in the number of women who received at least one anesthetic, analgesic, or spasmolytic drug during vaginal delivery at both maternities and in a combined sample (from 38.82% to 2.84%, $p<0.0001$). However, more dramatic decrease in anesthetic, analgesic, or spasmolytic drug use was observed at KOGH than at the Zestaponi Maternity Hospital. The use of any other drugs during vaginal delivery for the combined sample decreased from 85.53% to 4.26% ($p<0.0001$) after the intervention. For caesarean sections, all women (100%) at both facilities had general anesthesia (Table 5).

The use of drugs, such as analgesics, anti-anemia drugs, short-regimen antibiotics for prophylaxis after normal vaginal deliveries has also decreased (Table 4). At Zestaponi Maternity, for vaginal deliveries there was a decrease of post-partum drug use from 29.76% to 13.41% ($p<0.0001$), while at KOGH it decreased from 95.59% to 84.75% ($p<0.0001$). The use of drugs after vaginal delivery decreased from 59.21% to 43.26% ($p=0.0063$) for the combined sample. The occurrence of receiving at least one post-partum drug for caesarean sections has remained constant across the total sample with 100% of women receiving at least one drug (Table 5).

Tests Performed Before and During Labor and Postpartum

The number of women who received a test during vaginal delivery increased from 2004 to 2007 at the Zestaponi Maternity (from 0% to 10.98%, p<0.0001) and decreased at KOGH (100% to 88.14%, p<0.0001) (Table 4). The data for the combined sample showed a slight decrease in occurrence of tests during vaginal delivery from 44.74% to 43.26%, but the difference was statistically insignificant (p=0.7995).

The percentage of women who received a test prior to caesarean section at Zestaponi decreased from 31.25% in 2004 to 22.22% (p<0.0001) in 2007, while at KOGH the percentage slightly increased from 93.75% to 97.56% (p<0.0001) (Table 5). Although the findings for the combined sample showed a slight increase in the use of tests before c-section, the difference was statistically insignificant (p=0.8460).

The percentage of tests performed postpartum for vaginal deliveries remained relatively constant for both hospitals and across the combined sample. However, a slight increase was observed after c-section for Kotaisi Hospital (p=0.8460) and in the combined sample (p=0.8331). Though, these differences were statistically insignificant (Tables 4,5). The use of tests postpartum was observed in the overwhelming majority of cases regardless of delivery and hospital type before and after EPC intervention.

Amniotomy and Episiotomy

There was a dramatic decrease in the occurrence of amniotomies at KOGH between 2004 and 2007 (26.47% vs. 3.39% respectively, p<0.0001) (Table 4). In Zestaponi, the use of amniotomy was very limited both before and after interventions (only 2 cases in 2007 vs. 0 in 2004). Overall, for the combined sample, data showed a significant decrease in amniotomies from 11.84% to 2.84% (p=0.0035).

There was a significant decrease from 81.58% to 26.95% (p<0.0001) in the total number of vaginal deliveries which required episiorraphies to repair episiotomies and tears for the combined sample.

The occurrence of episiotomies reduced from 85.71% to 4.88% at Zestaponi and from 52.94% to 5.08% at KOGH (p<0.0001) resulting in overall reduction of episiotomies from 71.05% to 4.96% (p<0.0001) (Table 4). The overall occurrence of episioraphy for tears, however, significantly increased from 5.92% to 21.28% (p<0.0001). It rose from 1.19% to 20.73% (p<0.0001) in Zestaponi and from 11.76% to 22.03% (p<0.0001) in KOGH.

Active Management of the Third Stage of Labor and Excessive Bleeding Management

Active management of the third stage of labor (AMTSL) is a technique used for prevention of postpartum hemorrhage, which is one of the leading causes of maternal morbidity and mortality worldwide. AMTSL is defined by the following three elements: use of uterotonic drug within one minute of birth (preferrably oxytocin, 10 IU/IM), performance of controlled cord traction and uterine massage after the delivery of the placenta. Neither facility used the active management of the third stage of labor (AMTSL) technique during vaginal deliveries in 2004 (Table 4). The study findings show that AMTSL was used in 100% (p<0.0001) of vaginal deliveries at both facilities following the EPC interventions. AMTSL is not a technique applied during caesarean sections.

An opposite trend was observed in occurrence of excessive bleeding after vaginal deliveries at both facilities demonstrating the overall decrease from 5.92% to 1.42% (p=0.0428) (Table 4). In 2007, none of the women experienced bleeding complications after vaginal delivery at Zestaponi maternity. There was no

excessive bleeding observed after caesarean section in both years (Table 5).

Birth Canal Examination

Based on WHO recommendations, the EPC interventions discourage providers from routinely performing birth canal exams after normal deliveries. According to Table 4, the percentage of women who received birth canal exams after vaginal delivery significantly decreased from 51.97% to 12.06% ($p<0.0001$) across the combined sample. At Zestaponi, the percentage decreased from 17.86% to 2.44% ($p<0.0001$), while at KOGH, it decreased from 94.12% to 25.42% ($p<0.0001$).

Newborn Resuscitation

Newborn resuscitation serves as a health status indicator for neonates. The indication for newborn resuscitation is failure to establish spontaneous respiration in the first minute after birth. The frequency of newborn resuscitation has remained low at both maternities with a slight decrease from 2.49% in 2004 to 1.01% in 2007 for the combined facility sample (Table 6). Although this decrease is not statistically significant, it does reflect a positive trend. Both maternities reflected decreases in newborn resuscitation, which suggests that there have also been decreases in newborn asphyxia.

Newborns' Admission to the Intensive Care Unit (NICU)

The frequency of newborns' admission to the NICU nearly halved at both facilities: 5.05% versus 12.87% at Zestaponi and 4.04% versus 8.00% at KOGH (Table 6). The decrease from 10.45% to 4.55% for the combined sample was statistically significant ($p=0.0254$), although the difference is likely to be underestimated.

Table 6. Distribution of Key Procedures for ALL Newborns Delivered Before and After EPC Interventions by Maternity Hospital and Total *

KEY PROCEDURES	ZESTAPONI		KOGH		TOTAL	
	Before ('04)	After ('07)	Before ('04)	After ('07)	Before ('04)	After ('07)
	n=101** %	n=99*** %	n=100 %	n=99**** %	n=201 %	n=198 %
Infant subject to newborn resuscitation	2.97	1.01	2.00	1.01	2.49	1.01
Admitted for intensive monitoring	12.87	5.05	8.00	4.04	**10.45**	**4.55**
Immediate breastfeeding	0.00	94.95	52.00	93.94	**25.87**	**94.44**
Infant formula	0.00	0.00	0.00	1.00	0.00	0.50
Newborn received at least one drug before discharge	100.00	100.00	100.00	100.00	100.00	100.00
Newborn received at least one test before discharge	100.00	100.00	100.00	100.00	100.00	100.00

* *Results presented in bold face in the columns for the combined sample are statistically significant ($p\leq0.05$)*
** *N=101 due to one set of twins*
*** *N=99 due to presence of one stillbirth*
**** *Combined values take into account the two stillbirths and one set of twins*

Immediate Breastfeeding

The occurrence of immediate breastfeeding during the first two hours after birth increased from 2004 to 2007 across the combined sample from 25.87% to 94.44% ($p<0.0001$) (Table 6). A dramatic increase in immediate breastfeeding rate was observed at Zestaponi Maternity, where it rose from 0% to 94.95% ($p<0.0001$), while at KOGH it rose from 52% to 93.94% ($p<0.0001$). Immediate breastfeeding is part of the warm chain which is promoted by EPC.

Infant Formula Given to Infants Prior to Discharge

The data revealed the very limited use of infant formula at both facilities across time (Table 6). Overall, only one newborn was given formula in the entire sample. The limited use of formula was to be expected given the fact that MOLHSA guidelines do not recommend the widespread use of infant formula, unless it is medically indicated due to the particular conditions.

Drugs Given to Newborns Prior to Discharge

The number of newborns given at least one drug prior to discharge did not change at either facility. The entire sample of live-birth newborns were given at least one drug prior to discharge at both facilities in 2004 and 2007 (Table 6). However, according to the study data and the results of the key informant interviews, there is a substantial decrease in the number of drugs given to neonates that is attributed to EPC implementation.

Tests Performed on Newborns Prior to Discharge

The number of newborns who had at least one test administered prior to discharge did not change at either facility (Table 6). The entire sample of live-birth newborns had at least one test administered prior to discharge at both facilities in 2004 and 2007. Rh-typing and complete blood count are common tests routinely performed at Maternity Hospitals including the HWG sites as they are required by the state standards for maternity care.

Cost Impact

Impact of the EPC Interventions on Delivery Costs

While decreases in the use of drugs and unnecessary procedures and increases in the use of partographs and AMTSL improve the health outcomes of women and their newborns, they also affect the cost of care provision. The study findings showed that the changes in procedures have had a significant effect on the costs of delivery.

The results of statistical analysis (SAS Proc GLM procedure) allowed to determine the impact of the EPC trainings and subsequent intervention (before vs. after), delivery type (vaginal vs. caesarean), and hospital (Zestaponi vs. KOGH) on the costs of maternal and newborn drugs, supplies and tests per delivery. The effects of EPC training, delivery type, and hospital were each statistically significant ($p<0.0001$) on the total delivery cost.

Delivery Type and Cost

Delivery type had the great effect on cost. The average total costs of vaginal deliveries were consistently lower than c-sections. The average total cost for a caesarean section before EPC intervention ($47.11) was three times that of a vaginal delivery ($15.17) adjusted for hospital type ($p<0.0001$). Whereas, after intervention this difference in charges further increased up to four-fold ($37.89 vs $8.77, $p<0.0001$).

Costs per Hospital

Table 7 provides information on the average costs of deliveries at both maternities. The resources are broken down into maternal resources and newborn resources.

Hospital type also had an impact on the average total costs per delivery (Figure 2,3). In Kutaisi, the total delivery cost after EPC training ($28.41) was 23.8% lower than before EPC training ($37.29, $p<0.0001$). Whereas, in Zestaponi, the reduction reached up to 27.0% (from $24.98 to $18.24, $p<0.0001$).

Table 7. Average Total Costs per Delivery by Resource Type for Before and After EPC Interventions by Maternity Hospital and Total

RESOURCE TYPE	ZESTAPONI		KOGH		TOTAL*	
	Before ('04)	After ('07)	Before ('04)	After ('07)	Before ('04)	After ('07)
	n=100	n=100	n=100	n=100	n=200	n=200
MATERNAL RESOURCES						
Drugs	$9.58	$7.10	$17.84	$12.59	$13.71	$9.84
Supplies	$3.16	$2.27	$3.72	$4.04	$3.44	$3.16
Tests	$6.72	$6.01	$8.79	$6.74	$7.76	$6.38
Sub Total	**$19.46**	**$15.38**	**$30.35**	**$23.37**	**$24.91**	**$19.38**
NEWBORN RESOURCES						
Drugs	$3.27	$1.20	$1.66	$1.32	$2.47	$1.26
Supplies	$0.68	$0.40	$0.28	$0.19	$0.48	$0.30
Tests	$1.56	$1.26	$5.00	$3.52	$3.28	$2.39
Sub Total	**$5.52**	**$2.86**	**$6.94**	**$5.04**	**$6.23**	**$3.95**
TOTAL DELIVERY RESOURCES						
Drugs	$12.85	$8.30	$19.50	$13.91	$16.17	$11.11
Supplies	$3.85	$2.67	$4.00	$4.23	$3.92	$3.45
Tests	$8.29	$7.27	$13.79	$10.27	$11.14	$11.29
Total Cost	**$24.98**	**$18.24**	**$37.29**	**$28.41**	**$31.24**	**$23.33**

* Adjusted for the effects of delivery and hospital type

EPC Intervention and Cost

The EPC intervention had the greatest effect on delivery cost. Table 7 and Figure 1 show the average costs (in USD) per delivery for all the sampled deliveries (both vaginal and caesarean sections) for the first six months of 2004 and 2007. It can be seen that overall there was 25.32% decrease from $31.24 to $23.33 ($p<0.0001$) in the average total delivery cost after EPC interventions adjusted for delivery type and hospital. The break down of findings by recourse type shows that total cost of maternal recourses reduced from $24.91 to $19.38 (22% reduction, $p<0.0001$) and for newborn resources – from $6.23 to $3.95 (36.63 % reduction, $p<0.0001$).

Tables 8 and 9 present the average delivery costs (in USD) for vaginal deliveries before and after the EPC intervention adjusted for hospital type. For vaginal deliveries, total delivery cost was 42.20% lower after the EPC intervention ($p<0.0001$). More specifically, the total cost of a vaginal delivery has decreased from $15.17 to $8.77. Significant decreases were observed in drug (from $5.96 to $2.60, $p<0.0001$)) and supply (from $2.36 to $0.69%, $p<0.0001$) costs, whereas the cost reduction for tests was relatively lower (from $6.85 to $5.40, $p<0.0001$).

Table 8. Average Costs Per Vaginal Delivery by Resource Type Before and After EPC Interventions (USD)

RESOURCE TYPE	COST ($)		% CHANGE	P-VALUE
	Before ('04) n=100	After ('07) n=100		
MATERNAL RESOURCES				
Drug Costs	$3.54	$1.41	-60.21%	0.0036
Supply Costs	$2.04	$0.45	-78.16%	<0.0001
Tests and Exams	$3.67	$3.16	-13.92%	0.1281
Sub-Total	**$9.25**	**$5.02**	**-45.79%**	**<0.0001**
NEWBORN RESOURCES				
Drug Costs	$2.41	$1.19	-50.69%	<0.0001
Supply Costs	$0.32	$0.24	-24.62%	0.7515
Tests and Exams	$3.18	$2.32	-27.09%	<0.0001
Sub-Total	**$5.91**	**$3.75**	**-36.59%**	**<0.0001**
TOTAL DELIVERY RESOURCES				
Drug Costs	$5.96	$2.60	-56.35%	<0.0001
Supply Costs	$2.36	$0.69	-70.87%	<0.0001
Tests and Exams	$6.85	$5.4	-20.03%	<0.0001
Total Cost	**$15.17**	**$8.77**	**-42.20%**	**<0.0001**

The total average charges for caesarean section were 19.6% (p<0.0001) lower after the intervention adjusted for hospital type (from $47.11 in 2004 to $37.89 in 2007) (Table 10). Increase in total supply cost for caesarean section was statistically insignificant (p=0.1247).

Table 9. Average Costs of Drugs and Supplies per Vaginal Delivery Before and After EPC Interventions by Maternity Hospital and Total (USD)

VD RESOURCE TYPE	ZESTAPONI		KOGH		TOTAL	
	Before ('04)	After ('07)	Before ('04)	After ('07)	Before ('04)	After ('07)
	n=100	n=100	n=100	n=100	n=200	n=200
MATERNAL RESOURCES						
Drugs	$2.68	$0.93	$4.40	$1.89	$3.54	$1.41
Supplies	$1.79	$0.40	$2.28	$0.49	$2.04	$0.45
Sub Total	**$4.48**	**$1.33**	**$6.68**	**$2.38**	**$5.58**	**$1.86**
NEWBORN RESOURCES						
Drugs	$2.91	$1.12	$1.92	$1.26	$2.41	$1.19
Supplies	$0.34	$0.33	$0.30	$0.15	$0.32	$0.24
Sub Total	**$3.25**	**$1.45**	**$2.22**	**$1.41**	**$2.74**	**$1.43**
TOTAL DELIVERY RESOURCES						
Drugs	$5.59	$2.05	$6.32	$3.16	$5.96	$2.60
Supplies	$2.13	$0.74	$2.59	$0.64	$2.36	$0.69
Total Cost	**$7.73**	**$2.78**	**$8.91**	**$3.79**	**$8.32**	**$3.29**

Table 10. Average Costs Per Caesarean Section by Resource Type Before and After EPC Interventions (USD)

RESOURCE TYPE	COST ($)		% CHANGE	P-VALUE
	Before ('04)	After ('07)		
	n=100	n=100		
MATERNAL COSTS				
Drug Costs	$23.87	$18.28	-23.42%	<0.0001
Supply Costs	$4.84	$5.86	21.09%	0.0028
Tests and Exams	$11.84	$9.59	-19.02%	<0.0001
Sub-Total	**$40.56**	**$33.74**	**-16.82%**	**<0.0001**
NEWBORN COSTS				
Drug Costs	$2.52	$1.33	-47.11%	<0.0001
Supply Costs	$0.64	$0.35	-44.89%	0.1690
Tests and Exams	$3.39	$2.46	-27.31%	0.0004
Sub-Total	**$6.55**	**$4.15**	**-36.65%**	**<0.0001**
TOTAL DELIVERY RESOURCES				
Drug Costs	$26.39	$19.61	-25.69%	<0.0001
Supply Costs	$5.49	$6.22	13.37%	0.1247
Tests and Exams	$15.23	$12.05	-20.86%	<0.0001
Total Cost	**$47.11**	**$37.89**	**-19.58%**	**<0.0001**

Cost Impact in Actual Terms

Table 11 includes information about the estimated annual costs of delivery before and after EPC interventions. The estimates are based on the actual number of patients for both years (2004 and 2007), the occurrence of each type of delivery for 2004 or 2007, and the average cost per patient per year. This information allows us to estimate the cost of deliveries in 2007 if the facilities had not applied the EPC intervention, as well as to estimate the cost impact due to the changes in practices. Both maternities saved money through changes in practices between 2004 and 2007.

Table 11. Estimated Annual Costs Before and After EPC Interventions (USD)

COSTS	BEFORE EPC (2004)			AFTER EPC (2007)			COST IMPACT IN USD
	# OF CASES PER YEAR	PER DELIVERY COST* IN USD (N)	TOTAL ANNUAL COST IN USD (N)	ESTIMATED # OF CASES PER YEAR	PER DELIVERY COST IN USD (N)	TOTAL ANNUAL COST IN USD (N)	
zestafoni							
Maternal Care	738	$19.46 (100)	--	718	$15.38 (100)	--	
VD	624	$6.97 (84)	$4,349.28	609	$4.67 (82)	$2,844.03	
CS	114	$31.95 (16)	$3,642.30	109	$26.09 (18)	$2,843.81	
Newborn Care	738	$5.52 (100)	--	718	$2.86 (100)	--	
VD	624	$4.54 (84)	$2,832.96	609	$2.73 (82)	$1,662.57	
CS	114	$6.50 (16)	$741.00	109	$2.99 (18)	$325.91	
Total	--	--	**$11,565.54**	--	--	**$7,676.32**	
Estimated costs in 2007 if following 2004 procedures						**$11,200.64**	**-$3,524.32**
KOGH							
Maternal Care	785	$30.35 (100)	--	1038	$23.37 (100)	--	
VD	483	$11.54 (68)	$5,573.82	659	$5.36 (59)	$3,532.24	
CS	302	$49.17 (32)	$14,848.34	379	$41.39 (41)	$15,686.81	
Newborn Care	785	$6.94 (100)	--	1038	$5.04 (100)	--	
VD	483	$7.28 (68)	$3,516.24	659	$4.77 (59)	$3,143.43	
CS	302	$6.60 (32)	$1,993.20	379	$5.31 (41)	$2,012.49	
Total	--	--	**$25,931.60**	--	--	**$24,374.97**	
Estimated costs in 2007 if following 2004 procedures						**$33, 539.21**	**-$9,164.24**
Combined**							
Maternal Care	761.5	$24.91 (200)	--	878	$19.38 (200)	--	
VD	553.5	$9.25 (152)	$5,119.88	634	$5.02 (141)	$3,182.68	
CS	208	$40.56 (48)	$8,436.48	244	$33.74 (59)	$8,232.54	
Newborn Care	761.5	$6.23 (200)	--	878	$3.95 (200)	--	
VD	553.5	$5.91 (152)	$3,271.19	634	$3.75 (141)	$2,377.50	
CS	208	$6.55 (48)	$1,362.40	244	$4.15 (59)	$1,012.60	
Total	--	--	**$18,189.95**	--	--	**$14,805.32**	
Estimated costs in 2007 if following 2004 procedures						**$21,106.28**	**-$6,300.96**

* Based on costs calculated from sample

** The number of cases per year is an average of the number of cases per year seen by Zestaponi and KOGH for each time period. The per patient costs are the average total costs for both facilities combined

Drivers of Cost Change

Figure 1 presents information on the percent changes in the average delivery costs from the before and after time periods. Overall, remarkable (31.33%, p<0.0001) reductions in drug costs drove the total costs savings. Significant reductions were also seen in tests costs for the combined sample (20.60%, p<0.0001), while the reduction in overall supply costs was relatively moderate (11.97%, p=0.0146).

For Zestaponi, the main cost savings were achieved by significant reductions in drug (35.39%, p<0.0001) and supply (30.53%, p=0.0007) costs. For KOGH, significant reductions were seen in drug (28.66%, p<0.0001) and test costs (25.58%, p<0.0001). The costs of supplies rose at KOGH from $4.00 to $4.23 but this change is statistically insignificant (p=0.7524).

For vaginal deliveries, average total cost was 42.20% lower after the EPC intervention (p<0.0001) adjusted for hospital type (Figure 2). Significant decreases were observed in drug (56.35%, p<0.0001)) and supply (70.87%, p<0.0001) costs (Figure 3). Zestaponi saw a 64.01% reduction (p<0.0001) in the average cost of drugs and supplies for vaginal deliveries. In KOGH the average cost of drugs and supplies for vaginal deliveries was 57.40% (p<0.0001) lower after EPC (Figure 4). 22.13% increase in test cost for vaginal delivery in Zestaponi was statistically insignificant (p=0.2487).

Figure 1. Percent Changes in Average Cost of Care after EPC Interventions

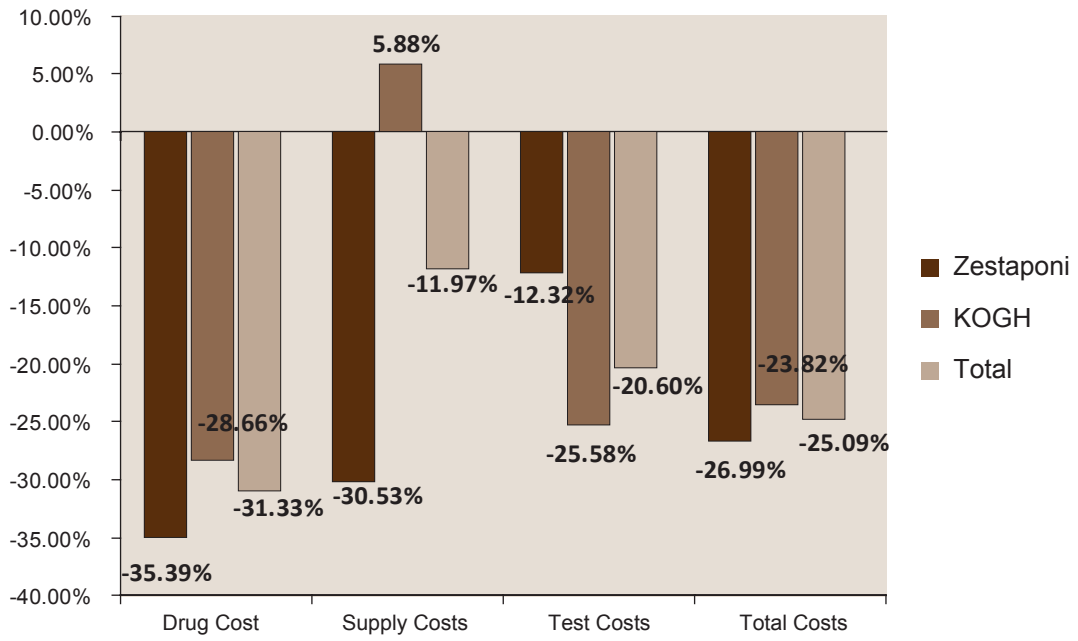


Figure 2. Percent Changes in Cost of Care for Vaginal Deliveries after EPC Interventions

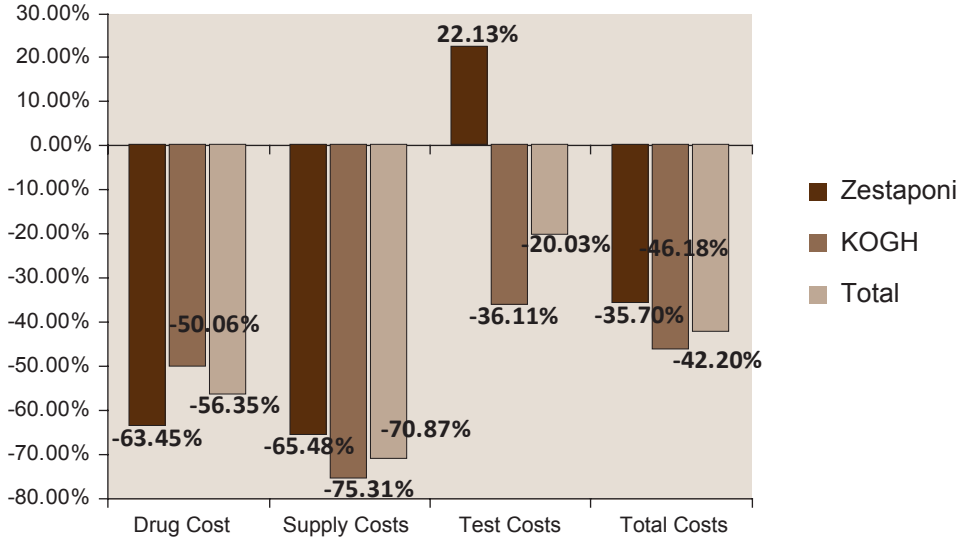
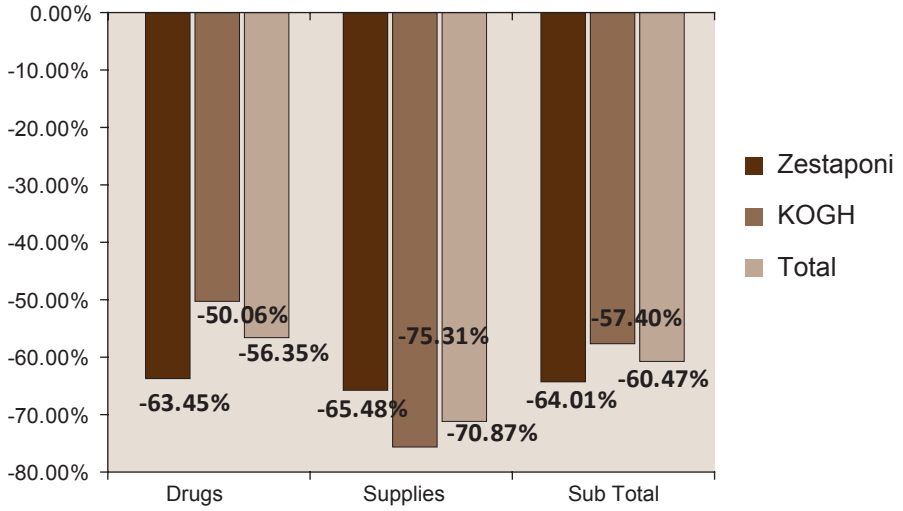


Figure 3. Percent Changes in Cost of Drugs and Supplies for Vaginal Deliveries after EPC Interventions



Discussion

The findings of the current study demonstrate that application of new technologies, ideas, and evidence-based practices, such as those found in the EPC interventions package, can result in the de-medicalization of deliveries and reductions in delivery costs. This report presents information, which demonstrates that both Zestaponi and KOGH made changes to their practices after EPC interventions that also affected costs.

Based on the significant reductions in labor stimulation, drug use, amniotomy, episioraphies, routine birth canal examinations after labor, and excessive bleeding, it is clear that these maternities have improved the care provided to women and newborns.

Before HWG interventions, episiotomies were a standard part of the birth practice and believed to prevent perineal damage and its sequelae, pelvic floor relaxation and its sequelae, and protect the newborn from either intracranial hemorrhage or intrapartum asphyxia. The EPC interventions encourage the restriction of liberal episiotomies and amniotomies to very specific situations when they are medically indicated. Less posterior perineal trauma, less suturing and fewer complications are the benefits of restrictive episiotomy policies clearly demonstrated by the randomized controlled trials. The episiotomy studies have failed to accomplish any of the above mentioned and traditionally ascribed maternal and fetal benefits. These studies have also shown that restrictive use of episiotomies may increase the risk of anterior perineal trauma. The increase in tear repairs in Zestaponi and Kutaisi maternities could be explained by the restrictive use of epsiotomy at both facilities. However, none of these were third- and forth-degree lacerations and were less severe, requiring less suturing than during episiotomy.

Significant increases in partograph use and active management of the third stage of labor also indicate improved care. As a result of partograph use, both maternities saw a dramatic reduction in occurrence of labor stimulation (from 63.82% in 2004 to 9.93% in 2007, $p<0.0001$). Similarly, the routine use of AMTSL (100% ($p<0.0001$) after EPC intervention resulted in the overall decrease of postpartum hemorrhage from 5.92% to 1.42% ($p=0.0428$).

A decrease in the number of drugs given to women both during vaginal delivery and postpartum period (anesthetic, analgesic, or spasmolytic, antibiotics, etc.) was observed at both maternities (from 38.82% to 2.84% on average, $p<0.0001$). This finding supports the underlying assumption of EPC intervention that over-prescription of drugs to stimulate labor and reduce pain can be avoided by allowing the mother to move around, have a companion present during labor and using other non-traditional pain relieve techniques.

The study findings regarding the tests use both during the labor and post-partum are controversial and mostly statistically insignificant. HIV testing was added to the State Standards for maternity care in 2007,

while in 2004, no HIV testing occurred in the maternities. This may explain increase in the percentage of tests over time at both hospitals either during vaginal delivery or c-section. Another explanation for increase in test use could be linked to inaccurate recording or keeping of test results in the medical records in maternities resulting in data missing, particularly before EPC interventions. Although HIV testing as a potential confounder was excluded from cost impact analysis, the findings related to the tests cost are still questionable and need further investigation.

The study also found positive trends in reducing the number of newborns who were admitted for intensive monitoring (10.45% in 2004 vs 4.55% in 2007, p=0.0254). The decreased need for newborns' intensive monitoring shows improvement in birth practices and care approaches. The EPC interventions such as partograph use, reductions in drug use and warm chain practices to prevent newborn hypothermia all contribute to the health of the newborn. The overall occurrence of immediate breastfeeding during the first two hours after birth dramatically increased from 25.87% in 2004 to 94.44% in 2007 (p<0.0001).

The changes in delivery practices resulted in a reduction in costs for both facilities. Adjusted for effects of hospital and delivery type, the average overall delivery cost after EPC was 25% (p<0.0001) lower than before. In Kutaisi, the average overall delivery cost after EPC training was 23.8% (p<0.0001) lower, and in Zestaponi, the reduction reached up to 27.0% (p<0.0001). The average total cost of vaginal deliveries reduced by 42% (p<0.0001), while the total average charges for c-section were 19.6% (p<0.0001) lower after EPC intervention. The average total cost for a caesarean section before EPC intervention was three times that of vaginal delivery adjusted for hospital (p<0.0001), whereas, after intervention this difference in charges even increased up to four-fold (p<0.0001).

Of all the changes made, the reduction in drug costs is the biggest driver of total reduction in cost of delivery and accounts for 31% of the overall cost reductions. For vaginal deliveries, overall, there was 56% (p<0.0001) reduction in drug costs and 71% (p<0.0001) reduction in supply costs. Zestaponi saw 64% (p<0.0001) reduction and Kutaisi - 57% (p<0.0001) reduction in the average cost of drugs and supplies for vaginal deliveries. It is estimated that Zestaponi saved approximately $3 524.32 and KOGH saved approximately $9 164.24 in 2007 by making changes to their delivery procedures. Overall, an estimated average cost saving amounts to $6 300.96. Given the fact that for cost calculation and analysis we used the lowest available wholesale prices, actual cost savings could be even larger.

Lastly, the calculated costs do not represent the full costs of caesarean-section and vaginal deliveries. The calculated costs are for specific practices and resources such as drugs, supplies and tests, which are hypothesized to be influenced by the implementation of the EPC interventions promoted by HWG. Differences in overhead were outside the scope of the study as the link between them and EPC interventions would be tenuous and difficult to prove at best.

Recommendations

Although the facilities have made many impressive changes which have resulted in costs savings, it is still possible to make further improvements.

The facilities could further increase their use of the partograph as this technique was used in only 80% of the vaginal deliveries. Other data of the HWG project shows that partograph use has been increasing steadily since the start of the intervention. It is necessary to continue this trend as this evidence-based practice helps to reduce the need for medical interventions and is cost effective. By increasing the application of this practice it is possible to identify and treat problems more quickly and effectively, which ultimately impacts cost.

Both facilities saw an increase in the number of caesarean sections between 2004 and 2007. Initially, HWG project data showed a decrease in caesarean sections, but this trend did not continue.[4] By the time of data collection, the number of caesarean sections had increased to above the 2004 levels. It would be useful to conduct a detailed qualitative study to understand why this increase occurred and what can be done to help maternities reduce the number of caesarean sections performed. The overall risks of cesarean section outweigh the benefits, thus reducing the rate of caesarean sections would be beneficial to mothers' health. Besides, it would further bring down delivery cost in Georgia. When the HWG's sister project in Ukraine conducted its cost impact study, it found reductions in cost of 80%, 67% and 25% at the three facilities surveyed.[5] The two facilities with the greatest decreases in cost also saw dramatic decreases in caesarean sections.

It will be also useful to further explore newborns' admission for intensive monitoring, including criteria for admission. More in depth analyses of the referral process to NICU, which was outside of the scope of this study, will be needed to better understand this process.

This study revealed the need for improvements in documentation of procedures in medical records as well as the way they are stored and maintained. Introduction of standardized medical records and reporting forms will contribute to improved perinatal health information system.

There are many other facilities within Georgia which stand to benefit from implementing similar practices and Georgia as a whole can benefit from both improved health and reduced medical costs.

4 HWG Safe Delivery Newsletters and program progress reports

5 Lefevre-Cholay, H., Alaoui, I., Lamstein, S., & Galayda, V. (2006). Exploring the Cost Impact of MIHP Interventions: JSI.

High-technology interventions and over-medicalization of low-risk deliveries have to be further discouraged. Such interventions involving expenditure of considerable resources, but which are of little benefit, reduce the amount of resources available for other activities that from a public health viewpoint, is the equivalent of doing harm.

There is a need to further develop and sustain the achievement already made in evidence-based EPC and expand quality improvement mechanisms which are vital to ensure the provision of quality services.

Knowing the impact of the EPC interventions on cost helps HWG to inform Georgian policymakers and public and private health care providers about the potential gains to be made in maternal and child health, of women outcomes, and in the potential savings accrued from providing better services. Study provides evidence that investments in modernizing delivery care are cost efficient leading to better maternal and newborn health outcomes and cost-savings in delivering services.

Appendix A

Patient Medical Review Form

Team Leader Signature: _____

Patient Medical Record Review Form for EPCCIS

Record abstraction is to be completed by a clinician who has agreed to cooperate with this project, has received training and signed a confidentiality agreement.

A total of 200 cases will be reviewed per site: 100 cases from the first six months of 2004 and 100 cases from the first six months of 2007. The records reviewed must be those records which are indicated and no others.

Information must be abstracted from the medical records in a uniform manner and written on the form in a way that it will be easily read by the data enterers.

If you have any question during the abstraction process, please telephone Eka Pestvenidze at …

General

a. Patient case history No. ☐☐☐☐☐

b. Hospital ☐ Zestaponi ☐ Kutaisi Obstetric Gynecological Hospital

c. Name of the person abstracting record: _____

General Characteristics of Mother

d. Date of birth (day/ month /year): ___/_____/____

e. Residence: _____ ☐ urban ☐ rural

f. Education level: ☐ secondary ☐ secondary technical ☐ higher

g. Marital status: ☐ married (registered) ☐ married (unregistered) ☐ single

h. Ethnicity: _____

i. Parity (including stillbirths and current delivery): ☐☐

j. Number of medical abortions (excluding natural abortions or miscarriages): ☐☐

Delivery

k. Date of admission for last hospitalization (day/month/year): ____ /_____/____

l. Date of delivery (day/month/year): ____ /_____/____

m. Date of mother's discharge (day/month/year): ____ /_____/____

n. Birth type:

- ☐ Live birth
- ☐ Still birth

o. Was delivery vaginal or by C–section? *(please check by* X *appropriate option)*

- ☐ Delivery by C–section
- ☐ Vaginal delivery

Vaginal Delivery (Labor)

1. Was labor **induced**? *(please check by X appropriate option)*

   - ☐ No, labor was not induced (skip to question No. 3)
   - ☐ Yes, labor was induced

2. If yes, indicate the drug(s) and the quantity used for labor induction:

Drug used for labor induction	Dosage	No. of units used
1. Oxytocine	5 IU – 1ml	
2. Enzoprost	5mg	
3. NaCl	0.9%-500 ml	
4.		

3. Was labor **stimulated**?

   - ☐ No, labor was not stimulated (skip to question No 5)
   - ☐ Yes, labor was stimulated

4. If yes, please indicate the drug(s) and the quantity used for labor stimulation:

Drug used for labor stimulation	Dosage	No. of units used
1. Oxytocine	5 IU – 1ml	
2. Enzoprost	5mg	
3. NaCl	0.9%-500 ml	
4.		

5. Was the partograph used?

   - ☐ No, partograph was not used

☐ Yes, partograph was used

6. Did the patient receive any **pain relief** and/or **anesthetic** and/or **spasmolytic** during labor?

☐ No, the patient did not receive any of the above pharmaceutical group (skip to question 8)
☐ Yes, the patient did receive some of the above pharmaceutical group

7. If yes, indicate the type and quantity of the medicine administered:

Medicine	Dosage	No. of units used
1. No–spa	2 ml	
2. Platyphyllini hydrotartratis	0.2% – 1 ml	
3. Papaverini	2.0% – 2 ml	
4. Analgin	50% – 2 ml	
5. Atropin	0.1% – 1 ml	
6. Phenthanyli	0.005% – 2 ml	
7. Promedol	2% – 1 ml	
8.		
9.		
10.		

8. Did patient receive any **other** drugs and /or fluid during labor?

☐ No, the patient did not receive any other drug or fluid (skip to question 10)
☐ Yes, the patient did receive some other drugs and /or fluids

9. If yes, indicate what other drugs and /or fluids the patient received during labor (**please do not include here drugs used for labor induction, labor stimulation or active management of the 3rd stage!**) and the quantity used:

Drug/fluid used during labor	Dosage	No. of units used
1. NaCl	0.9% – 500 ml	
2. NaCl	10% – 200 ml	
3. Refortan	6% – 500 ml	
4. Reopolyglucin	400 ml	
5. Dipyridamol (Kurantil)	0,5%- 2 ml	
6.		
7.		
8.		

10. Were there any tests performed during labor?

☐ No tests were performed during labor (skip to question 12)
☐ Yes, a (range of) test(s) was performed during labor.

11. If yes, indicate test(s) performed during labor:

Test performed during labor	Times
1. General Blood test	
2. General Urine test	
3. Coagulogram	
4. Biochemical blood test	
5.	
6.	

12. Was amniotomy performed?

- ☐ No, amniotomy was not performed
- ☐ Yes, amniotomy was performed

13. Was episiotomy performed?

- ☐ No, episiotomy was not performed (skip to question 19)
- ☐ Yes, episiotomy was performed

14. Was anesthesia used for episiorrhaphy?

- ☐ No, anesthesia was not used (skip to question 19)
- ☐ Yes, anesthesia was used

15. What type of anesthesia was used for episiorrhaphy?

- ☐ Local anesthesia was used
- ☐ General anesthesia was used (skip to question 17)

16. If local anesthesia was used, indicate the type, dose and quantity of **local** anesthetic used: (skip to 18)

Local anesthetic used for episiorrhaphy	Dosage	No. of units used
1. Lidocaine	10%- 2 ml	
2. Lidocaine	2%- 2 ml	
3. Novocaine	0.5%- 5ml	
4.		
5.		

17. If general anesthesia was used, indicate the type and quantity of **general** anesthetic used:

General anesthetic used for episiorrhaphy	Dosage	No. of units used
1. Thiopental–natrium	1 gr	

2. Droperidol	0.25% – 5 ml	
3. Sibazon	0.5% – 2 ml	
4. Propofol (recofol, diprivan)	1%- 20 ml	
5. Promedol	2% - 1ml	
6.		

18. Was episiorrhaphy the **only** indication for the general anesthesia (GA)?

- ☐ No, episiorrhaphy was NOT the only indication for the GA
- ☐ Yes, episiorrhaphy was the only indication for GA

19. Was the 3rd stage actively managed?

- ☐ No, 3rd stage was not actively managed (skip to question 21)
- ☐ Yes, 3rd stage was actively managed

20. If yes, indicate drug(s) used for active management of 3rd stage and the quantity used:

Drug used for the active management of the 3rd stage	Dosage	No. of units used
1. Oxytocine	5 IU – 1 ml	
2.		

21. Was an instrumental examination of the birth canal performed?

- ☐ No, the examination was not performed
- ☐ Yes, the examination was performed

22. Was **excessive bleeding** observed within 2hrs after vaginal delivery or C-section?

- ☐ No, excessive bleeding was not observed (skip to question 24)
- ☐ Yes, excessive bleeding was observed

23. If yes, indicate the type and quantity of drugs and/or fluids received:

Drug/fluids Used During Labor	Dosage	No. of units used
1. NaCl	0.9% – 500 ml	
2. NaCl	10% – 200 ml	
3. Refortan	6% – 500 ml	
4. Glucose	5% – 500 ml	
5. Reopolyglucin	400 ml	
6. Methylergometrin	0.02% – 1 ml	
7. Oxytocine	5 IU – 1 ml	
8. Ringer	500 ml	
9.		
10.		

C-section

24. Were there any lab tests and/or examinations performed prior to the C-section?

    ☐ No lab tests and/or examinations were performed (skip to question No 26)
    ☐ Yes, some tests and/or examinations were performed prior to the C-section

25. Indicate test(s) and/or examination(s) that were performed prior to the C-section and the number of times they were performed:

Test performed during labor	Times
1. General Blood test	
2. General Urine test	
3. Coagulogram	
4. Biochemical blood test	
5. Vaginal discharge test	
6. Blood group&Rh typing	
7. Hematocrit	
8. HIV test	
9. Wassermann test - serology	
10.	

26. What type of anesthesia was used for the C-section?

    ☐ Epidural anesthesia
    ☐ General anesthesia

27. Indicate the type, dosage and quantity of drug(s) used for the anesthesia (epidural or general):

Medicine names	Dosage	No. of units used
1. Atropin	0.1% – 1 ml	
2. Phenthanyli	0.005% – 2 ml	
3. Promedol	2% – 1 ml	
4. Thiopental–natrium	1 gr	
5. Droperidol	0.25% – 5 ml	
6. Sibazon	0.5% – 2 ml	
7. Pipecuronium	4 mg	
8. Naloxone	0.04%- 1ml	
9. Lidocaine	10%- 2ml	
10. Lidocain	2%- 2ml	
11. Bupivacaini		
12. Ketamin		
13. Morphin	1% – 1ml	
14. Listenon		
15.		
16.		
17.		

Postpartum

28. What lab test(s) and/or other examination(s) was the mother subject to in the postpartum period regardless after vaginal delivery or C-section and how many times was each test performed?

Tests performed postpartum	Times
1. General Blood test	
2. General Urine test	
3. Coagulogram	
4. Vaginal discharge test	
5. Ultrasound check	
6. Blood group &Rh typing	
7. Glucose	
8.	
9.	

29. Indicate the drug(s) and/or fluid(s) administered to the mother after vaginal delivery or C-section and the quantity used:

Drug/Fluid	Dosage	No. of units used
1. Ampicillin	0,5 g	
2. Ampiox	0,5 g	
3. Analgin	50% - 2ml	
4. Augmentin	1g	
5. Atropin	0,1% – 1ml	
6. Bifidumbacterinum	5 doses	
7. Ca Gluconat	10% – 10 ml	
8. Cefazolin	1 g	
9. Cefamizin	1 g	
10. Ceftriaxon	1g	
11. Cerucal	0,5% – 2 ml	
12. Dicinon	12,5% – 2 ml	
13. Dimedrol	1% – 1ml	
14. Dopminum	0,5% – 5 ml	
15. Dophaminum	4% – 5 ml	
16. Droperidol	0.25% -5 ml	
17. Ethyl alcohol	70%	
18. Ethyl alcohol	96%	
19. Euphylline	2,4% – 10 ml	
20. Fortum	1 g	
21. Gentamicin	4% – 2 ml – 80 mg	

Drug/Fluid	Dosage	No. of units used
22. Glucose 10%	10% – 500 ml	
23. Glucose 40%	40% – 10 ml	
24. Glucose 5%	5% – 500 ml	
25. Kalipsol	10 gr	
26. KCl	15% – 10 ml	
27. KCl	4%- 200 ml	
28. Klaforan	1 g	
29. Lactobacterin	5 doses	
30. Lasix	2 ml – 20 mg	
31. Lorexon	1g	
32. Methylergometrin	0.02% -1 ml	
33. Morphin	1% – 1ml	
34. NaCl	0,9% -500 ml	
35. NaCl	10%- 200 ml	
36. No–spa	2ml	
37. Oxacillin	0,5 g	
38. Oxybutirat	20% – 10 ml	
39. Oxytocine	5 IU - 1 ml –	
40. Papaverin	2% – 2 ml	
41. Paracetamol	250 mg	
42. Paracetamol	500 mg	
43. Penicillin	1.000.000 IU	
44. Penicillin	500.000 IU	
45. Permanganat K	6% – 30 ml	
46. Phenobarbital	0,1 g	
47. Pipolphen	2,5% – 2 ml	
48. Polyglucin	400 ml	
49. Prednisolon	1 ml – 30 mg	
50. Promedol	2% – 1 ml	
51. Proserinum	0.05% 1 ml	
52. Relanium	0,5% – 2 ml	
53. Ringer	500 ml	
54. Reopolyglucin	400 ml	
55. Sibazon	0.5% –2 ml	
56. Sulfacylum–natrium 5ml	30% – 5 ml	
57. Sulfat Mg	25% – 5 ml	
58. Tetraciclin Cream	1% – 5 g	
59. Vicasol	1% – 1 ml	
60. Vitamin C	5% – 1 ml	
61.		
62.		
63.		

END MOTHER RECORD REVIEW

Newborn Care

30. What type of cord care did the baby receive?

Type of cord care	*Please check (* **"✓"**) (check all that apply)
1. Brilliant green	
2. Potassium Iodine	
3. $KMnO_4$	
4. H_2O_2	
5. Bandage	
6. Open and dry	
7.	

31. Was the baby subject to newborn resuscitation?

- ☐ No, the baby was not subject to the newborn resuscitation
- ☐ Yes, the baby was subject to the newborn resuscitation

32. Was the baby admitted in the neonatal intensive care unit?

- ☐ No, the baby was not admitted to the newborn department
- ☐ Yes, the baby was admitted to the newborn department

33. Was the baby immediately breastfed?

- ☐ No, baby was not immediately breastfed
- ☐ Yes, baby was immediately breastfed

34. Was the baby given any infant formula?

- ☐ No, baby was not given any infant formula (skip to question 36)
- ☐ Yes, baby was given an infant formula

35. If yes, indicate the type(s), quantities and duration of formula feeding:

Infant Formula	Whole volume (ml) given	No. of days fed with IF
1. Malyutka		
2. Detolact		
3.		
4.		

36. Were any drugs administered to the baby in the newborn department before discharge?

- ☐ No drugs were administered to the baby (skip to question 38)
- ☐ Yes, a (range of) drug(s) was administered to the baby

37. Indicate the drug(s) and/or fluid(s) the baby was administered in the newborn department and the quantity used:

Drug/fluid	Dosage	No. of units used
1. Ampicillin	0,5 g	
2. Ampiox	0,5 g	
3. ATF	1ml	
4. Atropin	0,1% – 1ml	
5. Bifidumbacterinum	5 doses	
6. Ca Gluconat	10% – 10 ml	
7. Cefazolin	1 g	
8. Cefamizin	1 g	
9. Cerucal	0,5% – 2 ml	
10. Dicinon	12,5% – 2 ml	
11. Dimedrol	1% – 1ml	
12. Dopminum	0,5% – 5 ml	
13. Dophaminum	4% – 5 ml	
14. Droperidol	0.25%- 5 ml	
15. Ethyl alcohol	70%	
16. Ethyl alcohol	96%	
17. Euphylline	2,4% – 10 ml	
18. Fortum	1 g	
19. Gentamicin	4% – 2 ml – 80 mg	
20. Glucose 10%	10% – 500 ml	
21. Glucose 40%	40% – 10 ml	
22. Glucose 5%	5% – 500 ml	
23. Kalipsol	10 gr	
24. KCl	15% – 10 ml	
25. KCl	4%- 200 ml	
26. Klaforan	1 g	
27. Lactobacterin	5 doses	
28. Lasix	2 ml – 20 mg	
29. Morphin	1% – 1ml	
30. NaCl	0,9% – 500 ml	
31. No–spa	2ml	
32. Oxacillin	0,5 g	
33. Oxybutirat	20% – 10 ml	
34. Papaverin	2% – 2 ml	

Drug/fluid	Dosage	No. of units used
35. Paracetamol	250 mg	
36. Paracetamol	500 mg	
37. Penicillin	1.000.000 IU	
38. Penicillin	500.000 IU	
39. Permanganat K	6% – 30 ml	
40. Phenobarbital	0,1 g	
41. Pipolphen	2,5% – 2ml	
42. Polyglucin	400 ml	
43. Prednisolon	1ml – 30 mg	
44. Promedol	2% – 1ml	
45. Relanium	0,5% – 2 ml	
46. Reopolyglucin	400 ml	
47. Sibazon	0.5% –2 ml	
48. Sulfacylum–natrium 5ml	30% – 5 ml	
49. Sulfat Mg	25% – 5 ml	
50. Tetraciclin cream	1% – 5 g	
51. Vicasol	1% – 1 ml	
52. Vitamin C	5% – 1 ml	
53.		
54.		
55.		
56.		

38. Was the baby subject to any tests and/ or examinations in the newborn department before discharge?

☐ No, the baby was not subject to any test or examination before the discharge (end)
☐ Yes, the baby was subject to a (range of) test(s) and/or examination(s)

39. Indicate test(s), examination(s) and/or vaccines the baby was subject to in the newborn department before the discharge and the number of times the test, examination or vaccine was performed:

Test/examination/vaccine	Times performed
1. Blood analysis clinical	
2. Blood analysis biochemical	
3. Blood bacteriological analysis	
4. Blood group and Rh typing	
5. Blood glucose	
6. Blood bilirubine	
7. Urine analysis routine	
8. Urine protein	

Test/examination/vaccine	Times performed
9. Urine analysis Nechiporenko	
10. Hypothyreosis	
11. Hepatitis B	
12. BCG	
13.	

END NEONATAL RECORD REVIEW

Abstracter's comments:

Appendix B

Pricing with Assumptions for Injection Supplies

Drugs/Tests	Supplies needed	Price/drug /unit ($)	Price Source	Price Source Date	Price/ supply/unit ($)	Price Source	Price Source Date	Price/ test ($)	Price Source	Price Source Date
Vaginal Delivery (Labor)										
Labor Induction										
Oxytocine 5 IU – 1ml (2 units)	2 units = 1 syringe 2 ml	0.28	GPC	7/7/2007	0.048	West Pharma	10/1/2007			
Enzoprost 5mg 1ml (1 unit)	1 unit = 1 syringe 5 ml	4.84	GPC	7/7/2007	0.054	West Pharma	10/1/2007			
NaCl 0.9%-500 ml (1 unit)	1 unit = 1 IV set and 1 cath	0.69	GPC	7/7/2007	1.076	West Pharma	10/1/2007			
Folliculin, 0.1% 1+A66 ml (3 unit)	3 units= 1 syringe 5 ml	0.14	GPC	7/7/2007	0.054	West Pharma	10/1/2007			
Labor Stimulation										
Oxytocine 5 IU – 1ml (1, 2 units)	1 or 2 units = 1 syringe 2 ml	0.28	GPC	7/7/2007	0.048	West Pharma	10/1/2007			
Enzoprost 5mg 1 ml (1 unit)	1 unit = 1 syringe 5 ml	4.84	GPC	7/7/2007	0.054	West Pharma	10/1/2007			
NaCl 0.9%-500 ml (1 unit)	1 unit = 1 IV set and 1 cath	0.69	GPC	7/7/2007	1.076	West Pharma	10/1/2007			
Folliculin, 0.1%- 1ml (3, 9 unit)	1 unit = 1 syringe 2 ml	0.14	GPC	7/7/2007	0.048	West Pharma	10/1/2007			
Glucosa 5% 500ml (1 unit)	1 unit = 1 IV set and 1 cath	0.7	GPC	7/7/2007	1.076	West Pharma	10/1/2007			
Drugs used for pain relief / Anesthesia										
No–spa 40 mg 2 ml (1, 2, 4 units)	1 unit = 1 syringe 2ml	0.486	Aversi	7/7/2007	0.048	West Pharma	10/1/2007			
Papaverini 2% – 2 ml (1, 2 units)	1 unit = 1 syringe 2ml	0.034	GPC	7/7/2007	0.048	West Pharma	10/1/2007			
Analgin 50% – 2 ml (2 units)	1 unit = 1 syringe 2ml	0.175	Private pharmacy	12/31/2007	0.048	West Pharma	10/1/2007			
Atropin 0.1% – 1 ml (1 units)	1 unit = 1 syringe 2ml	0.065	GPC	7/7/2007	0.048	West Pharma	10/1/2007			
Baralgin, 5 ml (1 unit)	1 unit = 1 syringe 5ml	0.584	Private pharmacy	12/31/2007	0.054	West Pharma	10/1/2007			
Baralgin(1 unit)	pills	0.045	Aversi	7/7/2007						

Cetamin, 5% 10ml (0.2 units)	each unit = 1 syringe 2ml	3.6	Private pharmacy/ interview	10/1/2007	0.048	West Pharma	10/1/2007
Diazepam, 0.5%- 2ml (1 unit)	1 unit = 1 syringe 2ml	0.45	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Diazepam, 10 mg (1 unit)	pills	0.082	Aversi	7/7/2007			
Dibasol, 1% 1ml (4 units)	4 units= 1 syringe 5ml	0.042	Aversi	7/7/2007	0.054	West Pharma	10/1/2007
Droperidol, 0.25% 5ml (0.1, 0.2 units)	each unit= 1 syringe 5ml	1.75	Private pharmacy	12/31/2007	0.054	West Pharma	10/1/2007
Glucosa, 40% 10 ml (1, 2 units)	1 unit = 1 syringe 10 ml	0.07	GPC	7/7/2007	0.084	West Pharma	10/1/2007
Morphin, 1% 1ml (1 unit)	1 unit = 1 syringe 2ml	0.66	Private pharmacy /interview	10/1/2007	0.048	West Pharma	10/1/2007
Natrium oxybutirat, 20% 10 ml (2 units)	2 units= 1 syringe 20 ml	0.511	Private pharmacy /interview	10/1/2007	0.114	West Pharma	10/1/2007
Other drugs and /or fluid used during labor							
NaCl 0.9% – 500 ml (1 unit)	1 unit = 1 IV set and 1 cath	0.69	GPC	7/7/2007	1.076	West Pharma	10/1/2007
Reopolyglucin 400 ml (1 unit)	1 unit = 1 IV set and 1 cath	0.35	GPC	7/7/2007	1.076	West Pharma	10/1/2007
Ampicillin, 0.5g- 1 flacon (8 units)	1 unit = 1 syringe 5 ml	0.19	GPC	7/7/2007	0.054	West Pharma	10/1/2007
Ca Chloride, 10% 10ml (1 unit)	1 unit = 1 syringe 10ml	0.12	Aversi	7/7/2007	0.084	West Pharma	10/1/2007
Ca Gluconat, 10% 10ml (1 unit)	1 unit = 1 syringe 20 ml	0.283	West Pharma	10/1/2007	0.114	West Pharma	10/1/2007
Catgut, 1m (1 unit)	suture	0.583	GPC	7/7/2007			
Cocarboxilase, 50mg (2 unit)	1 unit = 1 syringe 2 ml	0.2	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Dibasol, 1% 1ml (4, 5 units)	4 or 5 units = 1 syringe 5ml	0.042	Aversi	7/7/2007	0.054	West Pharma	10/1/2007
Diazapam, 0.5% 2ml (1 unit)	1 unit = 1 syringe 2ml	0.45	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Dobegit, 250mg (1 unit)	pill	0.096	GPC	7/7/2007			
Euphylline, 2.4% 5ml (2 unit)	1 unit = 1 syringe 10 ml	0.1	Aversi	7/7/2007	0.084	West Pharma	10/1/2007
Folliculin, 0.1% 1ml (3, 9 units)	3 units= 1 syringe 5 ml	0.14	GPC	7/7/2007	0.054	West Pharma	10/1/2007
Gentamicin, 80mg 2ml (1 unit)	1 unit = 1 syringe 2ml	0.077	Aversi	7/7/2007	0.048	West Pharma	10/1/2007

Glucosa, 5% 500ml (1, 2, 10 units)	1 unit = 1 IV set and 1 cath	0.7	GPC	7/7/2007	1.076	West Pharma	10/1/2007
Glucosa, 10% 500ml (1 units)	1 unit = 1 IV set and 1 cath	0.83	Aversi	7/7/2007	1.076	West Pharma	10/1/2007
Glucosa, 40% 10ml (1, 2, 4 units)	1 unit = 1 syringe 20ml	0.07	GPC	7/7/2007	0.114	West Pharma	10/1/2007
Magnezia, 25% - 10ml (4 units)	1 unit = 1 syringe 10ml	0.115	Aversi	7/7/2007	0.084	West Pharma	10/1/2007
Nifedipin, 10mg (1 unit)	pills	0.016	GPC	7/7/2007			
No-spa, 2 ml (1 unit)	1 unit = 1 syringe 2ml	0.486	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Oxytocine, 1ml- 5units (1, 2, 3 units)	1 unit = 1 syringe 2ml	0.28	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Papaverin, 2% 2ml (1 unit)	1 unit = 1 syringe 2ml	0.034	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Vitamin B1, 5% 1ml (1, 2 units)	1 or 2 units = 1 syringe 2ml	0.034	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Vitamin B6, 5% 1 ml (1, 2 units)	1 or 2 units = 1 syringe 2ml	0.031	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Vitamin C, 5% 1ml (2, 4 units)	2 units = 1 syringe 2ml 4 units = 1 syringe 5 ml	0.039	GPC	7/7/2007	0.048 0.054	West Pharma	10/1/2007
Vitamin C, 2ml, (1 unit)	1 unit = 1 syringe 2ml	0.04	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Normal Episiotomy							
Local anesthetic used:							
Lidocaine 10%- 2 ml (1 unit)	1 unit = 1 syringe 2ml	0.055	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Lidocaine 2%- 2 ml (1, 2, 4 units)	1 unit = 1 syringe 2 ml 2 units = 1 syringe 5 ml 4 units = 1 syringe 10 ml	0.035	Aversi	7/7/2007	0.048 0.054 0.084	West Pharma	10/1/2007
Novocaine 0.5%- 5ml (2, 4, 6, 8, 10 units)	2, 4, 6, 8, 10 units= 1 syringe 10 ml	0.05	GPC	7/7/2007	0.084	West Pharma	10/1/2007
Diazepam, 0.5% 2ml (1 unit)	1 unit = 1 syringe 2ml	0.45	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Drugs used for general anesthesia:							

Sibazon 0.5% 2 ml (1 unit)	1 unit = 1 syringe 2 ml	0.45	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Atropin, 0.1% 1ml (1 unit)	1 unit = 1 syringe 2ml	0.065	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Cetamin, 5% 10ml (0.1, 0.2, 0.3, 0.4, 0.5 units)	each unit = 1 syringe 5 ml	3.6	Private pharmacy/ interview	10/1/2007	0.054	West Pharma	10/1/2007
Natural Tear/Rupture							
Local anesthetic used:							
Lidocaine 10%- 2 ml (2 units)	2 units = 1syringe 5 ml	0.055	GPC	7/7/2007	0.054	West Pharma	10/1/2007
Lidocaine 2%- 2 ml (2, 3 units)	2 units = 1syringe 5 ml, 3 units = 1 syringe 10ml	0.035	Aversi	7/7/2007	0.054 0.084	West Pharma	10/1/2007
Novocaine 0.5%- 5ml (0.1, 2, 4, 8 units)	each unit<1 = 1 syringe 5 ml 2, 4, 8 units = 1 syringe 10 ml	0.05	GPC	7/7/2007	0.054 0.084	West Pharma	10/1/2007
Drugs used for general anesthesia:							
Cetamin, 5% 10ml (0.2, 0.3, 0.4, 0.5 units)	each unit = 1 syringe 5 ml	3.6	Private pharmacy/ interview	10/1/2007	0.054	West Pharma	10/1/2007
Uterus Revision							
General anesthetic used:							
Cetamin, 5% 10ml (0.3, 0.4, 0.5 units)	each unit = 1 syringe 5 ml	3.6	Private pharmacy /interview	10/1/2007	0.054	West Pharma	10/1/2007
Active management of the 3rd stage of labor (AMTSL):							
20.1 Oxytocine 5 IU – 1 ml (2 units)	2 units= 1 syringe 2 ml	0.28	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Excessive bleeding observed within 2hrs after vaginal delivery or C-section							
NaCl 0.9% – 500 ml (1, 2 units)	1 unit = 1 IV set and 1 cath	0.69	GPC	7/7/2007	1.076	West Pharma	10/1/2007
Glucose 5% – 500 ml (1, 2 units)	1 unit = 1 IV set and 1 cath	0.7	GPC	7/7/2007	1.076	West Pharma	10/1/2007

Reopolyglucin 400 ml (1 unit)	1 unit = 1 IV set and 1 cath	0.35	GPC	7/7/2007	1.076	West Pharma	10/1/2007			
Methylergometrin 0.02% – 1 ml (1 unit)	1 unit = 1 syringe 2ml	0.362	West Pharma	10/1/2007	0.048	West Pharma	10/1/2007			
Oxytocine 5 IU – 1 ml (1, 2 units)	1 or 2 units = 1 syringe 2ml	0.28	GPC	7/7/2007	0.048	West Pharma	10/1/2007			
Blood B(III) Rh(+) positive, 500ml (1 unit)	1 unit = 1 IV set and 1 cath	33	GPC	10/1/2007	1.076	West Pharma	10/1/2007			
Enzaprost, 5 mg 1 ml (1 unit)	1 unit = 1 syringe 2ml	4.84	GPC	7/7/2007	0.048	West Pharma	10/1/2007			
Polyglucin, 400ml (1 unit)	1 unit = 1 IV set and 1 cath	3.2	GPC	7/7/2007	1.076	West Pharma	10/1/2007			
Vicasol, 1% 1ml (3 units)	1 unit = 1 syringe 2ml	0.038	Aversi	7/7/2007	0.048	West Pharma	10/1/2007			
XAEC, 10% 500ml (1 unit)	1 unit = 1 IV set and 1 cath	15.5	West Pharma	10/1/2007	1.076	West Pharma	10/1/2007			
Tests performed during labor										
General Blood test								1.37	State standard	12/6/2007
General Urine test								0.97	State standard	12/6/2007
Blood group & Rh typing								0.70	State standard	12/6/2007
HIV test								4.4	State standard	12/6/2007
Wasserman test - serology								0.46	State standard	12/6/2007
C-Section										
Test(s) and/or examination(s) performed prior to the C-section:										
General Blood test								1.37	State standard	12/6/2007
General Urine test								0.97	State standard	12/6/2007
Coagulogram								2.7	State standard	12/6/2007
Biochemical blood test								2.4	KOGH	12/7/2007
Vaginal discharge test								1.5	KOGH	12/7/2007
Blood group & Rh typing								0.70	State standard	12/6/2007
Hematocrit								0.90	State standard	12/6/2007

HIV test								4.4	State standard	12/6/2007
Wassermann test - serology								0.46	State standard	12/6/2007
Bleeding time test								0.4	State standard	12/6/2007
Blood urea nitrogen test								2.4.	KOGH	12/7/2007
Echoscopy								1.08	State standard	12/6/2007
Electrocardiogram (E.C.G)								3.0	State standard	12/6/2007
Urine analysis - Zimnitski								1.2	KOGH	12/7/2007
Epidural /general anesthesia:										
Atropin 0.1% – 1 ml (1 unit)	1 unit = 1syringe 2ml	0.065	GPC	7/7/2007	0.048	West Pharma	10/1/2007			
Phenthanyli 0.005% – 2 ml (1, 2, 3 units)	1 unit = 1 syinge 2ml	0.56	Private pharmacy	10/1/2007	0.048	West Pharma	10/1/2007			
Promedol 2% – 1 ml (1, 2 units)	1 unit = 1 syringe 2ml	1.2	Private pharmacy /interview	10/1/2007	0.048	West Pharma	10/1/2007			
Thiopental–natrium 1 gr (0.5, 1, 2 units)	each unit ≤1 = 1 syringe 2ml	1.85	Aversi	7/7/2007	0.048	West Pharma	10/1/2007			
Droperidol 0.25% 5 ml (0.2, 0.4, 1 units)	each unit ≤1 = 1 syringe 5 ml	1.75	Interview	12/31/2007	0.054	West Pharma	10/1/2007			
Pipecuronium 4 mg 2 ml (1, 2, 3 units)	1 unit= 1 syringe 2 ml	2.111	Aversi	7/7/2007	0.048	West Pharma	10/1/2007			
Cetamin, 5% - 10ml (0.08, 0.3, 0.5, 0.6, 0.8, 1 units)	each unit = 1 syringe 5 ml	3.6	Private pharmacy /interview	10/1/2007	0.054	West Pharma	10/1/2007			
Morphin 1% – 1ml (1 unit)	1 unit = 1 syringe 2 ml	0.66	Private pharmacy /interview	10/1/2007	0.048	West Pharma	10/1/2007			
Listenon, 2%- 5ml (1, 2 units)	1 unit = 1 syringe 5 ml	0.946	GPC	7/7/2007	0.054	West Pharma	10/1/2007			
Arduan, 4mg - 2ml (1 unit)	1 unit = 1 syringe 2 ml	2.111	Aversi	7/7/2007	0.048	West Pharma	10/1/2007			
Cordiamin, 25%-2ml (1 unit)	oral fluid	0.172	Aversi	7/7/2007						
Diazepam, 0.5% 2ml (1 unit)	1 unit = 1 syringe 2ml	0.45	Aversi	7/7/2007	0.048	West Pharma	10/1/2007			
Dimedrol, 1%- 1ml (1 unit)	1 unit = 1 syringe 2ml	0.059	GPC	7/7/2007	0.048	West Pharma	10/1/2007			
Ditilin, 2%- 5ml (1 unit)	1 unit = 1 syringe 5 ml	0.286	GPC	7/7/2007	0.054	West Pharma	10/1/2007			
Fosfalugel, 5ml (1 unit)	oral fluid	0.24	Aversi	7/7/2007						

Glucosa, 5%- 500ml (1 unit)	1 unit = 1IV set and 1 cath	0.7	GPC	7/7/2007	1.076	West Pharma	10/1/2007			
NaCl, 0.9%- 500ml (1, 2 units)	1 unit = 1IV set and 1 cath	0.69	GPC	7/7/2007	1.076	West Pharma	10/1/2007			
Oxybutirat Natrium,20%- 10ml (1 unit)	1 unit = 1 syringe 10 ml	0.511	Private pharmacy /interview	10/1/2007	0.084	West Pharma	10/1/2007			
Oxytocine, 5 IU- 1ml (4 units)	1 unit = 1 syringe 2 ml	0.28	GPC	7/7/2007	0.048	West Pharma	10/1/2007			
Pipolphen, 2.5% - 2ml (1, 2 units)	1 unit = 1 syringe 2ml	0.599	private pharmacy	10/1/2007	0.048	West Pharma	10/1/2007			
Proserinium, 0.05% 1ml (2 units)	1 unit = 1 syringe 2ml	0.073	Aversi	7/7/2007	0.048	West Pharma	10/1/2007			
Zinacef, 750mg (1, 2 units)	1 unit = 1 syringe 10ml	3.05	GPC	7/7/2007	0.084	West Pharma	10/1/2007			
Postpartum										
Lab test(s) and/or other examination(s) performed in the postpartum period (vaginal delivery or C-section)										
General Urine test								0.97	State standard	12/6/2007
Coagulogram								2.7	State standard	12/6/2007
Vaginal discharge test								1. 5	KOGH	12/7/2007
Ultrasound check=Ultrasound check								1. 08	State standard	12/6/2007
Blood group &Rh typing								0.71	State standard	12/6/2007
Glucose								1.2	State standard	12/6/2007
Hemoglobin test								0.34	ZMH	12/6/2007
Bleeding time test								0.4	State Standard	12/6/2007
General Blood test=Blood analysis clinical								1.37	State Standard	12/6/2007
Wassermann test-serology								0.46	State Standard	12/6/2007
HIV test								4.4	State Standard	12/6/2007
Hematocrit								0. 9	State Standard	12/6/2007
Drug(s) and/or fluid(s) administered after vaginal delivery or C-section:										

Ampicillin 0,5 g (1, 3 ,4 ,6, 8, 9, 10, 11, 12, 16, 17, 18, 19, 20, 22, 22, 24, 32, 40 units)	pills	0.065	Aversi	7/7/2007			
Analgin 50% - 2ml (1, 2, 3, 4, 5, 6, 7, 9 units)	1 unit = 1 syringe 2 ml	0.175	Private pharmacy	12/31/2007	0.048	West Pharma	10/1/2007
Atropin 0,1% – 1ml (1 unit)	1 unit = 1 syringe 2ml	0.065	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Ca Gluconat 10% – 10 ml (1,2 units)	1 unit = 1 syringe 20ml	0.283	West Pharma	10/1/2007	0.114	West Pharma	10/1/2007
Ceftriaxon 1g (13 units)	1 unit = 1 syringe 10 ml	1.9	GPC	7/7/2007	0.084	West Pharma	10/1/2007
Cerucal 0,5% – 2 ml (1, 2, 3, 4 units)	1 unit= 1 syringe 2 ml	0.68	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Dimedrol 1% – 1ml (1, 2, 3, 4, 5, 6 units)	1 unit = 1 syringe 2ml	0.059	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Dopminum 0,5% – 5 ml (6 units)	1 unit = 1syringe 5ml	0.27	GPC	7/7/2007	0.054	West Pharma	10/1/2007
Droperidol 0.25% -5 ml (1, 2 units)	1unit = 1 syringe 5ml	1.75	Private pharmacy	12/31/2007	0.054	West Pharma	10/1/2007
Euphylline 2,4% – 5 ml (2, 12 units)	1 unit = 1 syringe 10 ml	0.1	Aversi	7/7/2007	0.084	West Pharma	10/1/2007
Gentamicin 4% – 2 ml – 80 mg (5, 6, 8, 9, 10, 11, 12, 13, 14, 15 units)	1unit = 1 syringe 2ml	0.077	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Glucose 40% – 10 ml (1, 2 units)	1 unit = 1 syringe 20 ml	0.07	GPC	7/7/2007	0.114	West Pharma	10/1/2007
Glucose 5% – 500 ml (1, 2, 3 units)	1 unit = 1 IV set and 1 cath	0.7	GPC	7/7/2007	1.076	West Pharma	10/1/2007
KCl 4%- 200 ml (0.15, 0.3)	each unit = 1 IV set and 1 cath	1.49	GPC	7/7/2007	1.076	West Pharma	10/1/2007
Methylergometrin 0.02% -1 ml (1 unit)	1 unit = 1 syringe 2ml	0.362	West Pharma	10/1/2007	0.048	West Pharma	10/1/2007
Morphin 1% – 1ml (1, 2, 3, 4, 5, 6, 7 units)	1 unit = 1 syringe 2ml	0.66	Private pharmacy/ interview	10/1/2007	0.048	West Pharma	10/1/2007
NaCl 0,9% -500 ml (1, 2, 3, 4 units)	1 unit = 1 IV set and 1 cath	0.69	GPC	7/7/2007	1.076	West Pharma	10/1/2007
NaCl 10%- 20 ml (1, 4 units)	1 unit = 1 IV set and 1 cath	0.14	Aversi	7/7/2007	1.076	West Pharma	10/1/2007
No–spa 40 mg 2ml (1, 2, 3, 4 units)	1 unit = 1 syringe 2ml	0.486	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Oxybutirat 20% – 10 ml (2 units)	2 units = 1 syringe 20 ml	0.511	Private pharmacy/ interview	10/1/2007	0.114	West Pharma	10/1/2007
Oxytocine 5 IU - 1 ml (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 units)	1 unit = 1 syringe 2ml	0.28	GPC	7/7/2007	0.048	West Pharma	10/1/2007

Papaverin 2% – 2 ml (4 units)	1 unit = 1 syringe 2ml	0.034	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Paracetamol 250 mg (1, 2, 4 units)	pills	0.005	Aversi	7/7/2007			
Polyglucin 400 ml (1 unit)	1 unit = 1 IV set and 1 cath	3.2	GPC	7/7/2007	1.076	West Pharma	10/1/2007
Promedol 2% – 1 ml (1 unit)	1 unit = 1 syringe 2ml	1.2	Private pharmacy/ interview	10/1/2007	0.048	West Pharma	10/1/2007
Proserinum 0.05% 1 ml (1, 2, 3 units)	1 unit = 1 syringe 2ml	0.073	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Ringer 500ml (1, 2, 3, 4 units)	1 unit = 1 IV set and 1 cath	1	Aversi	7/7/2007	1.076	West Pharma	10/1/2007
Reopolyglucin 400 ml (1 unit)	1 unit = 1 IV set and 1 cath	0.35	GPC	7/7/2007	1.076	West Pharma	10/1/2007
Sulfat Mg 25% – 5 ml (2, 4, 5, 6, 15 units)	2 units = 1 syringe 10 ml 4 units = 2 syringes 10 ml 5 units = 2 syringes 20 ml 6 units = 3 syringes 10 ml 15 units = 4 syringes 20 ml	0.115	Aversi	7/7/2007	0.084 0.168 0.228 0.252 0.456	West Pharma	10/1/2007
Vitamin C 5% – 1 ml (1, 3, 6 units)	1 unit= 1 syringe 2 ml, 3 or 6 units = 1 syringe 5 ml	0.039	GPC	7/7/2007	0.048 0.054	West Pharma	10/1/2007
5-Nok 50mg - pills (1, 12 units)	pills	0.057	Aversi	7/7/2007			
Activated Charcoal 0.25g (1, 2, 3, 4, 8 units)	pills	0.011	Aversi	7/7/2007			
Amoxacilin 500mg- pills (16 units)	pills	0.219	Aversi	7/7/2007			
Ampisid 1.5 gram (2 units)	1 unit= 1 syringe 5 ml	3.5	GPC	7/7/2007	0.054	West Pharma	10/1/2007
Analgin 0.5g (1, 2, 3, 4, 5, 6 units)	pills	0.01	GPC	7/7/2007			
Calcium Chloride 10% - 10ml (1 unit)	1 unit = 1 syringe 10ml	0.12	Aversi	7/7/2007	0.084	West Pharma	10/1/2007
Cardioaspirin 100mg (4 units)	pills	0.065	Aversi	7/7/2007			
Catgut 1m (1, 2 units)	suture	0.583	GPC	7/7/2007			
Cipro 500mg (10 units)	pills	0.082	GPC	7/7/2007			
Citramon (1, 2 units)	pills	0.008	Aversi	7/7/2007			
Corinfar 10mg (1, 3 units)	pills	0.03	Aversi	7/7/2007			

Dexamethasone 0.4% 1ml(1 unit)	1 unit = 1 syringe 2 ml	0.24	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Diazepam 0.5% 2ml (Diazepam same as Diazepex) (1, 2, 4 units)	1 unit = 1 syringe 2ml	0.45	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Diazepam 2mg (1, 2 units)	pills	0.441	Private pharmacy/ interview	10/1/2007			
Diazepam 5mg (2, 4 units)	pills	0.048	Aversi	7/7/2007			
Dibasol 1% 1ml (2, 4, 12 units)	2 units = 1 syringe 2 ml	0.042	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Dicloberl 3ml / Dikloferol 3ml (same) (1, 2, 3 units)	1 unit = 1 syringe 5ml	0.88	GPC	7/7/2007	0.054	West Pharma	10/1/2007
Diclophenac 3ml (1, 2 units)	1 unit = 1 syringe 5 ml	0.07	GPC	7/7/2007	0.054	West Pharma	10/1/2007
Doxacycline/Doxycycline 100mg (same) (8, 9, 10, 12, 15, 16 units)	pills	0.036	GPC	7/7/2007			
Enzaprost 5mg 1ml (1 unit)	1 unit = 1 syringe 5ml	4.84	GPC	7/7/2007	0.054	West Pharma	10/1/2007
Feroplex 80mg (6 units)	pills	0.014	Aversi	7/7/2007			
Ferosulfat 40 mg (24 units)	pills	0.088	GPC	7/7/2007			
Ferrum- Lek 2ml (6 units)	1 unit = 1 syringe 2 ml	1.62	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Fosfalugel 5ml (1 unit)	oral fluid	0.24	Aversi	7/7/2007			
Heparin 5ml (0.2 unit)	1 unit = 1 insulin syringe 1 ml	0.48	GPC	7/7/2007	0.108	Aversi	9/26/2007
Metronidasol 0.25g/ Trichopol 0.25g (1, 4, 6, 8, 9, 10, 12, 14, 16, 18, 20, 24, 32 units)	pills	0.018	GPC	7/7/2007			
Metrogil 100ml (1, 2, 3 units)	1 unit = 1 IV set and 1 cath	1.2	Aversi	7/7/2007	1.076	West Pharma	10/1/2007
Mukaltin 0.05g (10 units)	pills	0.015	GPC	7/7/2007			
Multivitamin (5 units)	pills	0.211	GPC	7/7/2007			
Nistatin, 500000 IU (4 units)	pills	0.041	GPC	7/7/2007			
No- spa 40mg (1, 2, 3, 4, 6 units)	pills	0.055	GPC	10/1/2007			
Relanium 5ml (2 units)	1 unit = 1 syringe 5ml	0.566	Private pharmacy	10/1/2007	0.054	West Pharma	10/1/2007
Tavegil 1mg (6 units)	pills	0.178	GPC	10/1/2007			

Tercef 1ml (2 units)	1 unit = 1 syringe 5 ml	5.11	West Pharma	10/1/2007	0.054	West Pharma	10/1/2007
Thromboass 100mg (3 units)	pills	0.061	Aversi	7/7/2007			
Vitamin B1 5% 1ml (1 unit)	1 unit = 1 syinge 2ml	0.034	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Vitamin B6 5% 1ml (1 unit)	1 unit = 1 syinge 2ml	0.031	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Vitamin B12 1ml (1 unit)	1 unit = 1 syinge 2ml	0.045	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Zinacef 750mg (1, 2, 3, 4, 5, 6, 9, 11, 13 units)	1 unit = 1 syringe 5ml	3.05	GPC	7/7/2007	0.054	West Pharma	10/1/2007
Zinat 250mg (8 units)	pills	1.435	GPC	7/7/2007			
Newborn Care							
Cord care							
Brilliant green		0.3	GPC	10/1/2007			
Potassium Iodine		0.046	GPC	10/1/2007			
KMnO4		0.002	Private pharmacy	12/31/2007			
H2O2		0.022	GPC	10/1/2007			
Infant formula							
Infant Formula Humana 300 ml (2.3 units)		5.12	Aversi	10/1/2007			
Drug(s) and/or fluid(s) administered in the newborn department before discharge							
Ampicillin 0,5 g (1, 2, 3, 4, 5, 6 units)	1 unit = 1 syringe 2ml	0.065	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Bifidumbacterinum 5 doses (4 units)	oral fluid	0.185	GPC	7/7/2007			
Ca Gluconat 10% – 10 ml (0.5, 1, 2, 3 units)	each unit ≤ = 1 syringe 10ml	0.283	West Pharma	10/1/2007	0.084	West Pharma	10/1/2007
Dicinon 250 mg – 2 ml (1, 2, 3 units)	1 unit = 1 syringe 2ml	0.36	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Droperidol 0.25%- 5 ml (0.05 units)	each unit = 1 syringe 2ml	1.75	Private pharmacy	12/31/2007	0.048	West Pharma	10/1/2007
Euphylline 2,4% – 5 ml (2, 4, 6 units)	1 unit = 1 syringe 10 ml	0.1	Aversi	7/7/2007	0.084	West Pharma	10/1/2007
Gentamicin 4% – 2 ml – 80 mg (0.5, 1, 2, 3, 4, 5, 6 units)	each unit <1 = 1 syringe 2 ml	0.077	Aversi	7/7/2007	0.048	West Pharma	10/1/2007

Glucose 10% – 500 ml (1, 2 units)	1 unit = 1 IV set and 1 cath	0.83	Aversi	7/7/2007	1.076	West Pharma	10/1/2007
Glucose 40% – 10 ml (2 units)	1 unit = 1syringe 10ml	0.07	GPC	7/7/2007	0.084	West Pharma	10/1/2007
Glucose 5% – 500 ml (1 unit)	1 unit = 1 IV set and 1 cath	0.7	GPC	7/7/2007	1.076	West Pharma	10/1/2007
Klaforan 1 g (1, 2 units)	1 unit = 1syringe 5ml	3.35	GPC	7/7/2007	0.054	West Pharma	10/1/2007
Lasix 2 ml – 20 mg (1, 2, 3 units)	1 unit = 1syringe 2ml	0.205	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
NaCl 0.9% - 500ml (1 unit)	1 unit = 1 IV set and 1cath	0.69	GPC	7/7/2007	1.076	West Pharma	10/1/2007
Oxybutirat 20% – 10 ml (1 unit)	1 unit = 1 syringe 10 ml	0.511	Private pharmacy /interview	10/1/2007	0.084	West Pharma	10/1/2007
Phenobarbital 0,1 g (0.5, 5, 8,10 units)	each unit ≤ 1 = 1 syringe - 5ml	0.18	Aversi	7/7/2007	0.054	West Pharma	10/1/2007
Prednisolon 1ml – 30 mg (2 units)	1 unit = 1 syringe 2ml	0.433	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Sulfat Mg 25% – 5 ml (0.04, 1 units)	each unit ≤ 1 = 1 syringe 5ml	0.115	Aversi	7/7/2007	0.054	West Pharma	10/1/2007
Tetraciclin cream 1% – 5 g (1 unit)	cream	0.016	GPC	7/7/2007		West Pharma	10/1/2007
Vicasol 1% – 1 ml (1, 3 units)	1 unit = 1 syringe 2ml	0.038	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Vitamin C 5% – 1 ml (1, 2, 3, 4, 5 units)	1 unit = 1 syringe 2 ml	0.039	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Alokhol 40mg (2 units)	pills	0.014	Aversi	7/7/2007			
Analgin 50%- 2ml (1 unit)	1 unit = 1 syringe 2 ml	0.175	Interview	12/31/2007	0.048	West Pharma	10/1/2007
Ascorutin 0.5gram (2, 3 units)	pills	0.011	GPC	7/7/2007			
Cavinton (2 units)	pills	0.107	GPC	7/7/2007			
Colecalcipherol 1ml- 200000units (1 unit)	oral fluid	2.1	GPC	10/1/2007			
Dexamethasone 0.4% 1ml (2, 3, 4 units)	1 unit = 1 syringe 2ml	0.24	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Diazepam 0.5% 2ml (1, 2, 3 units)	1 unit = 1 syringe 2ml	0.45	Aversi	7/7/2007	0.048	West Pharma	10/1/2007
Dimedrol 1%- 1ml (I unit)	1 unit = 1 syringe 2ml	0.059	GPC	7/7/2007	0.048	West Pharma	10/1/2007
Gentamicin 80mg (1 unit)	1 unit = 1 syringe 5 ml	0.077	Aversi	7/7/2007	0.054	West Pharma	10/1/2007
Pyracetam 20% - 5ml (5 units)	1 unit = 1 syringe 5 ml	0.136	Aversi	7/7/2007	0.054	West Pharma	10/1/2007
Riboxin 2% 2ml (2 units)	2 units = 1 syringe 5ml	0.12	Aversi	7/7/2007	0.054	West Pharma	10/1/2007

Riboxin 2% 5ml (1, 2, 5 units)	1 unit = 1 syringe 5ml	0.12	Aversi	7/7/2007	0.054	West Pharma	10/1/2007			
Triampur 25mg - pills (1 unit)	pills	0.12	GPC	7/7/2007						
Vitamin B1 5% 1ml (1, 2, 3, 4, 5, 7 units)	1 unit = 1syringe 2ml	0.034	GPC	7/7/2007	0.048	West Pharma	10/1/2007			
Vitamin B6 5%- 1ml (1, 2, 3, 4, 5, 4, 7 units)	1 unit = 1syringe 2ml	0.031	GPC	7/7/2007	0.048	West Pharma	10/1/2007			
Vitamin E 10% 1ml (1, 3, 5 units)	1 unit = 1syringe 2ml	0.085	Aversi	7/7/2007	0.048	West Pharma	10/1/2007			
Immunization/Vaccines										
BCG								0	State Standard	12/6/2007
Hepatitis B vaccine								0	State Standard	12/6/2007
Newborn Tests/Instrumental examination										
Blood group and Rh typing								0.71	State Standard	12/6/2007
Blood analysis clinical								1.8	State Standard	12/6/2007
Hemoglobin test								0.34	ZMH	12/6/2007
Total white blood cells								1..2	KOGH	12/7/2007
Blood glucose								1.65	ZMH	12/6/2007
Blood bilirubine								1.4	ZMH	12/6/2007
Hypothyreosis								0	State Standard	12/6/2007
Blood bacteriological analysis								3.0	KOGH	12/7/2007
Urine analysis Nechiporenko								0.74	ZMH	12/6/2007
Phenylketonuria test								0	State standard	12/6/2007
Neurosonoscopy								3.0	KOGH	12/7/2007

Appendix C

Key Informant Interview Guide

Key Informant Interview Guide

For expert OB/GYNs, neonatologists and midwives (at least one from each facility). For the purposes of this study, "expert" is defined as a health care provider who has worked for at least 10 years.

This interview pertains to HWG and a cost impact study we are conducting. The purpose of the study is to assess the cost impact of HWG's EPC component on health service provision. The large portion of this study has involved the review of facility records from delivery rooms and newborn departments. This phase of the study involves interviews of "experts" such as yourself to gain a better understanding of the situation on the ground, particularly regarding items we could not collect from records.

The interview will likely take approximately one hour. Your participation will be very much appreciated, but is entirely voluntary. You can opt not to answer certain questions if you do not know the answer or are simply unwilling to answer.

Do you have any questions?

Do you agree to participate today?

Yes_____ No _____

Only proceed to interview if the person consents to participate, having understood what is expected of him or her.

1. By what percent do you estimate that prices have changed between 2004 and 2007 on all drugs, supplies and reagents used here for delivery and newborn care?
2. Is a new syringe usually used for each drug and injection? Can we assume this is the case?
3. What is an average price of a general blood test during or after labor?
4. What is an average price of a general urine test during or after labor?
5. What is a price of a coagulogram test during or after labor?
6. What is a price of biochemical blood test during labor?
7. What is a price of a vaginal discharge test during or after labor?
8. What is a price of a blood group and Rh typing test during or after labor?
9. What is a price of a hematocrit test during labor
10. What is a price of HIV test during labor?
11. What is a price of a Wassermann test- serology during labor?
12. What is a price of an ultrasound check after labor?
13. What is a price of a glucose test during or after labor?
14. Based on what you have observed over the past two years would you expect to see any changes in services provided or in the ways services are provided during deliveries and post-partum (for women and newborns)?
15. As mentioned before, the majority of this study has involved the review of facility records pertaining

to deliveries and newborn care. Based on your knowledge and experience working in this facility, do you have any comments or concerns regarding facility records? Do you think anything might be under-reported, over-reported or mis-reported?

16. Based on HWG program monitoring data and anecdotal evidence it appears that the frequency of labor induction, labor stimulation, CS, amniotomy, episiotomy, drug use, and newborn department admission has decreased from 2004 until now.

    a. For OBGYNs and midwives only: Do you think decreases in CS, amniotomy, episiotomy and drug use reflect a real change? Why or why not?

    b. For OBGYNs and midwives only: Do you think less labor induction and labor stimulation reflect a real change? Why or why not?

    c. For neonatologists only: Do you think less drugs, tests and NICU admission reflect a real change? Why or why not?

17. For OBGYNs and midwives only: How often do you think enema was performed in 2004 and now?

2004	**2007**
<25%	<25%
25-49%	25-49%
50-74%	50-74%
75-100%	75-100%

18. For OBGYNs and midwives only: How often do you think perineum shaving was preformed in 2004 and now?

2004	**2007**
<25%	<25%
25-49%	25-49%
50-74%	50-74%
75-100%	75-100%

19. What supplies are usually used for shaving? Please specify quantities used on average per procedure. (Mention examples listed and ask for any others.)

Item	**No of items/procedure**
Razor	
Shaving Gel/soap	

20. For OBGYN and midwife only: How often do you think the woman's bladder was catheterized after birth in 2004 and now?

2004	2007
<25%	<25%
25-49%	25-49%
50-74%	50-74%
75-100%	75-100%

21. What supplies are usually used for bladder catheterization? Please specify quantities used on average per procedure. (Mention examples listed and ask for any others.)

Item	No of items/procedure

22. For neonatologists only: How was the cord care in 2004 and now? Did all newborn receive the same cord care? And now?

23. What supplies and/or reagents are needed for cord care with brilliant green? Please specify quantities used on average per procedure.

Item	No of items/procedure

24. What supplies and/or reagents are needed for cord care with potassium iodine? Please specify quantities used on average per procedure.

Item	No of items/procedure

25. What supplies and/or reagents are needed for cord care with KMnO4? Please specify quantities used on average per procedure.

Item	No of items/procedure

26. What supplies and/or reagents are needed for cord care with H2O2? Please specify quantities used on average per procedure.

Item	No of items/procedure

27. What supplies and/or reagents are needed for cord care with bandage? Please specify quantities used on average per procedure.

Item	No of items/procedure

28. What supplies and/or reagents are needed for cord care with open and dry? Please specify quantities used on average per procedure.

Item	No of items/procedure

29. What is a price of a blood analysis (clinical) for a newborn?
30. What is a price of a blood analysis (biochemical) for a newborn?
31. What is a price of a bacteriological analysis for a newborn?
32. What is a price of a blood group and Rh typing for a newborn?
33. What is a price of a blood glucose test for a newborn? Please specify quantities used on average per administration of the test.
34. What is a price of a blood bilirubine test for a newborn?
35. What is a price of a urine analysis (routine) test for a newborn?
36. What is a price of a urine analysis (Nechiporenko) test for a newborn?
37. What is a price of a urine protein test for a newborn?
38. What is a price of hypothyreosis test for a newborn?
39. What is a price of Hepatitis B vaccine to a newborn?
40. What is a price of BCG vaccine to a newborn?

Appendix D

List of Key Informants

Zestaponi Maternity Hospital

Tsiala Abashidze – OB/GYN, Head of Maternity Hospital
Kote Bochorishvili – OB/GYN, Head of Obstetrics Department
Natela Koiava – OB/GYN

Nazi Mekoshvili – Midwife
Neli Natriashvili- Midwife
Natela Lomsadze - Midwife
Gulnazi Kupatadze - Midwife

Manana Labadze – Head of Neonatology Department
Nato Bubashvili – Neonatologist
Ketevan Mumladze – Neonatologist

Leila Kukhalashvili - Nurse
Nana Tsignadze - Nurse
Tamar Tsakadze - Nurse

Kutaisi Obstetrics/Gynecological Hospital

Leri Khonelidze – OB/GYN, Maternity Owner
Manana Bregadze – OB/GYN, Director of Maternity Hospital
Irakli Merkviladze – OB/GYN, Head of Obstetrics Department
Nino Ugrekhelidze – OB/GYN

Tsitsino Jailava – Head Midwife
Eka Jincharadze - Midwife
Nino Jashi - Midwife

Khatuna Cheishvili – Head of Neonatology Department
Natia Siradze – Neonatologist
Lia Jincharadze – Neonatologist
Khatuna Pkhakadze – Neonatologist

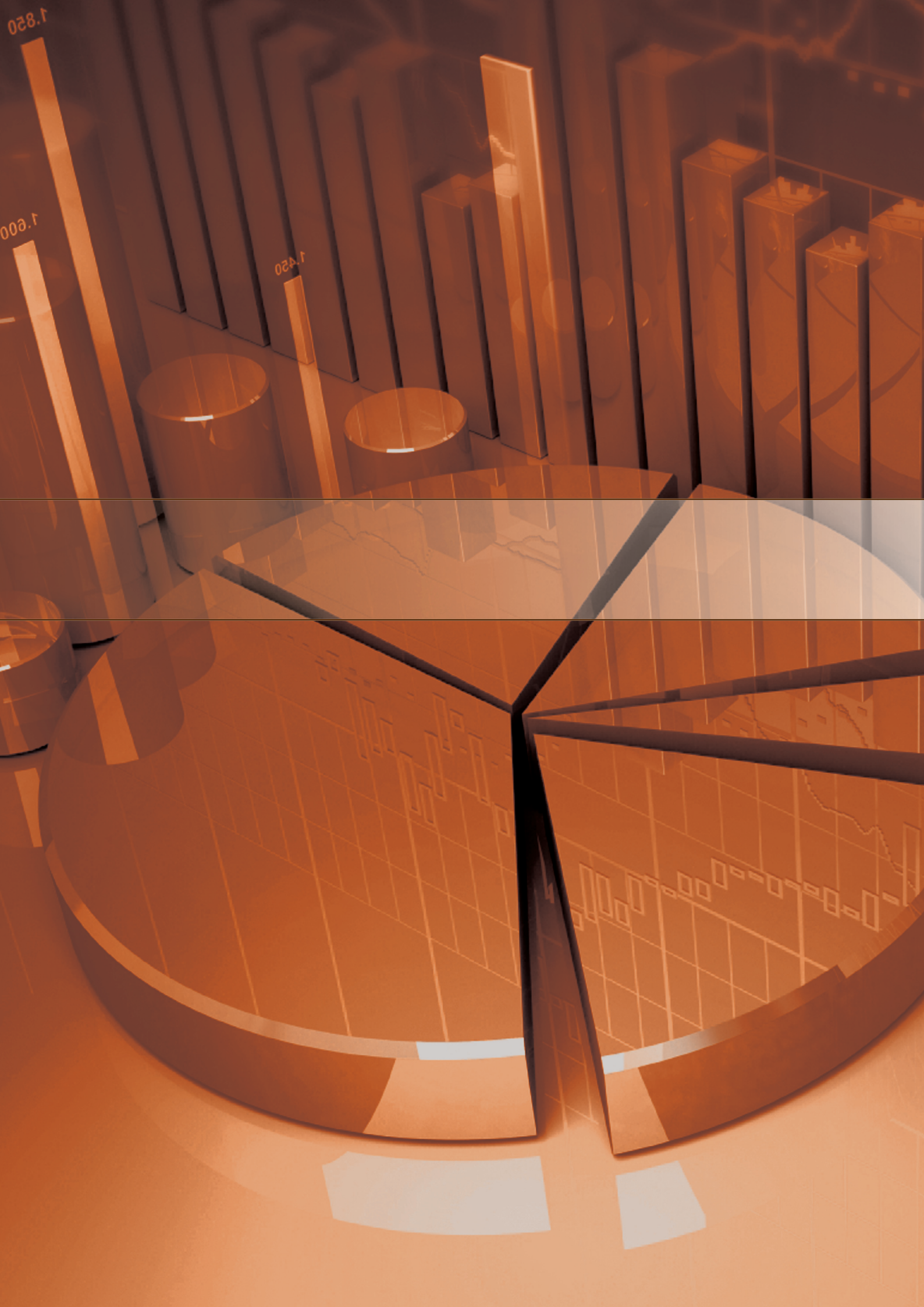
Nino Jailava - Nurse
Marika Robakidze - Nurse
Mari Sutidze – Nurse

Appendix E

Demographic and Reproductive Characteristics of the Study Sample

Table E.1. Demographic and Reproductive Characteristics of the Study Sample by Maternity Hospital and by Year

DEMOGRAPHIC INFORMATION	ZESTAPONI		KOGH		COMBINED	
	Before ('04)	After ('07)	Before ('04)	After ('07)	Before ('04)	After ('07)
	n=100 %	n=100 %	n=100 %	n=100 %	n=200 %	n=200 %
Age Groups						
10-14	0.0	1.0	1.0	0.0	**0.5**	**0.5**
15-19	26.0	13.0	16.0	18.0	**21.0**	**15.5**
20-24	35.0	39.0	40.0	47.0	**37.5**	**43.0**
25-29	16.0	27.0	25.0	19 .0	**20.5**	**23.0**
30-34	18.0	11.0	12.0	14 .0	**15.0**	**12.5**
35-39	3.0	6.0	2.0	2.0	**2.5**	**4.0**
40-44	2.0	3.0	4.0	0.0	**3.0**	**1.5**
Ethnicity						
Georgian	100.0	100.0	99.0	98.0	**99.5**	**99.0**
Moldovan	0.0	0.0	0.0	1.0	**0.0**	**0.5**
Russian	0.0	0.0	1.0	1.0	**0.5**	**0.5**
Urban or Rural Living Environment						
Urban	37.0	39.0	73.0	66.0	55.0	52.5
Rural	63.0	61.0	27.0	34.0	45.0	47.5
Education Level						
Secondary	66.0	60.0	67.0	74.0	66.5	67.0
Secondary-Technical	7.0	9.0	11.0	4.0	9.0	6.5
Higher	27.0	31.0	22.0	22.0	24.5	26.5
Marital Status						
Married-Registered	67.0	74.0	63.0	74.0	65.0	74.0
Married-Unregistered	18.0	26.0	35.0	26.0	26.5	26.0
Single	15.0	0.0	2.0	0.0	8.5	0.0
Parity (# of births including stillbirths & current delivery)						
1	44.0	51.0	55.0	61.0	49.5	56.0
2-3	53.0	45.0	43.0	38.0	48.0	41.5
4-5	3.0	4.0	2.0	1.0	2.5.	2.5
Abortions (# of induced abortions excluding natural abortions or miscarriages)						
0	93.0	82.0	62.0	71.0	77.5	76.5
1-2	3.0	12.0	29.0	18.0	16.0	15.0
3-4	4.0	5.0	4.0	6.0	4.0	5.0
5-6	0.0	0.0	2.0	4.0	1.0	2.0
7-9	0.0	0.0	3.0	1.0	1.5	0.5
10-11	0.0	1.0	0.0	0.0	0.0	0.5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