Rate, causes, and risk factors of caesarean section in north of Jordan and its associated maternal and perinatal risks

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Executive summary

Caesarean section (CS) is a life-saving surgical procedure when certain complications arise during pregnancy and labour. However, it is a major surgery and is associated with immediate maternal and perinatal risks and may have implications for future pregnancies as well as long-term effects that are still being investigated. The World Health Organization (WHO) recommends that the rate of CS should not exceed 10-15% in any country. In recent years, the rate of cesarean deliveries increased dramatically worldwide with many countries had exceeded the WHO recommended rate. One study in Jordanian University Teaching hospitals showed that the rate of CS increased from 18.2% in 2002 to 30.3% in 2012. The current study aimed to determine the extent, causes, and factors associated with cesarean deliveries in north of Jordan and their associated maternal and neonatal outcomes.

A prospective hospital-based longitudinal study was conducted to determine the rates, causes, and risk factors of CS in north of Jordan. Women were enrolled in the study after delivery, shortly before or at the time of discharge from the selected health facilities. All women who gave birth (dead or alive) at 20 weeks of gestation or more in four selected hospitals were eligible for inclusion. Necessary data for mothers including socio-demographic, clinical, maternal, pregnancy, delivery and other risk factors were gathered through face-to-face interview using a semi-structured questionnaire and by abstraction of data from medical records. All information in the study questionnaires including causes of CS were confirmed by physicians.

The overall rate of CS was 37.5% among Jordanian women. The rates were 16.3% for emergency CS and 21.2% for planned CS. The rate of CS varied significantly according to health sector. The rates of planned CS were 27.0% in teaching hospitals, 26.7% in military hospitals, 18.6% in public hospitals, and 10.1% in private hospitals. The rates of emergency CS were 15.3% in teaching hospitals, 13.8% in military hospitals, 20.1% in public hospitals, and 14.3% in private hospitals.

The most frequent reason for planned CS was scarred uterus (50.0%). The second most common reason was multiple fetuses (20.8%). Other relatively common reasons included abnormal presentation (7.6%) and mothers' desire for CS (6.9%). The most frequent reasons for emergency CS were prolonged fetal distress (33.5%) followed by obstructed labor (22.2%),

abnormal presentation (13.1%), and eclampsia or sudden severe high blood pressure or seizure (6.3%).

Health sector was not significantly associated with the rate of planned CS after adjusting for important variables. The odds of planned CS among women aged 20-35 and >35 years were 7.5 and 38.2 times that odds among women aged <20 years, respectively. Income of >350 was significantly associated with increased odds of planned CS by two times. Women with previous cesarean section had much higher odds to be planned for CS (OR = 30.1). Breach presentation was associated with a very high odds of planned CS (OR = 245). Women with multiple fetuses were 13.2 times more likely to deliver via planned CS compared to women with single fetus. On the other hand, women with previous cesarean section had twice higher odds to deliver via emergency CS (OR = 2.2) compared to women with no previous CS. Breach presentation was associated with a very high odds of emergency CS (OR = 58.7). Having a boy baby, gestational diabetes, and hospitalization between 24 and 34 weeks of gestation were significantly associated with increased odds of emergency CS.

About 45.6% of newborns delivered vaginally had good Apgar scores at 1 minute (8-10) compared to 46.2% for planned CS and 28.9% for emergency CS. The stillbirth rate was significantly higher (p=0.000) for planned CS (1.7%) and vaginal delivery (1.5%) compared to emergency CS (0.5%).

In conclusion, Jordan has a markedly high rate of CS. The rate of planned CS is higher than that of emergency CS. Scarred uterus and multiple fetuses are the most common reasons for planned CS. The main reasons for emergency CS are prolonged fetal distress, obstructed labor, and abnormal presentation.

Based on the available data, we recommend the followings:

1. A multidisciplinary quality assurance program should be established in all Jordanian facilities in which delivery occurs. As most CSs are currently based on physician's judgment, it may be extremely useful to develop and strictly implement national guidelines for performing CSs.
2. Implement a policy of mandatory second opinion for all Cs (planned or not).
3. Make written guidelines available for all physicians at the hospital.
4. Implement the monthly medical audits of the obstetrical practice.
5. Get a commitment from hospital obstetric departments to work on lowering the C-section rate.

6. Caesarean sections should ideally only be undertaken when medically necessary. Every effort should be made to provide caesarean sections to women in need, rather than striving to achieve a specific rate.
7. In making plans for delivery, physicians and patients should consider a woman's chance of a successful vaginal birth after cesarean (VBAC) as well as the risk of complications from a trial of labor.
8. Implement in case of induction a policy of informed consent that allows the mother to be fully informed of the possible consequences and benefits of an induction for non medical reasons.
9. Multifaceted strategies, based on audit and detailed feedback, are advised to improve clinical practice and effectively reduce caesarean section rates.
10. Alert patients about the true risks of major abdominal (C-section) surgery, compared to normal vaginal deliveries.
11. Provide more training and support for women giving birth to twins to do so vaginally.
12. Mobilize an effort to evaluate the effectiveness and need for labor induction, continuous fetal monitoring and epidurals because all of these procedures can lead to more C-sections.

Introduction

Caesarean section (CS) is a life-saving surgical procedure when certain complications arise during pregnancy and labour. However, it is a major surgery and is associated with immediate maternal and perinatal risks and may have implications for future pregnancies as well as long-term effects that are still being investigated (1–4). The use of CS has increased dramatically worldwide in the last decades particularly in middle- and high-income countries, despite the lack of evidence supporting substantial maternal and perinatal benefits with CS. Some studies had shown a link between increasing CS rates and poorer outcomes (5, 6). The reasons for this increase are multifactorial and not well-understood. Changes in maternal characteristics and professional practice styles, increasing malpractice pressure, as well as economic, organizational, social and cultural factors have all been implicated in this trend (7–10). Additional concerns and controversies surrounding CS include inequities in the use of the procedure, not only between countries but also within countries and the costs that unnecessary caesarean sections impose on financially stretched health systems (11, 12).

Country-level CS rates worldwide were compiled and global and regional estimates were generated and published in 2007 (13). According to the latest data from 150 countries, 18.6% of all births occur by CS, ranging from 6% to 27.2% in the least and most developed regions, respectively. Based on the data from 121 countries, the trend analysis showed that between 1990 and 2014, the global average CS rate increased 12.4% (from 6.7% to 19.1%) with an average annual rate of increase of 4.4%.

The World Health Organization recommends (WHO) that the rate of cesarean section (CS) should not exceed 10-15% in any country (14). In recent years, the rate of cesarean deliveries increased dramatically worldwide with many countries had exceeded the WHO recommended rate (15). Similar to other countries, the rate of CS in Jordan is high exceeding the WHO recommendation (16). One study in Jordanian Teaching hospitals showed that the rate of CS increased from 18.2% in 2002 to 30.3% in 2012 with the most common reason for CS being “absence of a clear indication” (16).

Many factors have been identified to be associated with CS across the world such premature rupture of the amniotic fluid membrane, cephalic pelvic disproportion, fetal distress, multiple pregnancy, breech presentation, place of health seeking (private/ public), maternal preferences, birth weight, parity, maternal height and history of antenatal care visit (17-23).

The main indications for cesarean delivery are previous cesarean delivery, breech presentation, abnormal labor, and fetal distress (24). However, when a CS is performed without medical need, it puts mothers and their babies at risk of short- and long-term health problems. Most complication of CS comes from the cause which leads to CS. Risks of short-term and long-term maternal and infant morbidity associated with elective caesarean section are higher than those associated with vaginal birth (25-27).

General objective: Determine the extent, causes, and factors associated with cesarean deliveries in north of Jordan and their associated maternal and neonatal outcomes.

Specific objectives:

1. Determine the rate of CS among Jordanian women in north of Jordan
2. Determine the causes and risk factors of CS in north of Jordan
3. Identify the associated maternal and perinatal outcomes (risks) of CS in north of Jordan.

Methods

Study design

A prospective hospital-based longitudinal study was conducted to determine the rates, causes, and risk factors of CS in north of Jordan. Women were enrolled in the study after delivery, shortly before or at the time of discharge from the selected health facilities. All women who gave birth (dead or alive) at 20 weeks of gestation or more in each of the selected hospitals were eligible for inclusion. Necessary data for mothers including socio-demographic, clinical, maternal, pregnancy, delivery and other risk factors were gathered through face-to-face interview using a semi-structured questionnaire and by abstraction of data from medical records. All information in the study questionnaires including causes of CS were confirmed by physicians.

Study setting / data sources

The study took place in 4 major maternity hospitals in Irbid governorate in north of Jordan; one public hospital, one military hospital, one teaching hospital, and one private hospital. The main researcher was responsible for overseeing the day-to-day work and ensuring the quality of data and monitoring progress, and for training the study team.

Study population

The study population included all women who will give birth (dead or alive) after 20 weeks of gestation during the study period in the selected four hospitals regardless the mode of delivery. The four hospitals serve women from all parts of the north of Jordan. Women who gave birth in the selected hospitals were heterogeneous in terms of socio-economic status, residency are (rural and urban), and clinical characteristics. The teaching hospital is a referral center for women from different parts of the north of Jordan. Although the settings were four hospitals in the same city but they serve different populations. All hospitals have a 24-hour in-house attending specialist or faculty coverage, and most births are attended by residents with specialist or faculty supervision.

Sample size

The sample size was determined for the purpose of estimating the rate of CS and determination of the association between any independent variable (Z) and CS. At a confidence level of 95%, the minimum sample size needed to estimate the expected CS rate of 30% (a rate that was estimated in a study in Jordan in 2012 (16) with a precision of 5% was calculated as 608. The sample size was planned to be increased to more than 1200 women to have an expected 360 CS cases to give a better picture on the indications of CS and its association with rare risk factors. The power to detect a clinically significant association (odds ratio of 1.5) between any independent important factor and CS or between CS and any associated outcome (in a case-control analysis plan using logistic regression analysis) is exceeding 80%. The number of women selected from each hospital was proportional to the number of deliveries in each hospital. Sample size calculations were performed using EpiCalc 2000 and G*Power 3.1

Data collection

Necessary data for mothers and their newborns including socio-demographic, clinical, maternal, pregnancy, delivery and other risk factors were gathered through face-to-face interview using a semi-structured survey instrument (Annex 1) and review of the medical records. Data on cesarean delivery including cause, whether the CS was planned or emergency, and the occurrence of any complications were ascertained by the obstetrician. Questions were grouped in sections, positioned in a logical order, and clearly numbered to lessen the chance of getting lost in using this long survey. A consent form was developed with an introductory paragraph explaining the purpose of the survey, asking for permission to do the interview and stating that the information obtained during the study is confidential.

The questionnaire included questions about factors that might be associated with CS and its associated maternal and perinatal outcomes including demographic (age of mother; education of mother); socioeconomic (socioeconomic status, employment status of mother and father), and family characteristics (birth order; birth interval); antenatal factors (routine visits, identification and appropriateness of management of complications, counseling for birth preparedness and breastfeeding); clinical characteristics (Preeclampsia, diabetes mellitus, high blood pressure, anemia, etc.); delivery factors (length of gestation, location of birth, birth attendant, type of delivery, mechanical assistance; Fetal outcomes (stillbirth, Apgar score at 5min , Apgar score1 min).

The baby was scored at 1 and 5 minutes after birth. Apgar score was classified as: A score of 8–10 is considered normal, 4–7 is intermediate, 0–3 is poor and the infant requires immediate resuscitation. Data about gestational age were recorded in the study questionnaires based on what reported by practicing physicians, based on both ultrasound and the last menstrual period. It was calculated as the interval between the date of delivery of the fetus or newborn and the first day of the mother's last normal menstrual period. A premature baby is born before 37 completed weeks of pregnancy. Based on the gestational age, preterm babies were further classified as follows: Preterm babies are born between the gestational ages of 32-36 weeks of gestation, as calculated from the mother's last normal menstrual period; Very preterm babies are born between the gestational ages of <31 weeks.

A stillbirth was defined as any fetus born without a heartbeat, respiratory effort or movement, or any other sign of life. Preeclampsia was defined according to International Society for the Study of Hypertension in Pregnancy (ISSHP). Obesity was defined according to body mass index (BMI) and it was calculated as pre-pregnancy women weight in Kg divided by height in meters square. A woman with BMI > 30 kg/m^2 was considered as obese.

Data management plan

Data were analyzed using the Statistical Package for Social Sciences (SPSS IBM 20). The rate of CS, overall and by relevant variables were calculated. The differences in CS rates according to studied variables were tested using Chi-square test. Multivariate analysis using logistic regression was conducted to determine the factors associated with CS. We assessed the presence of multicollinearity among the selected independent variables using cross-tabulations which showed a strong correlation between some independent variables. Several variables were involved in interdependencies. To deal with the multicollinearity in other variables, different

regression models were developed. The effect of variables was tested by adding one variable each time. The variables that were not significant in this step were excluded from the model. The adjusted odds ratios and 95% confidence intervals (CIs) were determined for variables in the constructed models. The outcomes of cesarean delivery for the baby were obtained and compared with the rest of the deliveries in bivariate and multivariate models. The frequencies of the different causes for CS were also obtained. CS was classified into emergency and planned and the frequency of each, overall and by relevant variables were obtained. A p-value of less than 0.05 was considered statistically significant.

Coordination, monitoring and quality control

Before and during data collection, a quality control process was implemented to ensure quality of the data. The principal investigator provided close supervision of every step of data collection and data entry in order to maintain data quality. In all phases of this study, close coordination was assured between the principal investigator and the data collectors. This was achieved through phone calls, meetings, and arranging site visits. The study questionnaire were developed and structured carefully to avoid confusion and minimize possible errors.

Ethical considerations:

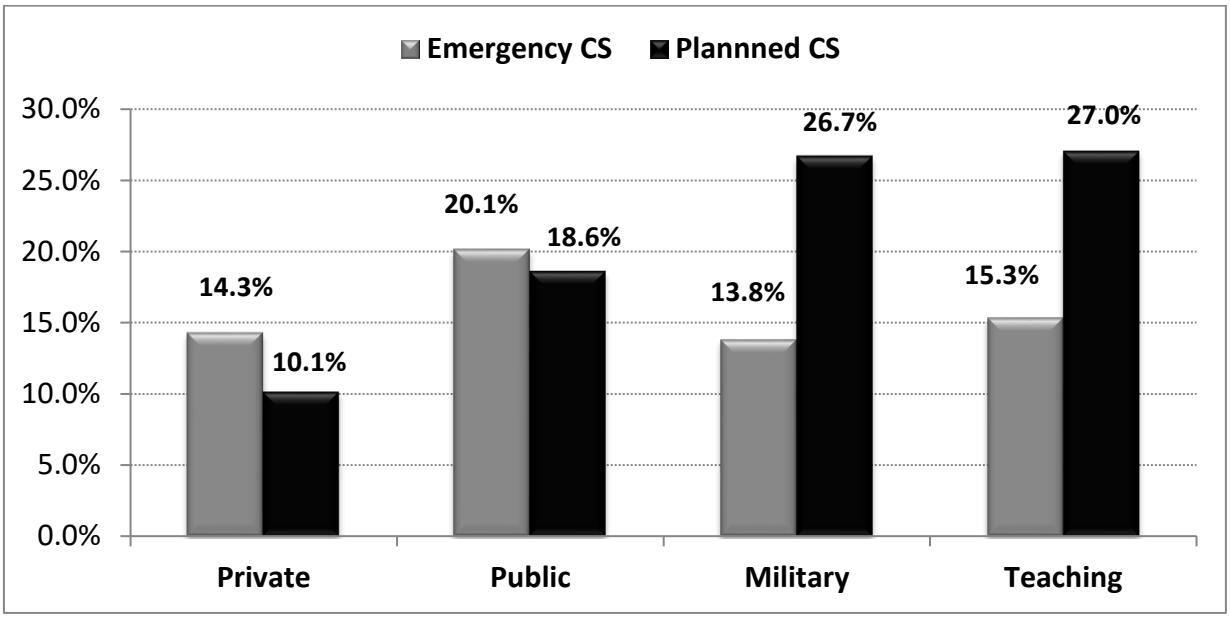
Ethical approval of the study was obtained prior to implementation. The importance of confidentiality and the protection of the identity of respondents was emphasized during training of the study team and as a part of the continuing supervision during data collection. A verbal informed consent was obtained from all participating women. Every effort was made to protect the confidentiality and the identity of participants. During data collection, participants had the full right to drop out at any time during the study and to not respond to questions they did not wish to answer. No harm to participating hospitals was anticipated because the study results were reported as overall estimates. No reporting by individual hospitals was carried out so that the interests and privacy of the individual hospitals were protected.

Results

Rate of Cesarean Section

A total of 1347 women were enrolled in this study. The overall rate of CS was 37.5% among Jordanian women. The rates were 16.3% for emergency CS and 21.2% for planned CS. The rate of CS varied significantly according to health sector. The rates of planned CS were 27.0% in teaching hospitals, 26.7% in military hospitals, 18.6% in public hospitals, and 10.1% in private hospitals. The rates of emergency CS were 15.3% in teaching hospitals, 13.8% in military hospitals, 20.1% in public hospitals, and 14.3% in private hospitals. Overall, the highest rates of CS were in teaching and military hospitals (Figure 1).

Figure 1. The rate of emergency and planned caesarean section according to health sector.



Rate of CS according to socio-demographic characteristics

Table 1 shows the mode of delivery for Jordanian women according to their socio-demographic characteristics. The rate of planned CS increased significantly with increasing age, being the highest among women who were older than 35 years (44.6%). The rate differed significantly according to occupation. The rate of planned pregnancy was significantly higher among employed women compared to housewives (25.8% vs. 20.1%). The rate of emergency CS was significantly higher among women who delivered boys compared to those who delivered girls (19.1% vs. 13.2%). The rate of CS did not differ significantly according to mothers' and fathers' education and income.

Table 1. Mode of delivery among Jordanian women according to socio-demographic characteristics.

	Mode of delivery							
	Vaginal delivery		Emergency CS		Planned CS		Total	
	n	%	n	%	n	%	N	p-value
Age (year)								<0.005
<20	49	76.6	12	18.8	3	4.7	64	
20-35	728	64.7	183	16.3	214	19.0	1125	
>35	61	38.9	26	16.6	70	44.6	157	
Mother's education								
<12	165	64.5	48	18.8	43	16.8	256	0.207
12-14	392	61.4	96	15.0	150	23.5	638	
>14	282	62.3	77	17.0	94	20.8	453	
Father's education								
<12	190	59.7	62	19.5	66	20.8	318	0.483
12-14	419	63.5	104	15.8	137	20.8	660	
>14	230	62.8	54	14.8	82	22.4	366	
Income (Jordan Dinars)								
≤350	522	64.0	136	16.7	158	19.4	816	0.095
>350	317	59.7	85	16.0	129	24.3	531	
Occupation								
Housewife	682	63.9	171	16.0	215	20.1	1068	
Employee	157	56.3	50	17.9	72	25.8	279	
Baby's gender								0.013
Male	427	60.1	136	19.1	148	20.8	711	
Female	412	64.8	84	13.2	140	22.0	636	

Rate of CS according to clinical characteristics

Compared to women with normal blood pressure, the rates of planned CS (30.9% vs. 20.9%) and emergency CS (27.3% vs. 15.9%) were significantly higher among women with hypertension (Table 2). Preeclampsia was significantly associated with higher rate of planned CS (51.6% vs. 20.6%) and lower rate of emergency CS (9.7% vs. 16.6%). The rate of planned CS was

significantly much higher among women with pregestational diabetes, while the rate of emergency CS was much higher among women with gestational diabetes. Women who were hospitalized between 24 and 34 weeks of gestation were more likely to be planned for CS.

Table 2: Mode of delivery among Jordanian women according to clinical characteristics.

	Mode of delivery							
	Vaginal delivery		Emergency CS		Planned CS		Total	
	n	%	n	%	n	%	N	p-value
Anemia								
Yes	136	62.1	29	13.2	54	24.7	219	.226
No	703	62.3	192	17.0	233	20.7	1128	
Urinary tract infection								
Yes	139	65.9	27	12.8	45	21.3	211	.286
No	700	61.6	194	17.1	242	21.3	1136	
High blood pressure								
Yes	23	41.8	15	27.3	17	30.9	55	0.005
No	816	63.2	206	15.9	270	20.9	1292	
Preeclampsia								<0.005
Yes	12	38.7	3	9.7	16	51.6	31	
No	827	62.8	218	16.6	271	20.6	1316	
Diabetes								
No diabetes	831	62.8	214	16.2	278	21.0	1323	.018
Gestational diabetes	6	35.3	6	35.3	5	29.4	17	
Pregestational diabetes	2	28.6	1	14.3	4	57.1	7	
Hospitalization between 24 and 34 weeks of gestation								<0.005
Yes	37	33.3	22	19.8	52	46.8	111	
No	802	64.9	199	16.1	235	19.0	1236	

Rate of CS according to obstetric characteristics

Table 3 shows the mode of delivery among Jordanian women according to obstetric characteristics. The rate of planned pregnancy was higher among women with history of low/preterm delivery (38.9% vs. 20.3%), history of previous CS (66.2% vs. 10.4%), history of stillbirth/neonatal death (42.9% vs. 20.0%), and history of abortion (28.3% vs. 18.8%). It seems that these women with history of these conditions were more likely to be planned for CS leaving the rate of emergency CS being lower in this group of women. The rate of planned CS increased significantly with increased number of deliveries while the rate of CS was the highest for primiparous women.

Table 3. Mode of delivery among Jordanian women according to obstetric characteristics

	Mode of delivery							
	Vaginal delivery		Emergency CS		Planned CS		Total	
	n	%	n	%	n	%	N	p-value
Number of fetuses								.053
Single	819	65.5	209	16.7	222	17.8	1250	
Multiple	20	20.4	12	12.2	66	67.3	98	
History of low/preterm delivery								<0.005
No	799	62.7	217	17.0	259	20.3	1275	
Yes	40	55.6	4	5.6	28	38.9	72	
History of previous CS								<0.005
Yes	58	22.1	31	11.8	174	66.2	263	
No	781	72.0	190	17.5	113	10.4	1084	
History of stillbirth/neonatal death								<0.005
No	810	63.8	206	16.2	254	20.0	1270	
Yes	29	37.7	15	19.5	33	42.9	77	
History of abortion								<0.005
Yes	197	54.6	62	17.2	102	28.3	361	
No	642	65.1	159	16.1	185	18.8	986	
Time of first antenatal								

1st trimester	803	61.9	217	16.7	277	21.4	1297	.239
2nd trimester	25	69.4	2	5.6	9	25.0	36	
3rd trimester	4	66.7	2	33.3	0	0.0	6	
No visit	7	87.5	0	0.0	1	12.5	8	
Number of antennal care visits								.301
None	7	87.5	0	0.0	1	12.5	8	
1-8	113	67.3	22	13.1	33	19.6	168	
>8	719	61.4	199	17.0	253	21.6	1171	
Number of deliveries								<0.005
1	255	62.5	100	24.5	53	13.0	408	
2	232	69.5	43	12.9	59	17.7	334	
3-4	233	59.1	49	12.4	112	28.4	394	
≥5	119	56.4	29	13.7	63	29.9	211	

Reasons for Planned CS

Table 4 shows the various reasons for planned cesarean section according to health sector. The most frequent reason was scarred uterus (50.0%). The second most common reason was multiple fetuses (20.8%). Other relatively common reasons included abnormal presentation (7.6%) and mothers' desire for CS (6.9%). The distribution of these reasons varied significantly according to sector. For example, scarred uterus was the common reason in public sector (63.5%) and lowest in military and teaching hospitals.

Table 4. The reasons for planned cesarean section among Jordanian women according to sector

	Health sector									
	Private		Public		Military		Teaching		Total	
	n	%	n	%	n	%	n	%	N	%
Scarred uterus	11	50.0	54	63.5	37	40.7	42	46.7	144	50.0
Multiple fetuses	1	4.5	16	18.8	23	25.3	20	22.2	60	20.8
Placenta previa / malposition	0	0.0	2	2.4	2	2.2	3	3.3	7	2.4
Large fetus	2	9.1	0	0.0	0	0.0	0	0.0	2	0.7

Mother's desire	1	4.5	4	4.7	5	5.5	10	11.1	20	6.9
Abnormal presentation	0	0.0	1	1.2	15	16.5	6	6.7	22	7.6
Special medical condition	0	0.0	0	0.0	3	3.3	1	1.1	4	1.4
others	2	9.1	1	1.2	4	4.4	3	3.3	10	3.5
Precious fetus	2	9.1	2	2.4	0	0.0	1	1.1	5	1.7
Old primi	1	4.5	1	1.2	0	0.0	0	0.0	2	0.7
Post date	1	4.5	2	2.4	1	1.1	0	0.0	4	1.4
Anterior posterior repair	0	0.0	1	1.2	0	0.0	0	0.0	1	0.3
Congenital anomaly	0	0.0	0	0.0	0	0.0	2	2.2	2	0.7
Bad obstetric history	0	0.0	0	0.0	0	0.0	1	1.1	1	0.3
Cephalopelvic disproportion	0	0.0	0	0.0	0	0.0	1	1.1	1	0.3
Oligohydraminous	1	4.5	1	1.2	1	1.1	0	0.0	3	1.0

Reasons for Emergency CS

Table 5 shows the various reasons for emergency cesarean section according to health sector. The most frequent reason was prolonged fetal distress (33.5%) followed by obstructed labor (22.2%), abnormal presentation (13.1%), and eclampsia or sudden severe high blood pressure or seizure (6.3%). The distribution of these reasons varied according to health sector. For example, obstructed labor accounted for 41.9% of emergency CSs in private hospitals as compared to 7.6% in public hospitals.

Table 5. The reasons for emergency cesarean section among Jordanian women according to sector

	Health sector								Total	
	Private		Public		Military		Teaching			
	n	%	n	%	n	%	n	%	N	%
Eclampsia or sudden severe high blood pressure or Seizure	0	0.0	13	14.1	0	0.0	1	2.0	14	6.3
Heavy persistent vaginal bleeding	2	6.5	2	2.2	2	4.3	0	0.0	6	2.7
Cephalopelvic disproportion	2	6.5	2	2.2	1	2.1	1	2.0	6	2.7
Obstructed labor	13	41.9	7	7.6	14	29.8	15	29.4	49	22.2
Failed vacuum or forceps delivery	0	0.0	0	0.0	0	0.0	2	3.9	2	0.9
Cord prolapse	1	3.2	1	1.1	2	4.3	2	3.9	6	2.7

Mother exhaustion	0	0.0	11	12.0	0	0.0	0	0.0	11	5.0
Abnormal presentation	1	3.2	18	19.6	5	10.6	5	9.8	29	13.1
Other mother reasons	3	9.7	7	7.6	2	4.3	0	0.0	12	5.4
Premature labor pain	1	3.2	1	1.1	0	0.0	0	0.0	2	0.9
Prolonged fetal distress	5	16.1	26	28.3	21	44.7	22	43.1	74	33.5
Other fetal reason	3	9.7	4	4.3	0	0.0	2	3.9	9	4.1
failed labour induction	0	0.0	0	0.0	0	0.0	1	2.0	1	0.5

Multivariate analysis of factors associated with planned cesarean section

Multivariate analysis (Table 6) showed different factors to be associated with planned CS including socio-demographic, anthropometric, clinical, and obstetric factors. Health sector was not significantly associated with the rate of planned CS after adjusting for important variables. The odds of planned CS among women aged 20-35 and >35 years were 7.5 and 38.2 times that odds among women aged <20 years, respectively. Income of >350 was significantly associated with increased odds of planned CS by two times. Women with previous cesarean section had much higher odds to be planned for CS (OR = 30.1). Breach presentation was associated with a very high odds of planned CS (OR = 245). Women with multiple fetuses were 13.2 times more likely to deliver via planned CS compared to women with single fetus.

Table 6. Multivariate analysis of factors associated with planned cesarean section

	OR	95% confidence interval		p-value
		Lower	Upper	
Sector				
Private	1.0			
Public	1.5	0.7	3.2	0.251
Military	1.8	0.9	3.8	0.108
Teaching	1.7	0.8	3.4	0.134
Age				
<20	1			
20-35	7.5	0.6	92.0	0.114
>35	38.2	3.0	486.9	0.005

Income				
≤350				
>350	1.9	1.2	3.1	0.005
Number of fetuses				
Single	1.0			
Multiple	13.2	5.6	31.1	0.000
Previous cesarean section	30.1	19.0	47.6	0.000
Presentation				0.000
Cephalic				
Breech	245.0	49.6	1211.6	0.000
Gestational age				
≤31				
32-36	8.0	1.6	39.9	0.011
≥37	2.8	0.6	12.9	0.199

Multivariate analysis of factors associated with emergency cesarean section

Women with previous cesarean section had twice higher odds to deliver via emergency CS (OR = 2.2) compared to women with no previous CS. Breach presentation was associated with a very high odds of emergency CS (OR = 58.7). Having a boy baby, gestational diabetes, and hospitalization between 24 and 34 weeks of gestation were significantly associated with increased odds of emergency CS.

Table 7. Multivariate analysis of factors associated with emergency cesarean section

Variable	OR	95% confidence interval		p-value
Previous cesarean section	2.2	1.3	3.8	0.003
Presentation				
Cephalic				
Breech	58.7	12.7	271.9	0.000
Baby's gender				
Female	1			
Male	1.7	1.1	2.4	0.007
History of low/preterm delivery	3.6	1.1	12.2	0.041

Diabetes status				
No Diabetes	1			
Gestational diabetes	4.0	1.1	15.0	0.038
Pregestational diabetes	4.6	0.3	82.7	0.299
Hospitalization between 24 and 34 weeks of gestation	2.5	1.4	5.0	0.003

Pregnancy outcomes according to mode of delivery

Table 8 shows the pregnancy outcomes according to mode of delivery. About 45.6% of newborns delivered vaginally had good Apgar scores at 1 minute (8-10) compared to 46.2% for planned CS and 28.9% for emergency CS. The stillbirth rate was significantly higher (p=0.000) for planned CS (1.7%) and vaginal delivery (1.5%) compared to emergency CS (0.5%).

Table 8. Pregnancy outcomes according to mode of delivery

	Mode of Delivery						Total	
	Vaginal delivery		Emergency CS		Planned CS			
	n	%	n	%	n	%	n	%
Stillbirth	13	1.5	1	0.5	5	1.7	19	1.4
Apgar score 1 minute								
Poor (0-3)	8	1	3	1.4	5	1.8	16	1.2
Intermediate (4-7)	426	53.4	152	69.7	144	52	722	55.8
Normal (8-10)	364	45.6	63	28.9	128	46.2	555	42.9
Apgar score 5 minute								
Poor (0-3)	2	0.3	2	0.9	0	0	4	0.3
Intermediate (4-7)	19	2.4	18	8.3	24	8.7	61	4.7
Normal (8-10)	776	97.4	198	90.8	252	91.3	1226	95

Discussion

Rate of Cesarean Section in Jordan

The main finding of the study is the markedly high rate of CS (37.5%). The rate was 16.3% for emergency CS and 21.2% for planned CS. This rate is much higher than the previously reported rates from a study of maternal morbidity in Jordan (2007-2008) by the Higher Population Council (27.7%) (28) and from the 2007 Jordan Population and Family Health Survey (18.5%). The figure becomes more striking when compared to the previously reported data from seven military hospitals across the country revealing a rate of only 8% for the period 1990-1992 which increased to 10.9% for the period 1999-2001 (29).

Many researchers had studied the increase in rate of CS and tried to suggest solutions for the problem. Robson et al. (30) suggested a Multidisciplinary Quality Assurance Program in each delivery unit as cesarean delivery should not be considered in isolation from other outcomes. Moreover, a Joint workshop of Eunice Kennedy Shriver National Institute of Child Health and Human Development, Society for Maternal-Fetal Medicine, and American College of Obstetricians and Gynecologists (31), addressed the concept of preventing the first cesarean. The workshop addressed essential issues particularly those concerning definition of common indications for cesarean delivery such as "failed induction" and "arrest of labor progress". Authors recommended that health caregivers should get adherent to appropriate definitions and enough time should be given before establishing the diagnosis of these indications.

Increasing Trend of CS and Its Possible Reasons

It is evident that there has been a rapidly increasing trend of CS in Jordan. In fact, an increasing trend in cesarean deliveries has been observed almost everywhere during the past few decades. In the United States, in 1970, the rate of cesarean was 5.5% as reported by the National Center for Health Statistics and the Center for Disease Control and Prevention. Cesarean delivery increased from 20.7% in 1996 to 31.1% in 2006 (32) and to 32.2% in 2014. (33).

In Egypt, cesarean rate increased from 4.6% to 10% between 1992 and 2000 (34). Ba'aqeel (35) reported that over the period between 1997 and 2006, CS delivery rate in Saudi Arabia increased from 10.6% to 19.1%.

The high rate of CS has well surpassed the recommendations of the WHO health experts who considered the ideal rate for CS to be between 10% and 15%. It has been claimed that many reasons may have led to this high rate of CS including:

1) Timing of delivery: Obstetricians get used to time deliveries according to their schedules and mothers get used to time deliveries according their convenient time or date.
2) Training of residents: Some residents may occasionally perform unnecessary CSs for training purposes. The present study showed the highest CS rate in teaching hospitals. However, the kind of women delivering in teaching hospitals may differ from women delivering in other hospitals which may explain such higher CS rates in teaching hospitals.
3) Financial reasons.
4) Improvement in tools used in delivery rooms like those used in monitoring fetal heart and fetal distress may contribute to the increasing CS rate.
5) Fear of complications may lead some obstetricians to perform CS without giving enough time for a fair trial of labor.

Socio-demographic factors related to CS

This study showed that CS was significantly higher among women who were older than 35 years (44.6%). Peipert and Bracken observed that women whose age is > 30 years had a 70% increased risk for cesarean delivery compared with women < 30 (36). Other studies showed that increased maternal age is associated with an increase in CS rate. There is no satisfactory explanation for this linear association between age and the CS rate. However, pelvic rigidity and over care for premium babies in this group might be behind this increase.

Although we did not found a difference in CS rate according to women' education level, other studies found that CS rate was significantly higher in highly educated women. Highly educated women tend to be older than low educated women, because usually they get married and pregnant at an older age.

Clinical characteristics related to CS

We observed that women with preeclampsia have an increased rate of CS. Preeclampsia is known to be associated with a higher incidence of intrauterine growth restriction, fetal distress and prematurity. Therefore, many mothers with preeclampsia are planned to deliver by CS. Similar findings were reported from several studies (37). The real danger with preeclampsia is that it prevents the placenta from getting the proper amount of blood needed which decreases the oxygen flow to the baby leading to breathing problems and low birth weight. High blood pressure overtime can lead to deterioration of mother and baby organs which may be fatal.

Our study showed that CS rate was significantly higher in mothers complaining of gestational diabetes or pregestational diabetes. These results are consistent with a study done in University

of Liverpool, which showed a high CS rate (67%) in women with type 1 and type 2 diabetes compared to 21% in other women. It has been recently discovered that women with diabetes have impaired uterine contractility (38).

Reasons for CS

CS is done either for emergency or planned reasons. As regard to emergency CS, the most common reported reasons in the current study were prolonged fetal distress and abnormal presentation like breech or transverse presentations. These results are consistent with the findings of a study in Bangladesh where the most common reasons cited for emergency CS were fetal distress and prolonged obstructed labor (39). Another study was done to determine the leading indications for emergency CS in West Visayas State University from January 2005 to December 2007. Dystocia (30.8%) emerged as the leading indication for emergency CS followed by malpresentation (23.8%) (41), a finding that is consistent with findings of the current study.

In regards to planned CS, the most frequent reason cited was scarred uterus which mostly indicates previous CS and abnormal presentation mostly (breech). These results are consistent with a study done in Bangladesh where the most common reasons cited for planned CS were previous CS and poor obstetric history. It's claimed that if pregnant women had a past history of CS the next delivery will be mostly by CS, and if pregnant women had delivered the last two deliveries by CS it will be an indication for CS (39). Overall, our findings are similar to most previous studies showing that the main reasons for cesarean delivery are previous cesarean delivery, breech presentation, abnormal labor (dystocia), and fetal distress. (24).

Among the proposed factors contributing to the increase in cesarean is mother's desire. Mother's desire in the current study was one of the main reasons for planned CS. Results from a previous study in the same population of Jordan (40) showed that the reason for preference of CS was simply to avoid pain of vaginal delivery. Consistent with the current study, a study done in UK and Northern Europe showed that the CS rate upon mother request was around 6% to 8% of all primary cesarean sections. Different figures were reported for CSs upon mother desire from USA (11%) (27,41) and Australia (17%) (30). Dobson found that CS rate is often attributed to an increase upon mother request (42).

On the other hand in a previous study of maternal morbidity in Jordan (2007- 2008), mother desire accounted for less than 1% of cesarean deliveries (The Higher Population Council, 2008). It may be seriously doubted whether CS upon mother request is solely responsible for the

worldwide increase in cesarean rates. But there is a solid belief that scientific progress, social and cultural changes, may lead to change in mother desire and attitude to CS.

Conclusions

Jordan has a markedly high rate of CS (37.5%). The rate of planned CS is higher than that of emergency CS. Scarred uterus and multiple fetuses are the most common reasons for planned CS. The main reasons for emergency CS are prolonged fetal distress, obstructed labor, and abnormal presentation. The distribution of reasons for planned and emergency CS varies according to health sector.

Age >35 years, previous cesarean section, breach presentation, and multiple fetuses were the significant predictors of planned CS. Health sector was not significantly associated with the rate of planned CS after adjusting for important variables. On the other hand, previous cesarean, breach presentation, having a boy baby, gestational diabetes, history of low/preterm delivery and hospitalization between 24 and 34 weeks of gestation were significantly associated with increased odds of emergency CS. The rate of stillbirth was significantly higher for planned CS (1.7%) and vaginal delivery (1.5%) compared to emergency CS (0.5%). However, the small number of stillbirths in this study make difficult to reach a conclusion on its association with mode of delivery.

Suggestions for Future Research

Future research is needed to explore the nonclinical causes of CS like attitudes, behaviors, and skills of obstetricians as well as the social, economic, and legal environment in the country. We need also to understand the preferences of women in this regard. As much of the offered causes for cesarean delivery in this study are to an extent subjective and dependent on the judgment of the physician, research may be directed to uncover the true causes for this alarming health problem. The effects of caesarean section rates on other outcomes, such as maternal and perinatal morbidity, pediatric outcomes, and psychological or social well-being are still unclear. More research is needed to understand the health effects of caesarean section on immediate and future outcomes

Recommendations

Based on the available data and using internationally accepted methods to assess the evidence with the most appropriate analytical techniques, caesarean sections are effective in saving maternal and infant lives, but only when they are required for medically indicated reasons. At population level, caesarean section rates higher than 10% are not associated with reductions in maternal and newborn mortality rates. Caesarean sections can cause significant and sometimes permanent complications, disability or death particularly in settings that lack the facilities and/or capacity to properly conduct safe surgery and treat surgical complications. Therefore, we recommend the followings:

1. A multidisciplinary quality assurance program should be established in all Jordanian facilities in which delivery occurs. As most CSs are currently based on physician's judgment, it may be extremely useful to develop and strictly implement national guidelines for performing CSs.
2. Implement a policy of mandatory second opinion for all Cs (planned or not).
3. Make written guidelines available for all physicians at the hospital.
4. Implement the monthly medical audits of the obstetrical practice.
5. Multifaceted strategies, based on audit and detailed feedback, are advised to improve clinical practice and effectively reduce caesarean section rates.
6. Caesarean sections should ideally only be undertaken when medically necessary. Every effort should be made to provide caesarean sections to women in need, rather than striving to achieve a specific rate.
7. In making plans for delivery, physicians and patients should consider a woman's chance of a successful vaginal birth after cesarean as well as the risk of complications from a trial of labor.
8. Implement in case of induction a policy of informed consent that allows the mother to be fully informed of the possible consequences and benefits of an induction for non medical reasons.
9. Get a commitment from hospital obstetric departments to work on lowering the C-section rate.
10. Alert patients about the true risks of major abdominal (C-section) surgery, compared to normal vaginal deliveries.
11. Provide more training and support for women giving birth to twins to do so vaginally.

12. Mobilize an effort to evaluate the effectiveness and need for labor induction, continuous fetal monitoring and epidurals because all of these procedures can lead to more C-sections.

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Serial No.

STUDY FORM

PRE-DISCHARGE INTERVIEW OF THE MOTHER

1. Women information

1.1 Nationality: 1. Jordanian 2. Iraqi 3. Palestinian 4. Syrian 5. Other, specify_____

1.2 Permanent residence:_____

1.23.1 Governorate_____1.2.2 City/village_____

1.3 Age of the mother in achieved years: [ ] years

1.5 Years of formal schooling completed by the husband: [ ] years

1.6 Occupation: 1. Housewife 2. Employee 3. Other: specify _____

1.7 Total monthly family income in JDs: [ ]

1.8 Number of children still alive (excluding the current birth): [ ]

1.9 Previous history:

1.9.1. Previous premature deliveries (Children born before 37 weeks): 1. Yes 2. No
1.9.2. Previous low birth weight deliveries (Children born with birth weight less than 2500g): 1. Yes 2. No
1.9.3. Previous neonatal deaths (Children born alive and died before 28 days): 1. Yes 2. No
1.9.4. Previous stillbirths: 1. Yes 2. No
1.9.5. Previous spontaneous abortions/miscarriages 1. Yes 2. No
1.9.6. Previous C-Sections 1. Yes 2. No (if yes, how many: _____)

1.10. Consanguinity:

1. Not relatives
2. First degree (أولاد وبنات العم، أولاد وبنات الخال، اولاد وبنات الخالة، أولاد وبنات العمة)
3. Second degree (الأقارب الأبعد)

1.11. Religion: 1. Muslim 2. Christian 3. Other; specify:_____

2. HISTORY OF CURRENT PREGNANCY

2.1 Mother pre-gestational weight ( ) Kg
2.2 Mother pre-gestational height: ( ) cm
2.3. Number of pregnancies including this one: [ ]
2.4. Number of deliveries including this one: [ ]
2.5 How many antenatal visits did you attend during this pregnancy? [ ]
2.6 When did you get the first antenatal visit for this pregnancy?
1: During the 1st trimester 2: 2nd tri- mester 3: 3rd trimester 4: No visit

2.7 Number of fetuses: 1: Singleton fetus 2: Two fetuses 3: ≥3 fetuses

2.9. Smoking during this pregnancy: 1. Yes 2. No
2.10 If yes, how many cigarettes/day on average [ ]
2.11 Diseases/conditions during the current pregnancy

Has the women been diagnosed with any of the following conditions during the current pregnancy?

Conditions	Yes	No
2.11.1 Anemia (<11g/dl)	1. Yes	2. No
2.11.2 Fever (>38°C) within two weeks before delivery	1. Yes	2. No
2.11.3 Urinary track infection within two weeks before delivery	1. Yes	2. No
2.11.4 High Blood Pressure	1. Yes	2. No
2.11.5 Pre gestational diabetes	1. Yes	2. No
2.11.6 Gestational diabetes	1. Yes	2. No
2.11.7 Preeclampsia	1. Yes	2. No
2.11.8 Diagnosed with Glucose-6-phosphate dehydrogenase deficiency (G6PD)	1. Yes	2. No
2.11.9 Other diseases, specify: 1:_____ 2.:_____ 3:_____		

2.12 Hospitalization(s) during the current pregnancy? 1. Yes 2. No
If the answer is "No", go to question "5.17"
2.13 If yes, number of hospitalizations: [ ]
5.14 Reasons for hospitalization(s) if any:
5.14.1: Hypertension: 1. Yes 2. No
5.14.2: Preterm delivery: 1. Yes 2. No
5.14.3: Intrauterine growth retardation: 1. Yes 2. No
5.14.4: Preeclampsia: 1. Yes 2. No
5.14.5: Others: specify:_____
2.15. Was the woman hospitalized between 24- 34 weeks of pregnancy? 1. Yes 2. No

2.16. If yes, was the prophylactic treatment for respiratory distress syndrome given: 1. Yes 2. No
2.17. Was the mother transferred from any other hospital? 1. Yes 2. No
2.18 If yes, what was the indication of transfer?
2.18.1 Due to the mother condition 1. Yes 2. No
2.18.2 Due to the fetus condition 1. Yes 2. No
2.18.3 No insurance 1. Yes 2. No
2.18.4 Others, specify the indication of transfer: _____

3. HISTORY OF THE CURRENT DELIVERY

3.1 Gestational age in weeks: [ ]

3.2 Presentation of fetus: 1: Cephalic 2: Breech 3: Other: specify: _____

3.3 Onset of the labor: 1: Spontaneous 2: Induced 3: Planned C-section

3.4 Mode of delivery: 1: Vaginal delivery 2: Cesarean

Please answer questions (3.5 to 3.11) if the mode is vaginal delivery. If cesarean Go to section 4 in the next page.

3.5 Was forceps/vacuum used? 1. Yes 2: No

3.6 Intrapartum drugs used during the labor?
1. No drugs used 2. Oxytocin 3. Antibiotics 4. Others: specify _____

3.7 Was analgesia used during the labor in case of vaginal delivery?
1. No analgesia 2. Opiates 3. Epidural 4. Spinal anesthesia

3.8 Did the mother have ruptured membranes more than 18 hours before delivery? 1: Yes 2: No

3.9 Did the mother have fever >38°C during labor? 1: Yes 2: No

3.10 Placenta: 1. Normal 2. Abnormal, Specify:_____

3.11 Amniotic fluid
6.11.1 Foul-smelling 1. Yes 2. No
6.11.2 Meconial 1. Yes 2. No
6.11.3 Quantity: 1. Normal 2. Polyhydramnios 3. Oligohydramnios

4. CESAREAN SECTION DETAILS: [Please answer questions in this section only if the mode of delivery is Cesarean]

For each question, please circle that apply:

4.1. What anesthesia was used?
1. General anesthesia 2. Spinal anesthesia 3. Epidural anesthesia

4.2. What was the type of C-section? 1: Emergency cesarean 2. Planned C-section

4.3. If emergency cesarean, what was the reason(s)? ***Select all that apply***;

If mother reasons:

1. Eclampsia or sudden severe high blood pressure or Seizure
2. Heavy persistent vaginal bleeding
3. Cephalopelvic disproportion
4. Obstructed labor
5. Failed vacuum or forceps delivery
6. Cord prolapse
7. Rupture of uterus
8. Mother exhaustion
9. Special presentation: (breech if big fetus, transverse, front, shoulder)
10. Other, specify_____

If fetal reasons:

1: Prolonged fetal distress
2: Other, specify_____

4.4. If planed C-section, what was the reasons? ***Select all that apply***;

1. Scarred uterus
2. Multiple fetuses
3: Placenta previa or placenta malposition
4: Large fetus
5: Infection of vaginal tract
6: Mother's desire
7: Abnormal presentation
8: Special medical condition (specify):_____
9: Other specify:_____

Newborn information and discharge dtatus [

5.1 **Status at birth**: 1. Alive 2. Stillbirth

5.2 **Gender:** 1.Male 2. Female 3.Other

5.3 **Birth Weight:** [ ] g

5.4. Apgar score:

At 1 Minute: [ ]/ 10
At 5 Minutes: [ ]/ 10