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Incidence and correlates of cesarean section in a capital city of a middle-income country

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Abstract

Objective: To determine the prevalence and correlates of cesarean deliveries (CS) in Beirut.
Methods: A cross-sectional study conducted on 18,837 consecutive infants born at nine hospitals from the National Collaborative Perinatal Neonatal Network (NCPNN). Stepwise Logistic Regression was performed to determine CS correlates.
Results: The rate of CS was 26.4% and correlated with socio-demographic, obstetrical and provider-related variables. Regression analysis identified age, paternal occupation, mode of payment, parity, birth weight, gestational age, multiple pregnancies, adequate prenatal care, complications during pregnancy, body mass index at delivery, hospital teaching status, day of the week and year of delivery to be significant correlates of CS.
Conclusion: This study shows an increased CS rate in a middle-income country, and identifies the correlates of women delivering by the abdominal route. These correlates may be used for effective reduction policies in the future.

Keywords: Cesarean delivery; correlates; middle-income country; prevalence.

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Introduction

The cesarean section (CS) was always considered as a last resort procedure to be carried out only for strict maternal or fetal indications. CS delivery has been associated with respiratory and neurological complications in the newborn [7], serious postpartum maternal morbidity [25], as well as an increase in cost and childbirth-related mortality [21].

Obstetric practice is facing a worldwide trend of increasing CS rates. In the United States, after a steady decline between 1989 and 1996, the CS rate rose sharply to 29.1% in 2004, the highest level ever reported [10]. In Italy, the CS rate increased from 11.2% in 1980 to 33.2% in 2000 [5]. Similar trends of increasing rates of CS have been observed in developing countries, particularly Brazil with a rate of 43% in 2004, reaching 82% of all private deliveries [3]. Although a "correct" CS rate remains controversial [13], the World Health Organization (WHO) suggests an optimum rate of 15% [29].

Correlates of CS have been extensively investigated, and can be classified into socio-demographic, obstetrical, and provider-related characteristics. Socio-demographic characteristics include maternal age [11], economic status [8], and mode of payment [4]. Obstetrical risk factors include parity, gestational age [15], labor and delivery complications [22] and body mass index (BMI) [12]. Provider characteristics that influence CS rates have been subjected to much debate, with some reports suggesting that hospital teaching status is an important factor [17]. In addition, significant differences in CS rates have been reported for different days and time of delivery [9].

Several measures have been undertaken worldwide in an attempt to contain the escalating rates of CS. Some include clinical interventions such as labor induction and augmentation [13] and vaginal birth after CS [19]. Other measures require a policy change such as case co-management whereby a second opinion is needed to initiate a CS [25] or confidential provider feedback whereby obstetricians receive confidential individual reports on

their CS rates and similar hospital wide statistics on a regular basis [13].

In Lebanon, two separate studies conducted in 1996 (Pap-child) [14] and in 1999 (UNICEF 1999–2000) [27] indicated increasing rates of CS. The Pap-child survey revealed an overall rate of 17% with the highest rate being in the capital city Beirut (22.6%). The UNICEF data show higher estimates with the overall rate of 23% and the highest rate being, again, in Beirut with a rate of 29.8%.

To establish appropriate rate reduction policies, understanding the reasons behind the high CS rate is warranted. The objectives of the present study were to determine the prevalence and identify the correlates of CS in Beirut, Lebanon.

Materials and methods

Data sources

The National Collaborative Perinatal Neonatal Network (NCPNN) is a database from nine major hospitals located in Beirut and its suburbs (known as the greater Beirut area). Information on parental socio-demographic characteristics as well as maternal and newborn health characteristics are collected daily with a structured questionnaire at all NCPNN centers by trained research assistants, midwives, and nurses. Sources of data include direct interviews with admitted patients, as well as obstetric and nursery medical charts.

Between January 2001 and December 2002, a total of 19,177 newborns were delivered at these nine hospitals of the NCPNN. Analysis of the present study was on 18,837 newborns with information about the mode of delivery (98%).

Study variables

The socio-demographic information considered for the present study included maternal age at delivery, maternal education, paternal occupation and mode of payment which was used as a surrogate for income, since no direct questions addressed the issue. Obstetric characteristics recorded were parity, birth weight, gestational age, type of gestation, prenatal care, pregnancy complications, and body mass index (BMI) at delivery. Prenatal care was categorized as adequate if it began during the first trimester of pregnancy and the total number of visits was nine or more, inadequate if began during the third trimester and the total number of visits was less than five, and moderate for all other combinations [2]. The presence of complications was defined as having any of gestational hypertension, preeclampsia, eclampsia, gestational diabetes, bleeding, preterm labor, non-reassuring fetal heart tracings and meconium aspiration. BMI at delivery was divided into four groups (<19.8, 19.8–26, 26–29, >29 kg/m^2) depending if women were underweight, normal, overweight or obese, respectively [20]. All hospitals practice continuous intrapartum fetal monitoring. Finally, provider-related variables included hospital teaching status, day of the week, season and year of delivery.

Statistical analysis

All analyses were performed using the Statistical Package for Social Sciences (SPSS) version 7.5. Odds ratio (OR) and 95% Confidence Intervals (95% CI) were calculated to assess the risk of having a CS across the different socio-demographic, obstetric and provider characteristics statistically significant. Furthermore, with the dependent variable being CS and the independent variables all the socio-demographic, obstetric, and provider characteristics statistically (at alpha of 0.095) at the bivariate level, stepwise logistic regression analysis was performed to determine the net effect of each of the different variables on the risk of delivering via a CS. Correction for missing data was carried out, by grouping the missing information (of variables with a missing rate above 10%) in one subgroup labeled unspecified.

Results

The overall rate of CS in the greater Beirut area was 26.4% (n=5056). The most common indication for CS was previous CS (36%), followed by arrest and protraction disorders during labor (17%), malpresentation (14%) and non-reassuring fetal heart (8%) (Table 1).

Table 2 presents the bivariate results for the association between mode of delivery and socio-demographic, obstetric, provider and time-dependant characteristics. The CS rate increased significantly with increasing maternal age, with the highest being for mothers >35 years (OR=2.6, 95% CI 2.3, 2.9). The lowest CS rate was for women of intermediate education, whereas the highest was for women who completed a university degree (21% vs. 33%, respectively). Furthermore, babies born to fathers who are unskilled workers had the lowest proportion of CS (26.8%) aside from those with missing (unspecified) occupation. Although 44% of the sample had missing information on the mode of payment, results showed that women who were self-payers had the lowest rate of CS (16.3%) as compared to any other mode of payment.

The rates of CS were highest for primiparous compared to multiparous women (OR=1.2, 95% CI 1.1, 1.2). Moreover, women who delivered infants weighing

Table 1 Indication for cesarean section among study participants.

Indications	n	%
Previous cesarean section/scar	1811	35.8
Arrest and protraction disorders	833	16.5
Presentation	709	14.0
Non-reassuring fetal heart	417	8.2
Multiple pregnancy	208	4.1
Elective	168	3.3
Placenta previa/Abruptio/Bleeding	110	2.2
Preeclampsia	77	1.5
Other	23	0.5
Unknown	700	13.8
Total	5056	100.0

Table 2 Socio-demographic, obstetric, and provider characteristics by mode of delivery among study participants.

	Vaginal n (%)	CS* n (%)	OR† (95% CI‡)
Socio-demographic			
Age			
≤24	3668 (82.1)	802 (17.9)	1
25–29	4309 (74.6)	1467 (25.4)	1.6 (1.4–1.7)
30–34	3661 (70.6)	1522 (29.4)	1.9 (1.7–2.1)
≤35	2027 (64.0)	1139 (36.0)	2.6 (2.3–2.9)
Maternal education			
Primary or less	952 (73.2)	348 (26.8)	1.0 (0.9–1.2)
Intermediate	4678 (79.3)	1220 (20.7)	0.7 (0.7–0.8)
Secondary	2893 (70.9)	1189 (29.1)	1.2 (1.0–1.3)
University	3161 (67.1)	1553 (32.9)	1.4 (1.2–1.5)
Unspecified	2097 (73.8)	746 (26.2)	1
Paternal occupation			
Managers/Professionals	2222 (68.0)	1044 (32.0)	2.0 (1.8–2.2)
Technicians	3663 (69.7)	1592 (30.3)	1.8 (1.7–2.0)
Clerks-skilled	2239 (70.9)	917 (29.1)	1.7 (1.5–1.9)
Unskilled	1038 (73.2)	381 (26.8)	1.5 (1.3–1.8)
Unemployed	60 (65.9)	31 (34.1)	2.2 (1.4–3.3)
Unspecified	4559 (80.7)	1091 (19.3)	1
Mode of payment			
Self	977 (83.7)	190 (16.3)	1
Private	1023 (71.5)	408 (28.5)	2.1 (1.7–2.5)
Public	4162 (76.1)	1305 (23.9)	1.6 (1.4–2.0)
MOH§	1949 (78.7)	526 (21.3)	1.4 (1.2–1.7)
Unspecified	5670 (68.3)	2627 (31.7)	2.4 (2.0–2.8)
Obstetric variables			
Parity			
Primiparous	4766 (71.5)	1902 (28.5)	1.2 (1.1–1.2)
Multiparous	8832 (74.3)	3053 (25.7)	1
Birth weight (g)			
<1500	87 (42.0)	120 (58.0)	3.0 (2.2–4.2)
1500–2500	767 (50.7)	746 (49.3)	2.1 (1.8–2.6)
2500–4000	12,340 (75.9)	3927 (24.1)	0.7 (0.6–0.8)
>4000	509 (68.8)	231 (31.2)	1
Gestational age (weeks)			
≤37	1562 (53.1)	1380 (46.9)	2.9 (2.7–3.2)
≥38	11,987 (76.9)	3596 (23.1)	1
Gestation			
Single	12,875 (75.5)	4185 (24.5)	1
Multiple	906 (51.0)	871 (49.0)	3.0 (2.7–3.3)
Care during pregnancy‖			
Adequate	9014 (72.8)	3373 (27.2)	1.6 (1.4–1.9)
Moderate	4074 (72.8)	1522 (27.2)	1.6 (1.3–1.9)
Inadequate	693 (81.1)	161 (18.9)	1
Complication¶			
No	13,030 (75.1)	4316 (24.9)	1
Yes	751 (50.4)	740 (49.6)	3.0 (2.7–3.3)
Delivery BMI (kg/m^2)#			
<19.8	37 (80.4)	9 (19.6)	1
19.8–26	2921 (77.4)	852 (22.6)	1.2 (0.6–2.5)
26–29	3752 (73.2)	1376 (26.8)	1.5 (0.7–3.1)
>29	3405 (66.1)	1746 (33.9)	2.1 (1.0–4.4)
Unspecified	3353 (77.8)	956 (22.2)	1.2 (0.6–2.4)

(Table 2 continued)

	Vaginal n (%)	CS* n (%)	OR† (95% CI‡)
Provider variables			
Hospital			
Teaching	8263 (68.9)	3734 (31.1)	1.9 (1.8–2.0)
Non-teaching	5518 (80.7)	1322 (19.3)	1
Day of week			
Monday	2121 (70.1)	906 (29.9)	2.1 (1.8–2.5)
Tuesday	2262 (72.1)	874 (27.9)	1.9 (1.7–2.2)
Wednesday	1991 (71.9)	779 (28.1)	2.0 (1.7–2.3)
Thursday	2194 (73.5)	792 (26.5)	1.8 (1.5–2.1)
Friday	2130 (69.3)	943 (30.7)	2.2 (1.9–2.6)
Saturday	1671 (77.8)	477 (22.2)	1.4 (1.2–1.7)
Sunday	1375 (83.3)	275 (16.7)	1
Season			
Fall	3642 (73.7)	1302 (26.3)	1.0 (0.9–1.1)
Winter	3376 (72.5)	1282 (27.5)	1.0 (1.0–1.1)
Spring	3129 (73.1)	1150 (26.9)	1.0 (0.9–1.1)
Summer	3634 (73.3)	1322 (26.7)	1
Year			
2001	6989 (73.9)	2470 (26.1)	1
2002	6792 (72.4)	2586 (27.6)	1.1 (1.0–1.1)

*CS: Cesarean Section.
†OR: Odds ratio.
‡CI: Confidence Interval.
§MOH: Ministry of Health.
||Care during pregnancy: adequate if it began during the first trimester of pregnancy and the total number of visits was nine or more, and inadequate if it began during the third trimester and the total number of visits was less than five, and moderate for all other combinations [27].
¶Complications: gestational hypertension, pre-eclampsia, eclampsia, gestational diabetes, bleeding, preterm labor, non-reassuring fetal heart tracings, meconium aspiration.
#BMI: Body Mass Index [28].

<1500 g had the highest CS rate (58%), this rate then decreased with increasing birth weight, to increase again among women who delivered infants >4000 g (31.2%). Similarly, women delivering at <38 weeks' gestation had a higher CS rate compared to women delivering at ≥38 weeks (OR=2.9, 95% CI 2.7, 3.2). The odds of CS among mothers with multiple gestation were three times more than among those with a single gestation (OR=3.0, 95% CI 2.7, 3.3). Complicated pregnancies had higher odds to have a CS compared to uncomplicated pregnancies (OR=3.0, 95% CI 2.7, 3.3) and women who received inadequate prenatal care had a lower rate of CS than women who had moderate or adequate care during their pregnancy (18.9% vs. 27.2%). Furthermore, the rate of CS increased with increasing pregnancy BMI ranging from 19.6% for a BMI<19.8 kg/m^2 to 33.9% for a BMI of >29 kg/m^2.

Regarding the provider characteristics, teaching institutions had a CS rate of 31.1% compared to 20.7% for non-teaching institutions (OR=1.9, 95% CI 1.8, 2.0). The rate of CS decreased during the weekend and particularly on Sunday, declining from an average of 27.5% to 16.7% on Sundays, with the highest rate being on Fridays (30.7%). There were no seasonal changes in the rates of CS, however, the CS rate in 2002 was slightly higher than that in 2001 (OR=1.1, 95% CI 1.0, 1.1).

Table 3 displays the adjusted ORs and 95% CI of the stepwise logistic regression model for the prediction of CS when all the significant factors at the bivariate level were included in the model. Socio-demographic variables that were found to be predictive of a CS were maternal age, paternal occupation, and mode of payment**.** Maternal age <24 years, fathers with unspecified occupation, and self-payers were at low odds of having CS. All seven obstetric variables were retained in the regression model as independent correlates of CS. CS was highest among primiparous women, extreme birth weight babies, preterm deliveries, multiple gestation, women who received adequate care, with pregnancy complications, and high BMI during delivery. Mothers delivering in teaching institutions were more likely to deliver by CS; furthermore, deliveries performed on Sundays had the lowest CS rates, and those performed in 2002 were more frequent than those in 2001.

Table 3 Stepwise regression analyses for the association between socio-demographic, obstetric, and provider characteristics and mode of delivery among study participants.

	OR*(95% CI†)
Socio-demographic	
Age (years)	
≤24	1
25–29	1.4 (1.3–1.6)
30–34	1.7 (1.5–1.9)
35+	2.3 (2.0–2.6)
Paternal occupation	
Managers/Professionals	1.5 (1.3–1.7)
Technicians	1.6 (1.4–1.8)
Clerks-skilled	1.5 (1.3–1.7)
Unskilled	1.4 (1.2–1.6)
Unemployed	1.8 (1.1–2.9)
Unspecified	1
Mode of payment	
Self	1
Private	1.7 (1.4–2.2)
Public	1.6 (1.3–1.9)
MOH‡	1.6 (1.3–1.9)
Unspecified	1.8 (1.5–2.1)
Obstetric variables	
Parity	
Primiparous	1.3 (1.2–1.5)
Multiparous	1
Birth weight (kg)	
<1.5	1.2 (0.9–1.8)
1.5–2.5	1.1 (0.9–1.4)
2.5–4	0.7 (0.6–0.8)
>4	1
Prematurity (≤37 weeks)	1.9 (1.7–2.1)
Multiple Gestation	2.0 (1.8–2.3)
Care during pregnancy§	
Adequate	1.4 (1.2–1.8)
Moderate	1.3 (1.1–1.6)
Inadequate	1
Complications‖	1.7 (1.5–1.9)
Delivery BMI (kg/m²)¶	
<19.8	1
19.8–26	1.6 (0.7–3.6)
26–29	1.9 (0.8–4.3)
>29	2.7 (1.2–6.1)
Unspecified	2.0 (0.9–4.6)
Provider variable	
Hospital	
Teaching	1.4 (1.3–1.5)
Non-teaching	1
Day of week	
Monday	2.1 (1.8–2.5)
Tuesday	2.0 (1.7–2.3)
Wednesday	2.0 (1.7–2.4)
Thursday	1.8 (1.5–2.1)
Friday	2.4 (2.0–2.8)
Saturday	1.4 (1.2–1.7)
Sunday	1
Year	
2001	1
2002	1.1 (1.0–1.2)

*OR: Odds ratio.
†CI: Confidence Interval.
‡MOH: Ministry of Health.
§Care during pregnancy: adequate if it began during the first trimester of pregnancy and the total number of visits was nine or more, and inadequate if it began during the third trimester and the total number of visits was less than five, and inadequate for all other combinations.
‖Complications: gestational hypertension, pre-eclampsia, eclampsia, gestational diabetes, bleeding, preterm labor, non-reassuring fetal heart tracings, meconium aspiration.
¶BMI: Body Mass Index.

Discussion

In this large population-based study we looked at the CS rate of nine hospitals in the greater Beirut area. This is the first study to address the correlates of the high CS rate in Lebanon. The present study confirms that more than one quarter of children born in the greater Beirut area are delivered by a CS. Correlates included from age, parity, to physician workdays and mode of payment.

A previous CS was the most common indication for the procedure when all pregnancies are taken into account. If only multiparous women are considered, this indication will represent about 49% of all indications, highlighting the importance of "once a CS, always a CS" cliché. The high CS rate is in line with other reports from the developed world [10], as well as developing countries in Latin America [3]. Compared to other countries in the region, the CS rate is higher than in Jordan (8.7%) [30] and in Saudi Arabia (6.7%) [23]. This difference in CS rates is probably multi-factorial and may be explained by the reimbursement system in Lebanon, the large number of male obstetricians, and a large number of working women [4, 17].

In the present study, older maternal age was a predictor of CS, which is in agreement with prior published reports [11]. Mode of payment for the obstetrical care was significantly associated with the CS rates. A closer look at the self-paying group, that had the lowest CS rate, showed that they were more likely to have an intermediate and secondary education (70%). This fact points towards the lower socioeconomic status of these women and possibly the efforts of physicians to spare them the extra cost of a CS. In Lebanon, the National Social Security Fund (NSSF) and the MOH pay about 300,000 Lebanese liras (LL) (about 200 US $) for vaginal deliveries and 400,000 LL (about 266 US $) for a CS. Although insurance companies pay more for each procedure, the difference noted between CS and vaginal delivery is

probably not significantly different from that of the NSSF; hence the reimbursement system does not provide a clear financial incentive for physicians to perform a CS although one might argue that the physician's reimbursement for CS (33% higher than for a vaginal delivery), especially with far fewer hours involved in care of the patient, might be incentive enough for some physicians.

In concordance with other studies, gestational age $\leq$37 weeks and extremes of birth weight were associated with increased rate of CS [15]. A practice of delivering low weight babies by CS has long been thought to decrease complication rates [16]. However, this is almost controversial with data showing no benefits in following such a policy. Moreover, some studies show that the increase in low birth weight babies was probably due to iatrogenic practices associated with elective cesarean section [24]. Increased weight at birth also correlated with a higher CS rate, in line with other published reports [18]. Furthermore, and similar to other studies, the results confirm that complicated pregnancies were more likely to be delivered by CS [8, 16] and that primiparous women have a higher CS rate than multiparas do [1].

The negative association between late prenatal care and CS has been described before [17]. It is probably related to the lack of financial resources for these patients to get early prenatal care, and thus the efforts of physicians to avoid the cost burden of a CS for these patients. An examination of the group of women who had late prenatal care shows that they were more likely to be less educated (68% had intermediate education or less), to be admitted under the public sector (72%), and whose husband held unskilled or unspecified jobs (48%).

The provider characteristic that was shown to have an independent positive association with CS was the teaching status of the hospital, with teaching institutions having a higher rate of CS than non-teaching institutions. This fact is the subject of much debate in the literature [6, 26], whether or not the higher CS rate in teaching institutions results from these institutions delivering more complicated cases or being referral centers. This difference is expected to be absent when corrected for case severity [28] but requires more investigation. CS rates were lowest for weekend days, consistent with prior reports in the literature [9]. This could be in line with prior reports which attribute the decline over the weekend to the high rate of planned CSs on weekdays.

One limitation of the present study is the high proportion of missing data in some of the covariates like the indication for CS, maternal education, paternal occupation, mode of payment and BMI. This is due to the retrospective nature of the study in addition to the large size of the database. However, this was accounted for in the final regression model by including "missing" as one category of the above-mentioned variables.

In conclusion, this study confirms a cesarean section rate in greater Beirut area that is comparable to that in developed countries. Advanced maternal age, paternal occupation, mode of payment, parity, birth weight, gestational age, multiple pregnancies, adequate prenatal care, complications during pregnancy, body mass index at delivery, hospital teaching status, day of the week and year of delivery were identified to be significant correlates of cesarean delivery. Further studies are required to investigate the rate and predictors of CS in other areas in Lebanon.

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