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Original Article

Prevalence, Indications and Determinants of Caesarean Delivery in Alexandria, Egypt

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Abstract

Background: Prevalence of Caesarean delivery (CD) is increasing worldwide including Egypt. Alexandria is one of the governorates recording the highest rates in Egypt. Identifying factors associated with CD is important to plan for reduction.

Objective: To identify prevalence, indications and determinants of CD in Alexandria, Egypt.

Methods: This cross sectional survey was carried out in Alexandria, Egypt between July and December 2017. Target population was ever-married fertile women aged 15-49 years. Only women having at least one child aged ≤ 5 years were included. Using the cluster sample survey, 900 eligible women were selected and subjected to an interview questionnaire for data collection. It included socio-demographic data, habits, reproductive history and medical profile.

Results: Prevalence of CD in Alexandria (2017) was 70.4%. The reported leading causes for CD were previous CD (34.9%) and women request (12.1%). The significant socio-demographic factors associated with CD included educational level (p< 0.000) and residence (OR=2). Biomedical variables involved previous abortion (p= 0.005), previous complicated pregnancy (OR=1.6), frequent antenatal visits (OR=1.8), pre-/eclampsia (OR=1.8), previous CD (OR=2.2), assisted reproduction (OR=2.2), delivery age ≥35 (OR=2.2), preceding birth interval ≤ 2 (OR=2.2), parity ≥5 (OR=2.5), preterm labour (OR=2.6), delivery in private sector (OR=2.7), and multiple pregnancy (OR=5.7).

Conclusion: The rate of CD in Alexandria is high. Predictors of CD are high parity, pre-/eclampsia, previous CD, short preceding birth interval, higher education, urban residence, frequent antenatal visits, and delivery in private sector. The study recommends women health education and developing guidelines with medical audit of CD practice.

Keywords: Caesarean delivery, determinants, Alexandria

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INTRODUCTION

Caesarean section (CS) is a life-saving surgical intervention among high risk births and is used as an indicator of the provision of life-saving maternal services. Both underuse and overuse are dangerous and associated with increasing morbidity and mortality for both mothers and infants. On the other side, no better outcome is achieved but increasing costs for family and health system. [1-3] Although it is difficult to determine an optimal efficacy rate, WHO (2009) recommended a Caesarean delivery (CD) level between 5%-15% of total deliveries[1] Nevertheless, the rate of Caesarean deliveries (CD) is markedly increasing worldwide since decades especially in less developed countries[4,5] The global estimated rate of CD in 2015 (21.1%) was double that of 2000 (12.1%). However, these higher rates were not associated with decreasing rates of maternal or infant morbidity and mortality indicating CS overuse.[4] In this context, CD rate in Egypt is rising, exceeding the acceptable WHO rate. It even folded several times since early 1990s[6,7] Alexandria is one of the governorates recording the highest rates in Egypt.[8] Researches identifying factors contributing to the increased rate of CD is important to define strategies for reduction. These are inadequate in Egypt. Hence, this study was conducted to identify community-based prevalence, indications, risk factors, and determinants of CD.

METHODS

The present cross-sectional survey was carried out in Alexandria, Egypt between July and December 2017.

Target population: target population was ever-married fertile women aged 15-49 years. Only women having at least one child ≤ 5 years of age were included .

Sampling: the cluster sample survey was adopted, where 30 clusters were identified all over Alexandria. From each

cluster, 30 eligible women were randomly selected yielding a sum of 900 women .

Data collection: data were collected using a pre-designed questionnaire which included socio-demographic characteristics as age, education, residence, occupation, smoking, age of marriage and consanguinity. Reproductive profile entailed number of pregnancies, deliveries, and abortions, marriage to first pregnancy period, history of any gyno-obstetric problems, or Caesarean delivery (CD). Detailed history of the most recent birth was obtained. It involved age at delivery, the preceding birth interval, type of conception, type of pregnancy, antenatal care, hospital or intensive care unit admission, timing of delivery, type of delivery, cause of CS and vaginal trial before surgery (if any), place of birth, and birth weight. Medical history of chronic conditions was also collected .

Statistical analysis

Incomplete variables were excluded from the analysis, namely marriage to first pregnancy period, vaginal trial before CS and birth weight. Data were analyzed using the statistical Package for Social Sciences (SPSS ver. 20; SPSS Inc., IBM, USA). The frequency, percentage, mean and standard deviation were computed. The Chi-square, Fisher's Exact Test, odds ratio (with 95% confidence interval) the student's t-test and logistic regression were implemented. The 5% level was chosen to judge the significance of the obtained results.

Ethical considerations

The study proposal was reviewed and approved by the Research Ethics Committee of Alexandria Faculty of Medicine. Aims and benefits of the survey were clarified to the enrolled women, and consent to join in the study was acquired.

RESULTS

Socio-demographic characteristic

Table (1) shows that this study included 900 women with a mean age of 31.8±5.8 years, mainly between 20 and <35 years (67.3%). The studied women were mostly urban residents (90%), unemployed (73.9%), non-smoker (98.2%), and university graduates (53.8%). The mean age of marriage was 24.1±4.3 years with a consanguinity rate of 11.7%.

Reproductive Profile

Table (1) reveals that the mean number of gravidity, parity and abortions were 2.9 ± 1.7, 2.3 ± 1.3 and 1.6 ± 0.9 respectively. Most mothers gave history of 2-3 pregnancies (43.1%) or deliveries (50.2%). The last delivery (within the preceding five years) was at a mean age of 29.3 ± 5.5 years after a mean preceding birth interval of 2.5 ± 1.1 years among multipara. The most recent pregnancy was achieved through assisted reproductive technology (ART) among 5.4% and multiple among 4.7% of instances. During that pregnancy, 87.8% of women had booking for antenatal care (ANC) with a mean number of 7.5 ± 3.8 visits. Among them, 76.2% reported ≥4 visits. Almost 24% of the last deliveries were pre-term and 70.4% were CD. Almost 98.1% (n=883) of the last live births took place in a health facility; 59.1% in private (n=532) versus 39.0% (n=351) in public health service.

Medical Profile

During the last pregnancy, different types of diabetes mellitus (DM) were encountered among 5.3%, hypertensive disorders of pregnancy (HDP) among 14.1% and pre-eclampsia among 10.8% of women. More than one quarter (27.3%) of pregnancies were associated with a medical problem and 4.1% of mothers needed intensive care unit (ICU) admission.

Prior to the last pregnancy, 47.4% of women reported a history of previous CD and 20.8% reported a previous complicated pregnancy (data not presented).

Indication of CD

Table (2) presents indications of the most recent CD as reported by women. The leading indication was previous CD (34.9%) followed by women request (12.1%), mal-presentation (11.0 %), and HDP (7.1%). Causes of maternal request were mostly fear of labour pain (55.8 %), bad experience with previous vaginal delivery (14.3 %), false belief that "once CD always CD" to avoid complications (22.1 %), and financial accessibility (7.8%). Failure to progress (5.8%), fetal distress (5.2%), and ante-partum hemorrhage (4.1%) were other causes.

Risk Factors of CD

Table (3) displays relationship between mode of delivery and some associated risk factors. It reveals that urban residents were twice folds more likely to have CD (OR=2) compared to rural. Versus illiteracy, high levels of education were more likely to associate CD (OR= 3.1 for high school and OR=4 for university education). The mean age at marriage was significantly higher among CD than among vaginal deliveries (24.3 ± 4.3 *versus* 23.6 ± 4.3 years, p= 0.040), with no significant differences among age groups. On the other hand, mothers aged ≥35 years at delivery were 2.2 times more likely to have CD compared to those aged 20-<35 years. The odds of CD significantly increased with increasing number of abortions (OR=1.6 among <3 and OR=2.2 among ≥3 times). Mothers having ≥5 versus 2-4 births or last preceding birth interval ≤2 versus >2 years were more vulnerable to CD (OR= 2.5 and OR=2.2 respectively).

The likelihood of CD was also higher among ART (OR=2.2) versus natural conception and among multiple pregnancy (OR=5.7) compared to singleton. Women with more frequent ANC visits (≥4 visits versus <4 visits) were 1.8 folds more prone to CD. It also shows that of the total 634 CD, 425 (67%) were made in private sector. This 425 CD of the total 532 private deliveries constitutes a private CD rate of 79.9% versus 59.5% (209 out of 351) CD rate in public facility. Probability of CD was 2.7 times higher in private health services versus public. Delivery before term (*versus* full term) made mother more prone to CD

(OR=2.6). Gravidas with co-morbidity or pre-/eclampsia were more likely to have CD compared to free ones (OR=1.3 and OR= 1.8 respectively). Those with history of prior complicated pregnancy or previous CD were also more likely to deliver via CD (OR= 1.6 and OR= 2.2 respectively).Work status, consanguinity, co-DM, HDP, hospitalization, and ICU admission during the last pregnancy showed no significant association with CD

Predictors of CD

Table (4) reveals that parity ≥5 (AOR=10.2), pre-/eclampsia (AOR=4.3), previous C.S (AOR=4.3), preceding birth interval ≤ 2 years (AOR=3.8), ≥high school education (AOR=3.2), urban residence (AOR=0.3), antenatal visits ≥4 (AOR=2.6), delivery in a private service (AOR=2.0) were the identified predictors for CD. This model correctly classifies 76.1% of causes for CD.

Table (1): Characteristics of the studied women in Alexandria, 2017

Women Characteristics	Studied women (n=900) No.	%
Socio-Demographic Profile		
Age (years**):**		
($\bar{X}$±S)	31.8±5.8 (17-48)	
17-<20	3	0.3
20-<35	606	67.3
35 – 48	291	32.4
Age at marriage(years**):** ($\bar{X}$±S)	24.1±4.3 (16-38)	
16-<20	130	14.4
20-<35	752	83.6
35 – 38	18	2.0
Education:		
Illiterate	80	8.9
Primary school	67	7.4
Preparatory School	88	9.8
High school	181	20.1
University+	484	53.8
Residence:		
Urban	810	90.0
Rural	90	10.0
Work:		
working	235	26.1
Not working	665	73.9
Smoking:		
Smoker	16	1.8
Non Smoker	884	98.2
Consanguinity:		
Yes	105	11.7
No	795	88.3
Reproductive Profile		
Gravidity: ($\bar{X}$±S)	2.9±1.7 (1-10)	
Primigravida	232	25.8
2-3	388	43.1
4-5	219	24.3
>5	61	6.8
Parity:		
($\bar{X}$±S)	2.3±1.3 (1-7)	
Primipara	303	33.7
2-3	452	50.2
4-5	125	13.9
>5	20	2.2

Women Characteristics	Studied women (n=900) No.	%
Abortion:		
($\bar{X}$±S)	1.6±0.9 (1-5)	
0	600	66.7
1-2	256	28.4
3+	44	4.9
Mode of Conception:		
Natural	851	94.6
Assisted reproductive technology (ART)	49	5.4
Type of Pregnancy:		
Single	858	95.3
Multiple	42	4.7
Last inter-birth interval (years**)**		
($\bar{X}$±S)*	2.5±1.1(1-9)	
1-2	311	52.1
>2	286	47.9
Age at most recent delivery(years**):**		
($\bar{X}$±S)	29.3±5.5 (17-42)	
17-<20	38	4.2
20-<35	646	71.8
35 - 42	216	24.0
Ante Natal Visits: ($\bar{X}$±S)	7.5±3.8 (1-18)#	
0 visits	110	12.2
1-3 visits	104	11. 6
4+ visits	686	76.2
Gestational Age:		
37-40 week (Full term)	662	73.6
<37 week (Preterm)	216	24.0
>40 week (Post-Dated)	22	2.4
Mode of Delivery:	266	29.6
Vaginal Delivery	634	70.4
Caesarean Delivery (CD)		
Place of Birth:		
Home	17	1.9
Governmental Health Service	351	39.0
Private Health Service	532	59.1

* Calculated for multipara (n=597)

For those who received antenatal care (n= 790)

Table (2): Reported indications of most recent Caesarean section among the studied women in Alexandria, 2017

Indication	Women with Caesarean Section (n=634)	
	No.	%
Previous CS	221	34.9
Women Demand	77	12.1
Mal-presentation	70	11.0
Hypertensive Disorders of Pregnancy (HDP)	45	7.1
Failure of progress	37	5.8
Fetal Distress	33	5.2
Ante-Partum Hemorrhage	26	4.1
Cephalo-pelvic disproportion	23	3.6
Medical Maternal Disorders	22	3.5
Drained Liquor	19	3.1
Post Dated Pregnancy	16	2.5
Multiple Pregnancy	12	1.9
ART	11	1.7
Placenta Previa	9	1.4
Other Fetal Causes	13	2.1

Table (3): Factors associated with Caesarean section among the studied women in Alexandria, 2017

Factor	Mode of Delivery		Significance Test (P)	OR (95% CI), p(χ^2)
	Caesarean (n=634)	Vaginal (n=266)		
	No. %	No. %		
Residence:				
Rural[a]	51 8.0	39 14.7	χ^2=9.1	1.0
Urban	583 92.0	227 85.3		2.0 (1.3-3.1), *p*=0.003*
Education:				
Illiterate[a]	38 6.0	42 15.8		1.0
Primary school	37 5.8	30 11.3	χ_4^2 =57.6 (<0.000)*	0.7 (0.4- 1.4), *p*=0.351
Preparatory School	46 7.3	42 15.8		0.8 (0.5-1.5), *p*=0.637
high school	133 21.0	48 18.0		3.1 (1.8-5.3), *p*<0.000*
University	380 59.9	104 39.1		4.0 (2.5-6.6), *p*<0.000*
Age of marriage: ($\bar{X}$±S) (years)	24.3±4.3 (17-37)	23.6±4.3 (17-38)	*t*=-2.1 (0.040)*	
16-<20	85 13.4	45 16.9		1.3(0.9-1.9), *p*=0.214[b]
20-<35[a]	533 84.1	219 82.3	*p*=0.098[b]	1
≥35 - 48	16 2.5	2 0.8		3.3(0.7-14.4), *p*=0.116[b]
Abortion: ($\bar{X}$±S)	1.6±1.0 (1-5)	1.6±0.8 (1-4)	t= -0.2 (0.824)	
0[a]	402 63.4	198 74.4		1.0
1-2	196 30.9	60 22.6	χ_2^2=10.8(0.005)*	1.6 (1.2-2.3), *p*=0.005*
≥3	36 5.7	8 3.0		2.2 (1.0-4.9), *p*=0.042*
Parity: Mean ± S	2.4± 1.3 (1-7)	2.2 ± 1.2 (1-7)	*t*= -1.5 (0.131)	
Primipara	215 33.9	88 33.1		1.1. (0.8-1.5), *p*=0.485
2-4[a]	370 58.4	169 63.5	χ_2^2=6.4 (0.041)*	1.0
≥5	49 7.7	9 3.4		2.5 (1.2-5.2), *p*=0.012*
Last inter-birth interval: ($\bar{X}$±S)[c] (years)	2.3±1.0 (1-7)	2.9±1.3 (1-9)	*t*= 4.9 (<0.000)*	
≤ 2 years	242 57.8	69 38.8	χ^2=18.1	2.2 (1.5-3.1), *p*<0.000*
>2 years[a]	177 42.2	109 61.2		1.0

Table (3): Factors associated with Caesarean section among the studied women in Alexandria, 2017 (continued)

Age at last delivery: ($\bar{X}$±S) (years)	29.7±5.4 (17- 43)	28.4±5.6 (17-41)	t= -3.2 (0.001)*	
17-<20	29 4.6	9 3.4		1.6 (0.8-3.5), p=0.207
20<35[a]	429 67.6	217 81.6	χ_2^2 =18.3 (<0.000)*	1.0
≥35 – 43	176 27.8	40 15.0		2.2 (1.5-3.3), p<0.000*
Type of conception:				
Natural[a]	593 93.5	258 97.0		1.0
Assisted reproductive t technology (ART)	41 6.5	8 3.0	χ^2 =4.4	2.2 (1.0-4.8), p=0.037*
Type of pregnancy:				
Single[a]	595 93.8	263 98.9	χ^2 =10.1	1.0
Multiple	39 6.2	3 1.1		5.7 (1.8-18.8), p<0.000* [b]
Rate of ante-natal visits: ($\bar{X}$±S) [d]	7.9±3.9 (1-18)	6.7±3.2 (1-14)	t= -4.4(<0.000)*	
<4 visits[a]	62 11.0	42 18.6		1.0
≥4 visits	502 89.0	184 81.4	χ^2 =8.1	1.8 (1.2-2.8), p=0.004*
Place of institutional birth (n=883):				
Public health service [a]	209 33.0	142 57.0		1.0
Private health service	425 67.0	107 43.0	χ^2 =43.2	2.7 (2.0-3.6), p<0.000*
Timing of delivery:				
Full term (37-40 week) [a]	437 68.9	225 84.6		1.0
Preterm (<37 week)	180 28.4	36 13.5	χ_2^2 =24.0 (<0.000)*	2.6 (1.8-3.9), p<0.000*
Post-Date (>40 week)	17 2.7	5 1.9		1.8 (0.6- 4.8), p=0.27
Associated medical problem:				
NO[a]	448 70.7	206 77.4		1.0
Yes	186 29.3	60 22.6	χ^2 =4.3	1.3(1.0-1.7), p=0.037*
Associated Pre-/eclampsia:				
NO[a]	556 87.7	247 92.9		1.0
Yes	78 12.3	19 7.1	χ^2 =5.1	1.8 (1.1-3.1), p=0.023*
Prior complicated pregnancy: [c]				
NO[a]	322 76.8	150 84.3		1.0
Yes	97 23.2	28 15.7	χ^2 =4.2	1.6 (1.0-2.6), p=0.042*
Previous CS [c]				
NO[a]	200 47.7	118 66.3		1.0
Yes	219 52.3	60 33.7	χ^2 =19.1	2.2 (1.5-3.1), p<0.000*

*statistically significant [a] Reference category [b] Fisher's Exact Test [c] For multipara (n=597) [d] For those who received care (n=790)

Table (4): Predictors of Caesarean section among the studied women in Alexandria, 2017

Predictor	**Odds Ratio** (OR)	**Adjusted Odds Ratio (95% CI)** (AOR)	**P value**
Parity≥5 (grand multipara)	2.3	10.2 (1.2-84.9)	0.032
Pre-/eclampsia	1.5	4.3 (1.2-15.6)	0.026
Previous C.S	1.5	4.3 (2.3-8.0)	<0.001
Last inter-birth interval ≤ 2	1.3	3.8 (2.2-6.7)	<0.001
≥High school education	1.2	3.2 (1.7-6.1)	<0.001
Urban residence	1.1	0.3 (0.1-0.9)	0.037
Antenatal visits ≥4	1.0	2.6 (1.1-5.9)	0 .022
Delivery in a Private Service	0.7	2.0 (1.2-3.5)	0.012
Constant	-14.2	0.000	<0.001
R^2 = 0.24 Adjusted R^2 = 0.34 X^2 (p value) = 92.1 (<0.001) Model sensitivity = 76.1%			

DISCUSSION

The present study observed a population prevalence of 70.4% for CD in Alexandria (2017). This rate is by far higher than the maximum threshold accepted by the WHO (15%)[1] and the average global rate of CS (18.6%).(5) Our rate is also higher than the highest intercontinental figures observed in a global study across 150 countries. Brazil (55.6%) and Dominican Republic (56.4%) (Latin American and the Caribbean region) recorded the highest national levels in the world. Among the other regions, Egypt reported the highest national CD rates (51.8%) in Africa, Iran (47.9%) and Turkey (47.5%) in Asia, Italy (38.1%) in Europe, United States (32.8%) in Northern America, and New Zealand (33.4%) in Oceania. [5] Our level is also higher than those recorded in other Arab countries (17.8%-55.5%).[9-12] However, it coincides with the highest rate observed in another study over 169 worldwide countries (70.2% within Brazil).[4] In contrast, extremely lower rates below 5% and down to 2.3% were seen in many African countries. [2,4,5,13].

Within Egypt, in the 2014 Demographic Heath Survey (DHS), while Kafr El-Sheikh showed exactly the same figure of our study (70.4%), Port Said and Damietta recorded higher rates, (76.6% and 76.0% respectively). On the other hand, Matrouh had a much lower rate (26.2%), whereas other governorates recorded intermediate levels. [8] Hospital studies in other governorates reported figures between 30.5% and 46%.(14-16) In Alexandria, the rate of CS in El-Shatby Maternity University Hospital ranged between 60.7% and 53.5% during 2012-2014. [17]

The global increase in CD is multi-factorial and could be driven by medical causes of increasing institutional deliveries, improved surgical techniques and anesthesia, better availability of blood transfusion and advanced antibiotics with more safe CS. Improved technology with early detection of fetal distress is also involved. The rising rate of CD in private sector and the overuse of CS for non-medical reasons have a major role. Non-medical factors involve clinicians' preference of CS, women request, medico-legal considerations as to avoid negligence claims, and the trend of risk avoidance in obstetric practice. [1,3,4,6,11,18] Non-medical illegitimate causes as financial reasons, training of juniors and saving time would not be reported.[10] Increasing frequency of repeated CS is a prominent cause.[1,4] Higher CD rate was also linked to higher socioeconomic status [3,4, 7,8, 11,13,19] and experiencing a preconception stressful life event.[19] On the other side, CD rate below the minimum of 5% recommended by the WHO means underutilization of CS indicating low antenatal and maternal care provision. It is mostly found in low resource countries due inadequate health systems and shortage of manpower and surgical facilities.[1,5]

Reviewing national data, Yassin et al concluded that the Egyptian rate of CD is extremely fast and undocumented in the view of absent national guidelines and researches to lead CS. He proposed that a large proportion of CS may be unnecessary.[6] In Egypt, it is suggested that fear of medical litigation, using safe obstetrics with avoidance of vaginal after Caesarean delivery, loss of the art of instrumental delivery, and lack of expertise in regional analgesia within the labor wards are among causes of high rate of CS performance. False perception of CS safety among women and physicians may also increase liability to CD. Money earning and poor audits are contributors of unnecessary CS.[7,14,15,17] Shift from vaginal to CD has led to increasing proportion of mothers with previous CS to become a major cause for subsequent CS and increasing the overall CD rate. [1,4,20] In consistence, previous CD was the leading indication of CD in the present as well in previous Egyptian[7,14-17] and non-Egyptian studies.[3,4,10,12,21,22] Also, previous CS was a main predictor for CS in the present and similar studies. [10,19] Moreover, Witt et al elicited that having earlier CS was the strongest predictor of non-indicated CS.[19] Obstetricians may repeat CS to refrain from practicing vaginal after CD; to avoid risk, or due to doubtful scar strength or absent information of the previous CS.[22] On the other hand, Egyptian women with prior CS showed positive attitude towards CS which surely reinforce repeat CS. [7]

CD is more frequently used in private than in public health facilities all over the world. [4] The present study confirmed this observation where CD rate was 80% in private sector versus 59.5% in public. Whereas consistent high rates up to100% were observed in some areas [11,13,18,19] lower rates were recorded in others.[10,13,21] Similar to earlier reports[4,7,8,11,18,21] CD was significantly linked to private health services in our univariate and multivariate analysis. Some authors suggested that the rising rate of the planned CD in private sector is due to unnecessary CS and not to increasing obstetric risk. [24] The unsupervised CD in private care, change in obstetric practice, clinicians' attitudes toward CS and financial incentives may drive unnecessary CS.[3,6,18,24] Beside providers' responsibility, women's own preferences and decision-making under social, cultural and media influences should be considered. [3,18] In support, mothers' request was the second common indication for CD in our research which was largely (55.8 %) for fear of labour pain "tocophobia". Other studies reported consistent findings. [3,11] More fears of body changes as pelvic floor injury, urinary incontinence, or sexual dysfunction after vaginal births were also reported. [3,4,11] Though fear is the main engine for CS desire; poor counseling from care providers contribute to its persistence and demand may be largely provider-induced.[17] This may explain that more than one fifth of participating women had a wrong belief that "once CS always CS", that originate from fear of complications after previous CD and was not corrected during ANC. Over 80% of Egyptian women in Health Issues Survey, 2015 who underwent CS reported that surgery was favored by the obstetrician. [7] Financial accessibility may play a major role in women decision where wealthy women can pay for CD and may

aim to be fashionable and stylish. This assumption is supported by the observed highest CD rate among the richest women and lowest rate among the poorest.[4,6,8,13] also,7.8% of the requested CS in our study was desired for nothing except being wealthy. High parity (≥5) was the strongest predictor for CD in the present study. Whereas comparable studies.[13,21] observed association of CD with high parity, contradicting ones showed association with primigravida or low parity.[6,9,10,13,20] Different studies demonstrated no association.[12,18] High parity is more commonly associated with malpresentations and risk factors for obstructed labor which may indicate CS.[15] Both univariate and multivariate analysis in the present study revealed that preceding birth interval ≤2 years was more likely to be associated with CD. Some authors agreed[6] and others did not.[10]

The present study observed significantly higher mean age of marriage among Caesarean versus vaginal deliveries, whereas Rajabi et al reported increasing rate of CD with increasing marriage age.[23] Similar to numerous studies[7-10,12,13,15,18,20,21,23] this study showed significantly higher CD rate with increasing maternal age at delivery (>35 years). In contrast, higher rate among younger maternal aged (< 30 years) was observed.[6] Advanced maternal age may be associated with pelvic rigidity, increased parity, higher number of previous CD, ART, obstetric complications or more medical disorders. In addition, over care for a precious baby may be more encountered. Further, Witt et al.,[19] observed association between maternal age ≥35 years and non-medical CS. All these conditions may be associated with higher CD rate.[6,15,19-21]

Several studies showed increasing rate of CD with increasing years of education.[4,7-10,13,23] Observations of the present study were confirmatory in both univariate and multivariate analysis. On the other hand, absent association[6] and association of CD with low education[12] were observed. Highly educated women may be of higher socioeconomic class, older age at marriage and delivery, higher preferences for CD and more likely to deliver in private sectors. These factors were linked to higher prevalence of CD in the present as in other studies.[2,4,10,18,23] Moreover, highly educated women may have high decision making power who were more likely to deliver via CS.[13] In agreement with some authors[6] and contradicting others[7-9,23] the current study showed no association between CD and work status of mothers.

Prior analysis of multinational data elicited significant increase of CD rate with urbanization. [4,6-8,19] In coordination, urban residence in the present study was a predictor of CD. In urban settings, there may be more accessible heath facilities and wide spread private services. Also, urban women may be wealthier and more educated. Moreover, urban Egyptian women had previously shown a favorable attitude toward CS.[4,6-8]

In the current and in earlier studies, preeclampsia was a main predictor of CD[10,21] and the odds of CS increased among multiple pregnancy.[10,13,18,19] Both conditions might be associated with maternal and fetal complications that indicate CS. In harmony with our results, previous authors observed higher prevalence of CD among ART[20] and with history of abortion[21,23],which increased with increasing number of abortions.[23] These might be attributed to underlying risk factors or associated sub- or infertility or multifetal pregnancy which found to be associated with CS. Adding, this conception may be precious.[3,23] While preterm labour increased the odds of CS in our and Rajabi's [23] studies, increased gestational age at delivery was a CS predictor in Batieha's study.[10] AlSheeha et al detected no association with gestational age.[12]

In agreement with prior studies[7,9,18,19,21] the studied women with co-morbidity in the last or prior pregnancy were more likely to deliver via CS. Parallel observations of significantly higher rate of CD among hypertensive, diabetic and cardiac mothers were seen in other studies. [10,20,21] In these conditions, CS may be medically indicated, requested by mothers for sense of security, or decided by obstetrician as a defensive practice.[3,14,18]

Contrary to a previous study[10] and in line with others [6,18], CD was associated with more antenatal care (ANC) visits in univariate and multivariate analysis. This may be explained by early detection of high risk pregnancies managed later by CS.

As discussed before, previous CD and women request were the most common indications of CS in our study. Next were breech/mal-presentation, HDP, failure of labour progress, and fetal distress. In difference with our data, breech/malpresentations were the strongest predictors of elective CS in other researches[10,21], that may denote regression of non-medical CS. Also, failure to progress was the second common indication in prior studies[12,14,22] and may be attributed to decrease in instrumental deliveries.[22] While breech/mal-presentation had more backward ranks in some studies[12,14], fetal distress had earlier ranks in others.[10,22] In agreement, studies at Ain Shams[14] and Cairo[15] University Hospital presented previous CS, malpresentations and HDP as CS indications with ranks consistent with ours.

Strength & limitations

Being a community survey of relatively large number constitutes study strength. One of the limitations is that study results can only be generalized to Alexandria and not to other regions of the county. Being cross sectional survey limited the investigated variables. Some variables were incomplete and could not be examined. Also, reported indications of CS may not be accurate

CONCLUSION & RECOMMENDATIONS

The rate of CD in Alexandria is very high and mainly due to previous CD and mother request. Predictors of CD are high parity, pre-/eclampsia, previous CD, short preceding birth interval, higher level of education, urban residence, frequent antenatal visits, and delivery in a private service.

- Developing guidelines for CD including shared decision-making with medical audit of CS practice in both governmental and private sectors.
- Supportive training of the young medics to be experts in vaginal assisted deliveries as in CS and reduce fear of litigation.
- Comprehensive women and community health education, including support for tocophobia, risks of CS, success of vaginal after CD or with co-morbidity, and importance of family planning.
- Further larger nationwide studies to investigate CD determinants and to explore the indications and the un-necessary avoidable CS.

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REFERENCES

1. World Health Organization. Monitoring emergency obstetric care: A handbook. Geneva, Switzerland: WHO, 2009.
2. Souza JP, Gülmezoglu A, Lumbiganon P, Laopaiboon M, Carroli G, Fawole B et al. Caesarean section without medical indications is associated with an increased risk of adverse short-term maternal outcomes: the 2004-2008 WHO Global Survey on Maternal and Perinatal Health. BMC Med 2010,8:71. doi:10.1186/1741-7015-8-71
3. Mylonas I, Friese K. Indications for and Risks of Elective Caesarean Section. *Dtsch Arztebl Int* 2015;112(29-30):489-95.
4. Boerma T, Ronsmans C, Melesse DY, Barros AJD, Barros FC, Juan L et al. Global epidemiology of use of and disparities in Caesarean sections. Lancet. 2018;13;392(10155):1341-8.
5. Betrán AP, Ye J, Moller AB, Zhang J, Gülmezoglu AM, Torloni MR. The increasing trend in Caesarean section rates: Global, regional and national estimates: 1990-2014. PLoS One. 2016;11(2):e0148343. doi: 10.1371/journal.pone.0148343.
6. Yassin K, Saida G. Levels and Determinants of Caesarean Deliveries in Egypt: Pathways to Rationalization. The Internet Journal of World Health and Societal Politics 2012;7(2). doi: 10.5580/2c74
7. Ministry of Health and Population [Egypt], El-Zanaty and Associates [Egypt], ICF International. Health Issues Survey 2015. Cairo, Egypt and Rockville, Maryland, USA: Ministry of Health and Population and ICF International, 2015.
8. Ministry of Health and Population [Egypt], El-Zanaty and Associates [Egypt], ICF International. Egypt Demographic and Health Survey 2014. Cairo, Egypt and Rockville, Maryland, USA: Ministry of Health and Population and ICF International, 2015.
9. Elmugabil A, Rayis DA, Hassan AA, Ali AA, Adam I. Epidemiology of Caesarean delivery, Kassala, eastern Sudan: A community-based study 2014-2015. Sudan JMS. 2016;11(2):49-54.
10. Batieha AM, Al-Daradkah SA, Khader YS, Basha A, Sabet F, Athamneh TZ et al. Caesarean Section: Incidence, Causes, Associated Factors and Outcomes: A National Prospective Study from Jordan. Gynecol Obstet Case Rep. 2017;3(3):55. doi:10.21767/2471-8165.1000055
11. Shabila NP. Rates and trends in Caesarean sections between 2008 and 2012 in Iraq. BMC Pregnancy Childbirth.. 2017;17:22. doi: 10.1186/s12884-016-1211-6
12. AlSheeha MA. Epidemiology of Caesarean Delivery in Qassim, Saudi Arabia. Open access Macedonian Journal of Medical Sciences. 2018;6(5):891-5.
13. Yaya S, Uthman OA , Amouzou A, Bishwajit G. Disparities in Caesarean section prevalence and determinants across sub-Saharan Africa countries. Global Health Research and Policy. 2018;3:19. doi: 10.1186/s41256-018-0074
14. Awadalla A. Monitoring of Upward Trend of C-Sections Performed Per Year at An Egyptian University Maternity Hospital: An Economic Barrier in Low-Income Countries. IJOGR. 2016;3(3):257-70.
15. El-Khayat W, Adel D, Abd El-Bar M, Waly M. Caesarean Section Rate at a Tertiary University Hospital in Egypt in Five Years Period (2008-2012). KAJOG 2013;4(3):66-74.
16. Dawood AS, Abdel-Ghafar AS, El-shwaikh SL. A Three Year Retrospective Study of Caesarean Section Rate at Tanta University Hospitals. Journal of Gynecology and Obstetrics. 2017;5(2):25-30. doi: 10.11648/j.jgo.20170502.11
17. Fawzy A, Sweilam M, El-Agwany AS, Hassan E, Moustafa AA, Fawzy DA. Pulling Down the Curtain on Un-necessary Caesarean Section: Shatby Maternity University Hospital Experience in Alexandria with Systematic Literature Review. Women's Health Gynecology. 2016;2(2):21-6.
18. Neuman M, Alcock G, Azad K, Kuddus A, Osrin D, More NS et al. BMJ Open 2014;4:e005982. doi:10.1136/bmjopen-2014-005982
19. Witt WP, Wisk LE, Cheng ER, Mandell K, Chatterjee D, Wakeel F et al. Determinants of Caesarean Delivery in the U.S.: A Lifecourse Approach. Matern Child Health J. 2015;19(1):84-93.
20. Janoudi G, Kelly S, Yasseen A, Hamam H, Moretti F, Walker M. Factors Associated With Increased Rates of Caesarean Section in Women of Advanced Maternal Age. J Obstet Gynaecol Can. 2015;37(6):517-26.
21. Sinnott S, Brick A, Layte R, Cunningham N, Turner M J. National variation in Caesarean Section Rates: A Cross Sectional Study in Ireland. PLoS One. 2016;11(6):e0156172. doi: 10.1371/journal.pone.0156172
22. Gupta M, Garg V. The rate and indications of Caesarean section in a tertiary care hospital at Jaipur, India. Int J Reprod Contracept Obstet Gynecol. 2017;6(5):1786-92.
23. Rajabi A, Maharlouei N, Rezaianzadeh A, Rajaeefard A, Gholami A. Risk factors for C-section delivery and population attributable risk for C-section risk factors in Southwest of Iran: a prospective cohort study. Med J Islam Repub Iran. 2015;29:294. Available at http://mjiri.iums.ac.ir Last access 16/4/2019
24. Einarsdóttir K, Haggar F, Pereira G, Leonard H, de Klerk N, Stanley FJ. Role of public and private funding in the rising Caesarean section rate: a cohort study. BMJ Open. 2013;3(5):e002789. doi:10.1136/bmjopen-2013-002789