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Cesarean Section According to Robson Classification in a Tertiary Hospital, Southern Thailand

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ABSTRACT

Background & Objective: Cesarean section (CS) rates have increased continuously worldwide in the past decades while not being associated with significant benefits for mothers and newborns. According to Robson's classification, the present research aimed to analyze the associating factor to cesarean section to set the practice system and decrease the cesarean section rate in the near future.

Materials & Methods: This is a retrospective cross-sectional analytic study of the medical record of pregnant women who delivered in 2019 at MNST Hospital. The logistic regression model carried out the adjusted odds ratio (OR) of cesarean section rate and 95% confidence intervals.

Results: A total of 5,360 medical records were recruited. Of all birth, 55.4% occurred by cesarean section, most of whom were categorized in R1 to R4 of Robson classification (23.3%), followed by R5 (21.1%) and R10 (5.4%). The subgroup R1-R4 analysis demonstrated that obesity, Bachelor's education, and private obstetrician were significantly related to the cesarean section in the group of spontaneous labor (R1, R3), and Bachelor's education and private obstetrician were significantly related to the cesarean section in the group without spontaneous labor (R2, R4) (adjust OR 13.50, P<0.001 and adjust OR 2.11, P<0.001, respectively).

Conclusion: Private obstetrician and education level were factors related to the obstetric indication of unnecessary cesarean section.

Keywords: Cesarean section, Factor, Robson classification

Introduction

Cesarean section (CS) is a procedure that can practically prevent mothers and newborn mortality when used for medically indicated reasons. CS rates have been increased around the world in the past decades. The analytic trend in 121 countries between 1990 and 2014 found that the average CS rate was 12.4% rising from 6.7% to 19.1% **(1, 2)**. The rate increased in Asian countries such as Turkey, Georgia, and China by 39.5%, 32.9%, and 31.8%, respectively. **(1, 3)**. The increasing CS rates in Thailand were from 14.8% in 1990 to 20.7% in 2001 and reached 39.4 in 2014 **(4)**, while not being associated with maternal and neonatal benefits **(4, 5)**.

Previous studies found that maternal mortality rates were 2.2 deaths per 100,000 in cesarean section (CS) compared to 0.2 deaths per 100,000 in vaginal delivery **(6)**, and maternal morbidity rates were doubled by CS compared to normal delivery (ND) **(7)**. The psych-osocial outcomes for example, depression, anxiety, and confidence in parenting ability, were less satisfactory in emergency CS compared with ND **(8)** and with possible negative consequences for the infant and child **(9)**. The cost-effectiveness is another factor to be evaluated. Although elective CS is cheaper than spontaneous ND, there is more risk of maternal and neonatal adverse effects **(3)** that result in more expected value than operative vaginal delivery **(10)**. Therefore, ND is preferred.

In 1985, World Health Organization (WHO) declared that "There is no justification for any region to have a CS rate higher than 10-15%" **(11)** then in 2015, WHO released a new statement concluded that "CS rates higher than 10% are not associated with reductions in maternal and newborn mortality rates" by using Robson classification (RC) system as a global standard for assessing, monitoring and comparing CS rates **(12)**.

Robson system classifies pregnant women into 10 groups by 6 obstetric characteristics: 1) parity (nulliparous, multiparous), 2) onset of labor (spontaneous, induced or pre-labor CS), 3) gestational age (preterm or term), 4) fetal presentation (cephalic, breech or transverse), 5) number of fetuses (one or more than one) and 6) history of previous CS **(13)** which described in Figure 1.

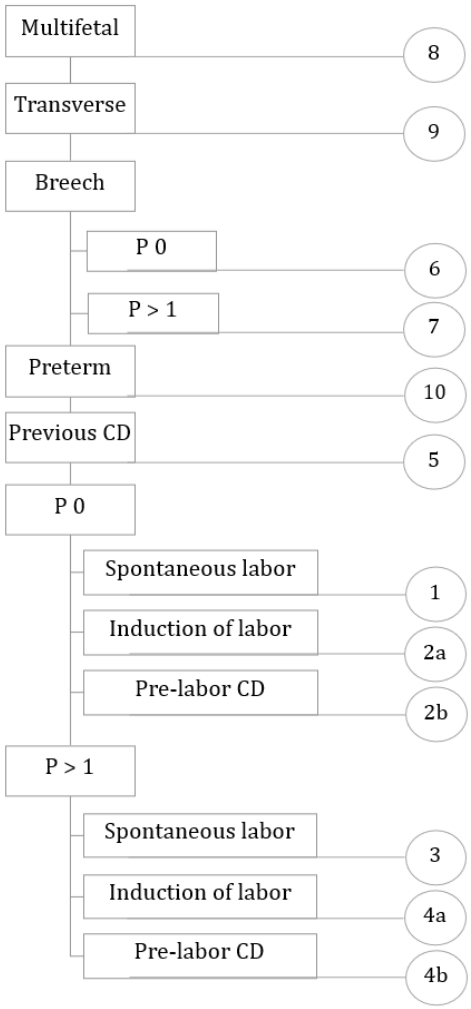

Figure 1. Robson classification

Mostly, CS performed in Maharaj Nakhon Si Thammarat (MNST) Hospital were a group of previous CS and pre-labor CS with term cephalic singleton pregnancy **(14)**. The contributing factors to rising CS rates are complex, and finding interventions to solve them is challenging. Although RC is an international standard for evaluating CS rates, it is only describing the CS situation. The decreasing CS rate should identify the cause or risk factors, including the association between CS and population characteristics such as obesity, multiple pregnancies, and older women **(15, 16)**. The present research was purposed analyzing associating factors to CS according to RC to set the practice system and decrease CS rate in the near future.

Materials and Methods

This is a population-based case-control study that collected the medical records of the pregnant women who delivered in the obstetrical unit of a tertiary hospital in southern Thailand according to Robson classification (RC) during the 2019 fiscal year.

The Study Design and Population

The present study was a retrospective descriptive-analytic research of medical records of the pregnant women who delivered in labor rooms of Maharaj Nakhon Si Thammarat (MNST) hospital between October 2018 to September 2019. The inclusion criterium was carrying a living fetus in the uterus. The exclusion criterium was born before arrival (BBA) and the incomplete labor record.

The collecting sheet was created in an electrical form consisting of 3 sections; the first section was demographic data of pregnant women such as age, body weight, height (for calculated BMI), education, and private maternity care. In the later section, the six factors, which were parity, previous cesarean section, the onset of labor, number of fetuses, gestational age, and fetal presentation, were codified and interpreted in RC by statistical program, and the last section included the route of delivery. The content validity of this recording form was verified by three obstetrical experts. The present study, which was part of a research project named “Factor Associated with Elective Cesarean section in a Tertiary Hospital, Southern Thailand” was approved by IRB of MNST hospital and Walailak University.

The Statistical Analysis

The data in each group of RC were shown in percentage, then calculated CS rate as percentage concerning obstetrical population. The absolute contribution is the proportion of CS in relation to the total obstetric population, and the relative CS rate is the proportion of CS in each Robson group related to the total number of CS. Demographic data and neonatal outcomes were described by frequency, percentage, mean, and SD based on RC. The inferential analysis of the difference between RC groups was compared by the Chi-square test. The 95% confidence interval (CI) was carried out using the Cochran's and Mentel-Haenszel statistics to test common odds ratio and binary logistic regression for the adjusted odds ratio. A P-value<0.05 was considered statistically significant.

Results

A total of 5994 pregnant women were referred to the obstetrical unit of MNST hospital in 2019. The 24 pregnant women who had no living fetus in utero and 26 pregnant women who delivered before hospital referral were excluded. The 5,944 medical records were recruited, then 584 incomplete medical records were removed. Finally, 5360 medical records were included in the present study.

The CS and ND demographic data, including age, body mass index (BMI), education level, and primary doctors, were statistically significantly different as summarized in Table 1. The mean age was 30 years and 27 years in CS and normal delivery (ND) respectively, most of them were in the reproductive age group (20-34 years), approximately 3871 participants (72.2%), followed by advanced maternal age (> 35 years) and teenage (< 20 years). The higher maternal age is directly related to CS, with a significant difference. The mean height was 158.4 centimeters (cm) and 158.8 cm in CS and ND, respectively, without a significant difference. The mean BMI was 28.6 kg/m2 and 27.2 kg/m2 in CS and ND, respectively. In addition, more BMI and education level were significantly associated with CS. Also, the private obstetrician was associated with CS with demonstrating a significant difference.

Table 1. The demographic data

Demographic data	N (%)	n (%)		*P*-value
		CS	ND	
Age (years)				
< 20	391 (7.3)	139 (35.5)	252 (64.5)	<0.001***
20-34	3,871 (72.2)	2,072 (53.5)	1,799 (46.5)	
≥ 35	1,098 (20.5)	761 (69.3)	337 (30.7)	
Height (cm)				
< 145	38 (0.7)	23 (0.4)	15 (0.3)	0.527
≥ 145	5,322 (99.3)	2,949 (55.0)	2,373 (44.3)	
BMI (kg/m^2)				
< 18.5	38 (0.7)	13 (34.2)	25 (65.8)	<0.001***
18.5-24.9	1509 (28.2)	693 (45.9)	816 (54.1)	
25.0-29.9	2,235 (41.7)	1,288 (57.6)	947 (42.4)	
≥ 30	1,578 (29.4)	978 (62.0)	600 (38.0)	
Education level				
Below primary School	65 (1.2)	30 (46.2)	35 (53.8)	<0.001***
Primary School	565 (10.5)	221 (39.1)	344 (60.9)	
High School	2,320 (43.3)	1,064 (45.9)	1,256 (54.1)	
Diploma	502 (9.4)	280 (55.8)	222 (44.2)	
Bachelor's degree	1,702 (31.8)	1,216 (71.4)	486 (28.6)	
Master's degree	206 (3.8)	161 (78.2)	45 (21.8)	
Primary doctor				
Private obstetrician	1,610 (30.0)	1,433 (26.7)	177 (3.3)	<0.001***
Nonspecific obstetrician	3,750 (70.0)	1,539 (28.7)	2,211 (41.3)	

BMI, Body mass index; CS, Cesarean section; cm, centimeters; kg/m^2, kilograms per square meter; ND, Normal delivery Statistic: p-value; ns = non significant, *p<0.05 **p<0.01 ***P<0.001

Of the 5360 reviewed medical records, 1221 contained multiparous women with spontaneous labor (R3). About 22.8% of all records showed multiparous women with singleton terms and previous CS (R5). The terms nulliparous women with singleton term and spontaneous labor (R1) were observed in 1,133 (21.1%) and 876 (16.3%), respectively.

According to 2972 analyzed medical records of CS (55.4%), 38.1% of CS was R5 followed by 12% for the term nulliparous women without spontaneous labor who delivered by CS (R2b), and 9.7% of the records belonged to women with singleton cephalic preterm pregnancy (R10). The nulliparous and multiparous breech pregnancy (R6, R7), multifetal pregnancy (R8), and transverse or oblique presentation (R9) were truly obstetric indications for CS, which were 321 medical records or 5.9% as illustrated in Table 2.

Table 2. All delivered women according to Robson classification

Group	N (%)	CS (%)	CS rate	Absolute Contribution
R1	876 (16.3)	214 (7.2)	24.8%	4.0%
R2	886 (16.5)	748 (25.2)	84.4%	14.0%
R2a	*245 (4.6)*	*107 (3.6)*	*44.1%*	*2.0%*
R2b	*641 (12.0)*	*641 (21.6)*	*100.0%*	*12.0%*
R3	1,221 (22.8)	80 (2.7)	8.2%	1.5%
R4	400 (7.4)	203 (6.9)	50.6%	3.8%
R4a	*238 (4.4)*	*41 (1.4)*	*17.4%*	*0.8%*
R4b	*162 (3.0)*	*162 (5.5)*	*100.0%*	*3.0%*
R5	1,133 (21.1)	1,133 (38.1)	100.0%	21.1%
R6	108 (2.0)	105 (3.5)	97.3%	2.0%
R7	96 (1.8)	91 (3.1)	95.0%	1.7%
R8	68 (1.3)	62 (2.1)	95.7%	1.2%
R9	49 (0.9)	49 (1.6)	100.0%	0.9%
R10	523 (9.8)	287 (9.7)	54.2%	5.4%
Total	5,360 (100.0)	2,972 (100.0)	55.4%	

CS, Cesarean section

Robson classification categorized delivered women into obstetric indications for CS who were R6 to R9, which was the minority, while the women with a singleton cephalic term pregnancy were more in number. So R1 to R4 group was more concentrated in the present study.

In the group of pregnant women with a single cephalic pregnancy, the terms spontaneous labor (R1, R3), Obesity (BMI ≥ 30 kg/m2), Bachelor's degree, and private obstetrician were associated with CS with statistically significant (P<0.05) as demonstrated in Table 3.

Table 3. The factors associated CS in pregnant women with spontaneous labor (R1, R3)

Demographic data	N	CS (%)	OR (95%CI)	P-value	Adjust OR (95%CI)	p-value
Age (years)						
≥ 35	285	40 (14.0)	1.00 (0.70-1.44)	0.994		
< 35	1812	254 (14.0)	1			
Height (cm)						
< 145 cm	2086	1793 (86.0)	0.61 (0.08-4.80)	0.640		
≥ 145 cm	11	10 (90.9)	1			
BMI (kg/m^2)						
≥ 30	547	447 (81.7)	1.56 (1.20-2.04)	0.001**	1.74 (1.33-2.28)	<0.001***
< 30	1550	1356 (87.5)	1			
Education level						
Bachelor's degree	505	405 (80.2)	1.78 (1.37-2.32)	<0.001***	1.45 (1.08-1.95)	0.013**
Under Bachelor's degree	1592	1398 (87.8)	1			
Primary doctor						
Private obstetrician	170	118 (69.4)	3.07 (2.16-4.37)	<0.001***	2.74 (1.86-4.03)	<0.001***
Nonspecific obstetrician	1927	1865 (87.4)	1			

CS, Cesarean section; cm, centimeters; kg/m^2, Kilograms per square meter; ND, Normal delivery; OR, Odds ratio
Statistic: p-value; ns=non significant, *p<0.05, **p<0.01, ***P<0.001

In the group of pregnant women with a single cephalic term pregnancy without spontaneous labor (R2, R4), the advanced maternal age (age ≥ 35 years), Obesity (BMI ≥ 30 kg/m2), Bachelor's degree, and private obstetrician were associated with CS in a statistically significant form. The multivariate analysis showed Bachelor's degree and private obstetrician were significantly associated with CS (P<0.05) after adjusting other factors as expressed in Table 4.

Table 4. The factors associated CS before labor compared with labor induced (R2, R4)

Demographic data	N	R2b+R4b (%)	OR (95%CI)	p-value	Adjust OR (95%CI)	p-value
Age (years)						
≥ 35	252	178 (70.6)	1.57 (1.17-2.12)	0.003*	1.13 (0.08-1.58)	0.496
< 35	1034	625 (60.4)	1			
Height (cm)						
< 145 cm	16	9 (56.3)	0.77 (0.29-2.68)	0.608		
≥ 145 cm	1270	794 (65.5)	1			
BMI (kg/m^2)						
≥ 30	414	242 (58.5)	0.78 (0.61-0.99)	0.042*	1.04 (0.80-1.36)	0.773
< 30	872	561 (64.3)	1			
Education level						
Bachelor's degree	565	445 (78.8)	3.76 (2.93-4.82)	<0.001***	1.61 (1.20-2.17)	0.002**
Under Bachelor's degree	721	358 (49.7)	1			
Primary doctor						
Private obstetrician	578	499 (86.3)	8.39 (6.34-11.11)	<0.001***	6.65 (4.86-9.08)	<0.001***
Nonspecific obstetrician	708	304 (42.9)	1			

CS, Cesarean section; cm, centimeters; kg/m^2, Kilograms per square meter; ND, Normal delivery; OR, Odds ratio
Statistic: p-value; ns=non significant, *p<0.05, **p<0.01, ***P<0.001

Discussion

The report of MNST shows CS rates increased from 44.1% in 2011 to 50.5% in 2014 and 52.2% in 2018 **(14)**, which was higher than WHO's statement at 10-15% **(11)** and steady rise in the present study (55.4%). The RC was used to understand the CS situation in the MNST context, divided into 2 parts, type of population and CS rate.

The Type of Population

The majority of pregnant women who delivered in MNST were a single cephalic term pregnancy which was a closed proportion between 32.9% for nulliparous and 30.2% for multiparous. The proportion of R1/R2 was 0.98, which was lower than the expected value of 3.3 from WHO recommendation "Multicountry survey on maternal and newborn health" (WHO-MCS) **(17)**, differed from Siriraj Hospital and Rajavithi Hospital, the reputable tertiary center of Thailand, approximately 3.0 and 4.2, respectively **(18, 19)**. These mean high-risk primigravida and the need for CS in the MNST hospital leading to a higher CS rate. The MNST hospital is only a tertiary hospital in Nakhon Si Thammarat province, while Siriraj Hospital and Rajavithi Hospital are located in Bangkok, the capital of Thailand. The proportion of R3/R4 was 3.0, compatible with the expected value (more than 2.0) **(17)** but clearly differed from Siriraj Hospital and Rajavithi Hospital (approximately 10.5 and 16.2 respectively) **(18, 19)**.

The population of term multiparous women with previous CS (R5) was 21.1% which was higher than 15% of WHO statement **(12)** and 1.5 times higher compared with Siriraj Hospital and almost 2 times higher for Rajavithi Hospital **(18, 19)** that could be implied high total CS rate.

The total of breech presentation (R6, R7) was 3.8%, compatible with the expected value 3-4% **(17)** and similar to Siriraj Hospital and Rajavithi Hospital (approximately 4.4 and 4.2 respectively) **(18, 19)**.

The population of multiple gestations (R8) was 1.3%, nearly by 1.5% of expected value and 1.6% of Siriraj Hospital and 1.8% of Rajavithi Hospital **(17-19)**. The total of transverse and oblique lie (R9) was 0.9%,

compatible with less than 1.0% of the expected value but higher than Siriraj Hospital (approximately 3 times) and Rajavithi Hospital (approximately 4.5 times) **(17-19)**. The single cephalic preterm pregnancy (R10) was quite high, about 9.8% (expected value was 2.0%) but similar to Siriraj Hospital and Rajavithi Hospital (approximately 10.4 and 12.7 respectively) **(18, 19)**; it could be implied that was appropriate with a tertiary center of MNST.

The CS Rate

The highest contribution to CS rate in the present study was R5 (term multiparous women with previous CS), which is similar to previous studies conducted in Thailand **(18, 19)**. It showed that 100% of CS rate in the group was followed by the clinical practice guidelines of MNST. However, the trial of labor after cesarean (TOLAC) should be considered to reduce this group's CS rate **(20-22)**. It is currently not recommended in MNST. The decreasing primary CS could diminish the CS rate of R5 in the future.

Although the absolute contribution of R5 was only 21.1% which was lower than the WHO recommendation **(17)** (about 28.9%), the total absolute contribution of R1, R2, R3, R4, and R5 was 80.0% higher than the WHO recommendation, which was approximately 66%. Thus the principle analysis in the present study was performed in R1 to R4 categories.

CS rates in R1 and R3, approximately 24.8% and 8.2%, respectively, were quite high compared with the WHO recommendation **(17)**, which concerned the appropriateness of indications for CS. There are still variations among obstetricians in the decision of CS, including criteria of diagnosis, management guidelines, and possible medical lawsuits. At the same time, the other tertiary centers could be better compared to the situation in Thailand; for example, Siriraj Hospital, was 37.1% in R1 and 9.4% in R3 **(18)**, and Rajavithi Hospital was 18.9% in R1, and 6.2% in R3 **(19)**.

Moreover, the present study found that the multiparous trended to success for ND compared to a nulliparous group, explaining that the fear and concern were decreased by experiences **(23-26)** and the benefits of ND (Lower infection rate, decreased postpartum hemorrhage (PPH) incidences and less Thromboembolism event **(7)** including complication of anesthesia in CS) are acknowledged **(27, 28)**.

The Obesity (BMI $\geq$ 30 kg/m2), Bachelor's degree, and private obstetrician were directly associated with CS among pregnant women with a singleton cephalic term pregnancy with spontaneous labor (R1, R3) significantly different (P<0.05), similar to the previous systematic review that reported a relationship between the education level and occupation and CS **(29)**; co-incidence in high education, high economic status and obesity led to the maternal request for private obstetrician and CS to decrease the risk of injury for baby and the inconvenience for mother **(23-26)**. The development of appropriate management and decision guidelines could help reduce the CS rate in these groups in the future.In the group of pregnant women with a singleton cephalic term pregnancy without spontaneous labor (R2, R4), the present study showed a CS rate of approximately 84.4% in R2 and 50.6% in R4 with close to those in Siriraj hospital (84.0% in R2 and 58.3% in R4) and Rajavithi hospital (90.2% in R2 and 73.0% in R4) **(18, 19)**, completely contradicting WHO recommendation **(17)**. According to subgroup analysis, the proportion of Prelabor CS and labor inductions in nulliparous (R2b/R2a) and multiparous (R4b/R4a) were quite high as a result of higher total CS rate and very high CS rate in labor inductions (43.7% in R2a and 17.2% in R4a), compared with those in Siriraj Hospital (49.4% in R2a and 7.4% in R4a) **(18)** where inappropriate labor inductions led to failed induction and CS in the end.

Furthermore, the present study found that the Bachelor's degree and private obstetrician were significantly associated with CS in these groups (P<0.05), which may result from the Cesarean section on Maternal Request (CSMR) consequently. Then, using campaigns and explaining the benefits of ND and disadvantages of CS to pregnant women at an antenatal clinic could prevent unnecessary CS in the future.

Conclusion

Private obstetrician and education levels were related to the obstetric indication of CS of R1 to R4 Classification. An appropriate guideline for auditing CS should be developed among private services to reduce an unnecessary CS rate.

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Conflict of Interest

The authors declared no conflict of interest.

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