Rate and determinants of cesarean delivery in northwest of Iran: descriptive results from public health records

Sorayya Kheirouri[1], Mohammad Alizadeh[2], Zahra Akbari[3], Sanaz Ghalehghir[3], Masumeh Feizian[3], Zahra Shoae[3]

[1]Associate professor, Department of Nutrition, Tabriz University of Medical Sciences, Tabriz, Iran - E-mail: kheirouris@tbzmed.ac.ir; [2]Professor, Nutrition Research Center, Tabriz University of Medical Sciences, Tabriz, Iran - E-mail: mdalizadeh@tbzmed.ac.ir; [3]Students' Research center, Tabriz University of Medical Sciences, Tabriz, Iran

Summary. *Objective:* We investigated socio-demographic, antenatal and neonatal nutritional factors that might contribute to the increased risk of cesarean delivery in Iranian women. *Methods:* This descriptive study was carried out in Tabriz city, Iran, during June to August 2014. The data of 807 urban mothers delivering a singleton live infant and their offspring were collected from databases of eight primary health care centers and analyzed using spearman's rank test, univariable and multivariable logistic regression. *Results:* Cesarean section rate was 55.9%. Higher rates of cesarean section was observed among mothers aged ≥ 35 years (63.2%), with pre-pregnancy weight ≥ 65 kg (62.3%), higher educated (75.0%), high economic status (68.8%), with LBW infants (75.7%), early term delivery (74.9%), and mothers with newborns head circumference (HC) ≥ 34 cm (58.9%). According to multivariate analysis, maternal advanced age (OR= 1.59; 95 % CI 0.99, 2.57; p= 0.05), maternal pre-pregnancy weight ≥ 65 kg (OR= 1.47; 95 % CI 1.08, 1.99; p= 0.01), maternal higher education (OR= 3.49; 95 % CI 1.80, 6.75; p= 0.0001), middle economic status (OR= 1.66; 95 % CI 1.13, 2.43; p= 0.009), early term delivery (OR= 7.11; 95 % CI 5.00, 10.10; p= 0.0001) and newborns HC ≥ 34 cm (OR= 2.08; 95 % CI 1.38, 3.14; p= 0.001) were independently associated with increased odds of cesarean section. *Conclusion:* The high cesarean rate in Iran must be paid substantial attention. Considering the contributing factors in the incidence of cesarean section, appropriate policies must be adopted to improve quality of maternal care services and to implicate community based health education interventions.

Key words: cesarean section, maternal factors, neonatal factors, anthropometric indices

Introduction

Cesarean section is one of the most commonly performed surgeries in the world, with rates continuing to growth, mainly in high- and middle-income countries. Although it can save lives, cesarean section is often performed without medical need which could have short- and long-term health problems for women and their babies (1).The desired rate for cesarean sections has been considered between 10% and 15% by the international healthcare community. New studies reported that when cesarean section rates increase towards 10% across a population, the number of maternal and newborn deaths decreases. But when the rate goes above 10%, there is no evidence that mortality rates improve (1). In contrast, numerous evidences have indicated that cesarean delivery may have considerably greater risks than vaginal deliveries (2,3). Furthermore, increased risk of maternal mortality and severe morbidity was reported in women who undergo cesarean section with no medical indication (4). Hence, there is a widespread tendency to stop and reverse this trend. To attain this, in depth detection of the factors contributing to the rise is required.

Over the past few decades, the cesarean section rate in Iran has grown sharply from less than 7% in the

1970s to over 48% in 2009 (5). Findings summarized in a meta-analysis indicate that sociocultural, maternal education, obstetric and non-obstetric-medical causes were major reasons of cesarean in Iran (6). In addition to obstetric factors, evidences indicated that prenatal factors and characteristics of individual women have been associated with cesarean section, some of which may be modifiable (7, 8). With regard to ethnic diversity within the country, evidence on strength of the contributing factors to cesarean section, especially in the northwest of Iran, is still very limited. If these factors can be elucidated it may be of help in specifying key areas that could be targeted to control cesarean section rates. Therefore, the aim of this study was to investigate the socio-demographic, antenatal, and fetal nutritional factors associated with cesarean section.

Materials and Method

Field of study and participants

The procedure and participants characteristics have been described elsewhere (9). This descriptive, population-based study was conducted in Tabriz, capital of East Azerbaijan province in Northwest of Iran from June to August 2014. Out of 27 public health care centers in the city, total of eight centers were selected by cluster sampling method. The study was approved by ethical committee at Tabriz University of Medical Sciences.

Population proportion formula with 95 % confidence interval, 50 % proportion, 3.5 % margin of error and a dropout rate of 3% was used to estimate sample size. The data of 807 urban mothers delivering a singleton live infant and their offspring during the last two years up to August 2014 were collected from databases of 8 health care facilities and analyzed. The collected data included all potential maternal related factors including anthropometry, age, smoking, drinking, education, economic status, nutrient supplements, gestational weight gain (GWG), gestational age, birth order, and also neonatal anthropometric measurements at birth [weight, height, and head circumference (HC)] which were hypothesized to influence on the mode of delivery. Multiple deliveries, stillbirth and abortion were excluded.

Neonates with birth weight less than 2500 g were defined as LBW. Maternal age at the time of delivery was categorized as follows: <18 (younger age), 18- 34.9 (middle age) and ≥ 35 (older age) years (9). Mothers were nutritionally classified into four groups using the cutoff points recommended by the World Health Organization (WHO) as follows: underweight (BMI< 18.5 kg/m²), normal weight (18.5≤ BMI< 24.99 kg/m²), overweight (25≤ BMI< 29.99 kg/m²) and obese (BMI≥ 30 kg/m²). Regarding maternal pre-pregnancy weight and infant birth HC, receiver operating characteristic curves (ROC) were drawn to determine optimal cut-off values. Then, mothers fell into two weight categories of < 65 and ≥ 65 kg and birth HC into two categories of < 34 and ≥ 34 cm (9). Gestational age was classified into four groups: babies born alive at ≤ 36 weeks of gestation defined as preterm, 37- 38 weeks as early term, 39-40 weeks full term and ≥ 41 weeks late term.

Illiterate women along to who had education at primary level combined into one category defined as low education. Women with junior or senior high school level were classified in moderate and those with academic education into high education level. Items such as educational level and occupational status were used to estimate the economic status of the study subjects and categorized in three groups as follows: low (unemployed or jobless with low education, construction workers, handicraft makers, housekeepers with low or moderate education), middle (single parent / government staff, farmer with medium education) and high (dual worker parents /government staff, large trader and farmer with medium or high education) (9).

Statistics

The statistical package SPSS (version16) was used to obtain descriptive statistics (frequencies, percentages). Differences between the groups were assessed by Chi-square test.–Spearman's coefficients correlations were performed to obtain associations between each variable and the mode of delivery. Then, univariable logistic regression was used to obtain odds ratios (ORs), 95% confidence intervals (CIs), and two-sided P-values. The data were further analyzed using multivariable logistic regression to controlling the effect of potential confounding variables. P values ≤ 0.05 were considered statistically significant.

Results

Socio-demographic characteristics of mothers

Maternal socio-demographic characteristics are shown in Table 1. Among 737 deliveries, cesarean section rate was 55.9%. Of mothers, 99.9% were not smoking or drinking, 63.9% had middle level of education and 48.9% were at middle level of economic status. Type of diseases had been recorded only for 296 (36.6%) mothers. Of them, 276 (34.1%) were with no disease and the most frequent diseases were hypothyroidism (n = 7, 34.1%), asthma (n = 2, 0.2%), depression (n = 1, 0.1%), diabetes (n = 2, 0.2%), hypertension (n = 2, 0.2%), vascular headache (n = 2, 0.2%).

Association between prenatal factors and mode of delivery

As shown in Table 2, six of the used variables, showed some evidence ($P < 0.05$) of an association with the mode of delivery. Mode of delivery significantly and positively correlated with maternal pre-pregnancy weight (r= 0.08, p= 0.02), education (r= 0.21, p= 0.0001), economic status (r= 0.16, p= 0.0001) and disease type in pregnancy period (r= 0.11, p= 0.01). Delivery type was negatively associated with gestational age (r= -0.33, p= 0.0001). A positive correlation was also observed between infants birth HC and delivery type (r= 0.09, p= 0.01). Delivery type were not correlated with maternal pre pregnancy BMI, gestational weight gain, iron, folic acid and multi-vitamin supplements intake during pregnancy and also maternal age and birth order.

Table 1: Socio-demographic characteristics of mothers

Delivery type (n= 737)	
vaginal	325 (44.1)
cesarean	412 (55.9)
Age (year, n= 794)	
< 18	23 (2.9)
18- 34.9	668 (84.1)
≥ 35	103 (13.0)
Education (n= 807)	
low	200 (24.8)
middle	516 (63.9)
high	91 (11.3)
Economic (n= 788)	
low	294 (37.3)
middle	385 (48.9)
high	109 (13.8)

Data were expressed as frequency (percent)

Effect of maternal and neonatal factors on cesarean rate and univariate and multivariate analysis of factors associated with cesarean delivery

Cesarean rate increased non-significantly with enhancement of maternal age (p= 0.13). According to univariate regression analysis performed, the odds of having cesarean delivery among mothers aged ≥ 35 years were 1.38 (95% CI; 0.88 to 2.16, p= 0.16) times than mothers aged 18- 34.9 years (Table 3).

Cesarean rate was 62.3% among mothers with pre-pregnancy weight ≥ 65 kg versus 52.2% among of those who were < 65 kg (p= 0.007). Maternal pre-pregnancy weight ≥ 65 kg was associated with higher odds of cesarean section both in univariate [1.51 (95% CI; 1.12 to 2.03, p= 0.007)] and multivariate analysis [1.47 (95% CI; 1.08 to 1.99, p= 0.01)] (Table 3) compared with those who were < 65 kg.

Cesarean section rate increased in proportion to enhancement of maternal education and mothers with higher level of education had significantly greater rate of cesarean section (p= 0.0001). In univariate analysis, the odds of having cesarean delivery among mothers with high and middle education level were 4.42 (95%

Table 2: Association between prenatal factors and mode of delivery

	r	p-value
Pre- pregnancy BMI	0.07	0.09
Pre-pregnancy weight	0.08	0.02
Maternal height	0.04	0.35
Gestational weight gain	−0.05	0.20
Gestational age	−0.33	0.0001
Gestational iron supplement intake	−0.006	0.88
Gestational Folic acid supplement intake	−0.03	0.47
Gestational multi-vitamin supplement intake	0.04	0.30
Education	0.21	0.0001
Economic status	0.16	0.0001
Maternal age	0.06	0.08
Birth rank	−0.02	0.59
Infants birth height	−0.03	0.42
Infants birth weight	−0.03	0.42
Infants birth HC	0.09	0.01
Prenatal diseases type	0.11	0.01

Spearman's coefficients correlations were performed to obtain associations between the variables with mode of delivery.

Table 3: Effect of maternal and neonatal factors on cesarean rate and univariate and multivariate analysis of factors associated with cesarean delivery

	Number	Cesarean rate (%)	p[a]	Univariate analysis Odds ratio (95% CI)	p	Multivariate analysis Odds ratio[b] (95% CI)	p
Mothers age (years)			0.13				
<18	20	40		0.54 (0.22, 1.33)	0.18	0.72 (0.27, 1.90)	0.50
18-34.9	621	55.4		1.00 (reference)		1.00 (reference)	
≥ 35	95	63.2		1.38 (0.88, 2.16)	0.16	1.59 (0.99, 2.57)	0.05
Pre-pregnancy weight (kg)			0.007				
< 65	405	52.2		1.00 (reference)		1.00 (reference)	
≥ 65	316	62.3		1.51 (1.12, 2.03)	0.007	1.47 (1.08, 1.99)	0.01
Education			0.0001				
low	178	40.4		1.00 (reference)		1.00 (reference)	
middle	475	58.3		2.06 (1.45, 2.92)	0.0001	1.97 (1.34, 2.90)	0.001
high	84	75.0		4.42 (2.48, 7.87)	0.0001	3.49 (1.80, 6.75)	0.0001
Economic status			0.0001				
low	249	45.4		1.00 (reference)		1.00 (reference)	
middle	373	60.1		1.81 (1.31, 2.50)	0.0001	1.66 (1.13, 2.43)	0.009
high	109	68.8		2.65 (1.65, 4.27)	0.0001	1.64 (0.92, 2.94)	0.09
LBW (g)			0.01				
< 2500	37	75.7		2.59 (1.20, 5.56)	0.01	2.02 (0.92, 4.47)	0.08
≥ 2500	696	54.6		1.00 (reference)		1.00 (reference)	
Gestational age			0.0001				
preterm	9	55.6		3.18 (0.83, 12.15)	0.09	2.21 (0.54, 8.96)	0.27
early term	419	74.9		7.61 (5.41, 10.70)	0.0001	7.11 (5.00, 10.10)	0.0001
full term	280	28.2		1.00 (reference)		1.00 (reference)	
post term	15	46.7		2.23 (0.78, 6.34)	0.13	2.48 (0.85, 7.22)	0.10
Birth HC (cm)			0.0001				
< 34	142	42.3		1.00 (reference)	0.0001	1.00 (reference)	0.001
≥ 34	591	58.9		1.96 (1.35, 2.84)		2.08 (1.38, 3.14)	

[a] *Differences between groups were assessed by ANOVA for variables with ≥ 3 categories and chi-square test for variables with two categories;* [b] *adjusted for appropriate confounding factors (gestational age, maternal age, weight, BMI, education, economic status and diseases type).*

CI; 2.48 to 7.87, p= 0.0001) and 2.06 (95% CI; 1.45 to 2.92, p= 0.0001) times than mothers with low level of education, respectively (Table 3).

Cesarean rate was also significantly greater among mothers with high and middle economic status compared with low economic status (p= 0.0001). Mothers with high and middle economic status were 2.65 (95% CI; 1.65 to 4.27, p= 0.0001) and 1.81 (95% CI; 1.31 to 2.50, p= 0.0001) times more likely to have cesarean delivery compared to mothers with low economic status, respectively, in univariate analysis (Table 3).

Mothers with LBW neonates had also greater rate of cesarean compared with mothers who had normal weight neonates (p= 0.01). The odds of having cesarean delivery among mothers with LBW neonates were 2.59 (95% CI; 1.20 to 5.56, p= 0.01) times than mothers who had normal weight neonates, in univariate analysis.

Mothers with full term neonates had significantly the lowest rate of cesarean (28.2%) and mothers with early term neonates had the highest rate of cesarean section (74.9%) (p= 0.0001). The odds of having cesarean delivery among mothers with early term neonates were 7.11 (95% CI; 5.00 to 10.10, p= 0.0001) times than mothers with full term neonates, in univariate analysis.

Higher rate of cesarean section was observed among mothers who their infants birth HC was ≥ 34 cm compared with those who their infants birth HC was less than 34 cm (58.9% vs. 42.3%, p= 0.0001). The odds of having cesarean delivery among mothers with infants birth HC ≥ 34 cm was 1.96 (95% CI; 1.35 to 2.84, p= 0.0001) times than mothers with infants birth HC less than 34 cm, in univariate analysis.

However, according to multivariate analysis, after adjusting for appropriate confounding factors, mater-

nal age ≥ 35 years, pre-pregnancy weight, education, economic status, early term delivery and birth HC were significant predictors of cesarean section. But, the effect of LBW was attenuated (OR: 2.02, 95% CI; 0.92 to 4.47, p= 0.08).

Of mothers who had cesarean section, 94.9% were found with no disease in pregnancy period. In respect to cesarean rate, no significant difference was observed between various type of diseases (p= 0.06). Among mothers, the highest observed disease was hypothyroidism (n= 7), which of them 85.7% (n= 6) had cesarean section. Since other diseases were not observed in more than one or two people, therefore, regression analysis was not conducted for this variable.

Discussion

The highest ORs of cesarean section in this analysis were for early term deliveries. Increasing maternal education level and economic status, advanced maternal age, and neonatal head circumference were also associated with elevated odds of cesarean section.

In the present study, we observed that, after controlling for important confounding variables, the risk for cesarean delivery elevated continuously with advancing maternal age. The finding is in agreement with previous studies (8, 10). In a cohort study on 12 944 singleton, liveborn pregnancies, with three different models of analysis, it was shown that increasing maternal age is independently associated with increased odds of cesarean section (7). In another study on 502524 singleton deliveries, it was reported that increment in cesarean rate was in proportion to advancing maternal age (8). Although, the exact cause of this association is not clear, however, maternal physiology or practitioner behavior in some studies has been attributed to the issue. Inefficiency of the aging myometrium and dystocia (11), increased rates of chronic medical diseases and certain maternal complications such as preeclampsia, gestational diabetes and adverse pregnancy outcome among women at advanced maternal age (12), and also maternal request are other explanation for increased cesarean delivery at advanced maternal age.

In the current study, the occurrence of cesarean births augmented with increasing pre-pregnancy

weight. Earlier researches have mostly investigated association between pre-pregnancy BMI and cesarean delivery. Barau et al. in an observational study on 17 462 singleton live births over 4.5 years demonstrated that there was a significant linear association between pre-pregnancy maternal corpulence and risk of cesarean deliveries (13, 14). A previous study showed that obese women had 1.78 times the odds of cesarean delivery as compared with women with a normal BMI (15). Dzakpasu et al. attributed 10.1% of caesareans in Canada in 2005-2006 to high maternal weight (16). Taken all together, it appears that maternal high pre-pregnancy weight or BMI to be a risk factor for cesarean delivery.

In both models of regression analysis, increased education level and high economic status were found to be associated with increased odds of cesarean section. A higher rate of cesarean section was also observed among women with higher education and family income. Economic status and ability to pay have also been introduced by earlier studies as an indicator contributed with increased odds of cesarean delivery. Studies of United States women have indicated married white women giving birth in private hospitals are more likely to have a cesarean section than poorer women (17). But findings in the area of education impact on cesarean delivery rate are different depending on region and country. Gilbert et al. in a retrospective cohort study of women with a previous cesarean section reported that higher education is associated with an increased rate of elective repeat cesarean section (18). Neuman et al. in a study on 45,327 births found that highly educated women were particularly likely to deliver by cesarean(19). Inversely, findings of some other cohort study including 837,312 deliveries in Norway (20) and 88,698 deliveries in Italy (21) revealed that mothers with little education were consistently more likely to deliver by cesarean section than highly educated women. In another study in Italy on 62888 births in the Campania region both in public and private hospitals, high educational qualification and young age of mothers were introduced as protective factors for elective cesarean section (22). In Iran, in the recent years, despite existence of much publicity about the complications of cesarean delivery and efforts for creating a positive maternal attitude towards

vaginal delivery from health professionals, we see that a woman's higher education, independent of economic status and maternal age, is associated with her risk of cesarean delivery. The cause of this phenomenon needs to be considered from health-care providers.

In this study, cesarean section was more common among early term births. The result is similar to the findings of another earlier research (23). Data from CDC/NCHS, National Vital Statistics System showed that the US cesarean delivery rates increased more than 60% for births at 37–38 weeks (early term births) for 1996–2009, but from 2009 to 2011, the early-term cesarean delivery rate declined 4% (24). Births at 37 or more completed weeks of gestation (term) have been included as one of options in the definition of low risk births (25-27). The U.S. Department of Health and Human Services established a Healthy People 2010 objective to reduce cesarean delivery rate among the low-risk births [term, singleton, vertex (head first) presentation] (26). Similarly, in 2009 The Joint Commission's National Quality Core Measures for hospitals included an objective to reduce the nulliparous, term, singleton, vertex cesarean delivery rate (27). In the United States, the low-risk cesarean delivery rate began to decline in 2010. The rate continued the downward trend in 2013, to 26.9%, the lowest rate since 2005 (25). However, in Iran efforts should be shift on reduction non-medically indicated deliveries for early term deliveries.

We observed that birth head circumference is correlated with raised odds of cesarean section. Results of a population-based retrospective cohort study in Washington State indicated that infants with large fetal HC were nearly twice as likely to be delivered by cesarean section (27) which is similar to our finding. Some other evidences also confirmed the association between fetal HC and cesarean delivery (29, 30).

Generalizability

Using relatively large sample size is helping to maximize generalizability of the results. Therefore, it is possible to generalize the findings of our study to populations that are more proximally similar to our study.

Strengths and limitations

The strength of the study was its relatively large sample size. The main limitation of the study was use of the third party data which led to miss some important factors involved in decision to cesarean delivery including cause of cesarean section.

Conclusion

The high cesarean rate in Iran must be paid substantial attention. Our study found that maternal pre-pregnancy anthropometry and socio-demographic characteristics (age, education and economic status) were associated with increased odds of cesarean section. Moreover, neonates birth HC and early term births were known as important determinants of cesarean section. In obstetric practice, various factors may influence on the decision to deliver by cesarean section. Considering the contributing factors in the incidence of cesarean section, appropriate policies must be adopted to improve quality of maternal care services and to implicate community based health education interventions.

References

1. World Health Organization 2015. Caesarean sections should only be performed when medically necessary; Available from: http://www.who.int/mediacentre/news/releases/2015/caesarean-sections/en/.

2. Belizán JM, Althabe F, Cafferata ML. Health consequences of the increasing caesarean section rates. Epidemiology 2007; 18(4):485-6.

3. Oladapo OT, Lamina MA, Sule-Odu AO. Maternal morbidity and mortality associated with elective Caesarean delivery at a university hospital in Nigeria. Aust N Z J Obstet Gynaecol 2007; 47(2):110-4.

4. Lumbiganon P, Laopaiboon M, Gülmezoglu AM, Souza JP, Taneepanichskul S, Ruyan P, et al. World Health Organization Global Survey on Maternal and Perinatal Health Research Group. Method of delivery and pregnancy outcomes in Asia: the WHO global survey on maternal and perinatal health 2007-08. Lancet 2010; 375(9713):490-9.

5. Yazdizadeh B, Nedjat S, Mohammad K, Rashidian A, Changizi N, Majdzadeh R. Cesarean section rate in Iran, multidimensional approaches for behavioral change of providers: a qualitative study. BMC Health Serv Res 2011;

11:159.

6. Azami-Aghdash S, Ghojazadeh M, Dehdilani N, Moham-madi M, Asl Amin Abad R. Prevalence and causes of ce-sarean section in Iran: Systematic review and meta-analysis. Iran J Public Health 2014;43(5):545-55.

7. Patel RR, Peters TJ, Murphy DJ; ALSPAC Study Team. Prenatal risk factors for Caesarean section. Analyses of the ALSPAC cohort of 12,944 women in England. Int J Epide-miol 2005; 34(2):353-67.

8. Lin HC, Sheen TC, Tang CH, Kao S. Association between maternal age and the likelihood of a cesarean section: a pop-ulation-based multivariate logistic regression analysis. Acta Obstet Gynecol Scand 2004; 83(12):1178-83.

9. Kheirouri S, Alizadeh M. Impact of prenatal maternal fac-tors and birth order on the anthropometric status of new-borns in Iran. J Biosoc Sci 2016;25,1-14.

10. Bayrampour H, Heaman M. Advanced maternal age and the risk of cesarean birth: a systematic review. Birth 2010; 37(3):219-26.

11. Treacy A, Robson M, O'Herlihy C. Dystocia increases with advancing maternal age. Am J Obstet Gynecol 2006; 195(3):760-3.

12. Delbaere I, Verstraelen H, Goetgeluk S, Martens G, De Backer G, Temmerman M. Pregnancy outcome in primipa-rae of advanced maternal age. Eur J Obstet Gynecol Reprod Biol 2007; 135(1):41-6.

13. Barau G, Robillard PY, Hulsey TC, Dedecker F, Laffite A, Gérardin P, et al. Linear association between maternal pre-pregnancy body mass index and risk of caesarean section in term deliveries. BJOG 2006; 113(10):1173-7.

14. Sherrard A, Platt RW, Vallerand D, Usher RH, Zhang X, Kramer MS. Maternal anthropometric risk factors for cae-sarean delivery before or after onset of labour. BJOG 2007; 114(9):1088-96.

15. Graham LE, Brunner Huber LR, Thompson ME, Ersek JL. Does amount of weight gain during pregnancy modify the association between obesity and cesarean section delivery? Birth 2014; 41(1):93-9.

16. Dzakpasu S, Fahey J, Kirby RS, Tough SC, Chalmers B, Heaman MI, et al. Contribution of prepregnancy body mass index and gestational weight gain to caesarean birth in Can-ada. BMC Pregnancy Childbirth 2014; 14:106.

17. Wagner, Marsden. Born in the USA: How a Broken Ma-ternity System Must Be Fixed to Put Women and Children First. p. 42. ISBN 0-520-24596-2.

18. Gilbert A, Benjamin A, Abenhaim HA. Does education level influence the decision to undergo elective repeat cae-sarean section among women with a previous caesarean sec-tion? J Obstet Gynaecol Can 2010; 32(10):942-7.

19. Neuman M, Alcock G, Azad K, Kuddus A, Osrin D, More NS, et al. Prevalence and determinants of caesarean sec-tion in private and public health facilities in underserved South Asian communities: cross-sectional analysis of data from Bangladesh, India and Nepal. BMJ Open 2014; 4(12):e005982.

20. Tollånes MC, Thompson JM, Daltveit AK, Irgens LM. Cesarean section and maternal education; secular trends in Norway, 1967-2004. Acta Obstet Gynecol Scand 2007; 86(7):840-8.

21. Cesaroni G, Forastiere F, Perucci CA. Are cesarean deliver-ies more likely for poorly educated parents? A brief report from Italy. Birth 2008; 35(3):241-4.

22. Giani U, Bruzzese D, Pugliese A, Saporito M, Triassi M. Risk factors analysis for elective caesarean section in Cam-pania region (Italy). Epidemiol Prev 2011; 35(2):101-10.

23. Sengupta S, Carrion V, Shelton J, Wynn RJ, Ryan RM, Sin-ghal K, et al. Adverse neonatal outcomes associated with early-term birth. JAMA Pediatr 2013; 167(11):1053-9.

24. Michelle JK, Osterman MHS, Joyce A Martin MPH. Changes in Cesarean Delivery Rates by Gestational Age: United States, 1996–2011. NCHS Data Brief 2013; No. 124, Available from: http://www.cdc.gov/nchs/data/data-briefs/db124_tables.pdf#1

25. Michelle JK, Osterman MHS, Joyce A Martin MPH. Divi-sion of Vital Statistics. Trends in Low-risk Cesarean Deliv-ery in the United States, 1990–2013. National Vital Statis-tics Reports 2014; 63(6).

26. U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. Healthy Peo-ple 2010. Washington, D.C. Available from: http://www.healthypeople.gov/2010/.

27. The Joint Commission. Specifications manual for Joint Commission national quality measures (v2010A): PC-02 NTSV caesarean section. 2009 Available from: https://manual.jointcommission.org/releases/archive/TJC2010A/MIF0167.html

28. Mujugira A, Osoti A, Deya R, Hawes SE, Phipps AI. Fetal head circumference, operative delivery, and fetal outcomes: a multi-ethnic population-based cohort study. BMC Preg-nancy Childbirth 2013; 13:106.

29. Elvander C, Högberg U, Ekéus C. The influence of fetal head circumference on labor outcome: a population-based register study. Acta Obstet Gynecol Scand 2012; 91(4):470-5.

30. Lipschuetz M, Cohen SM, Ein-Mor E, Sapir H, Hochner-Celnikier D, Porat S, et al. A large head circumference is more strongly associated with unplanned cesarean or in-strumental delivery and neonatal complications than high birthweight. Am J Obstet Gynecol 2015; 213(6), 833.e1-833.e12.

—————
Correspondence:
Mohammad Alizadeh
Nutrition Research Center, Tabriz University of Medical Sciences, Attar Nishabouri St., Tabriz, I. R. Iran.
Postal code: 5166614711, P.O. Box 14711
Tel: +98-411-33362117, Fax: +98-411-33340634
E-mail: mdalizadeh@tbzmed.ac.ir