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Prevalence and Predictors of Cesarean Section in Zanjan-Iran during 2014-2016

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Abstract

Background: The increased prevalence of cesarean section (C–section) is a global epidemic.
Objectives: The aim of this study was to determine the prevalence and demographic, fertility, and childbirth-related factors of C–section in Zanjan province, Iran,-from 21 March 2014 to 19 March 2016.
Methods: This study was a descriptive analytic study, carried out in 2014–2016, which gathered 41, 265 registered childbirth data in Zanjan province hospitals and from country electronic childbirth register system. Data were analyzed using descriptive, univariate and multivariate logistic binominal regression.
***Results*:** according to the findings, the prevalence of C–section was 40.1%. The odds of having C–section went up with increasing maternal age (OR=1.026), gravidity (OR=0.670), and gestational age (OR=0.093), while it decreased with an increased parity, end educational level up to high school graduate. In contrast, higher educational (OR=3.064) level increased the odds of having C–section. Living in the urban areas (OR=1.855) also increased the oddsof C–section. Diabetes (OR=1.990), preeclampsia or eclampsia (OR=2.350), hypertension (OR=1.983), and thyroid disorders (OR=2.289) increased the odds of having C–section. Newborns with low birth weight (OR=1) and macrosomia (OR=2.663), and boys (OR=1.107) were delivered more via C–section. Among the interventions during labor, induction (OR=1.131) and stimulation of labor (OR=0.269) reduced the odds of C–section ($P<0.05$).
Conclusion: C–section rate is very high in Iran and its association with different variables can be a basis for planning and policymaking in order to reduce the C–section rate, particularly in Zanjan province.

Keywords: cesarean section, prevalence, risk factors, Zanjan

Introduction

In recent years, governments and experts have warned about the increasing prevalence of cesarean section (C–section) [1]. C–section is a major surgery and can be associated with maternal and neonatal mortality [2,3]. Complications of anesthesia, increased postpartum hemorrhage, postpartum pain, surgical Incision infection, increased healthcare costs, later start or discontinuation of breastfeeding, reduced fertility, and overall maternal and infant mortality in C–section are more frequent than normal vaginal delivery [4-7].

Increased global rates of C–section in all groups suggest that it is a global epidemic [8]. The World Health Organization (WHO) has called for a reduction in C–sections to 10–15% of the total deliveries [1]. In two studies, the prevalence of C–section in two deferent hospitals in Zanjan province was reported to be 30.5% and 42.5%

[9,10]. According to previous researcher's review, studies of this type were few in Zanjan. The C–section rate is a global indicator of maternal health and its unnecessary increase reflects poor performance of the health system of countries [11]. One of the objectives of Health Sector Evolution Plan (HSEP) in Iran is to reduce the cesarean rate to 10%, which has been communicated to all health centers by the Iranian Ministry of Health and Medical Education [12]. According to the few of study in Iran-Zanjan and the importance of the predictors and planning for the reduction of C–section, such studies seem necessary. This study aimed to determine the prevalence of C–section as well as demographic, fertility, and childbirth factors associated with it in Zanjan province, Iran, from 21 March 2014 to 19 March 2016.

Methods

This study adhered to a descriptive analytic design. The Data was gathered from Iranian Mother and Neonates (IMAN) web system of Zanjan province, Iran, from 21 March 2014 to 19 March 2016. The IMAN is a web-based online system for registering childbirth information in Iran. Registration of childbirth information is done/ established by all Iranian hospitals using this system. The IMAN registration form contains two parts: maternal characteristics and neonatal characteristics. The researchers achieved all data from the Iranian Ministry of Health (MOH) in professional excel format and entered it into the SPSS software, version 16. The full coverage of data was confirmed by matching the IMAN data with the provincial birth statistics, reported by the provincial civil registration office. The data was received from Iranian MOH for the research, approved by the Ethics Committee of the Zanjan University of Medical Sciences, number ZUMS.REC.1395.56, and permission obtained for using them in this study.

During the past years, the province had a total of about 41,265 deliveries with a gestational age of >22 weeks, recorded in the maternal and newborn system, of which 16, 581 were C–section and 24, 656 vaginal deliveries. Of the C–sections, 7, 410 were due to repeated C–section and/or myomectomy. In the descriptive analysis, all data was used; however, the analytic analysis was conducted on 33, 855 vaginal or cesarean deliveries, whose delivery was not due to repeated C–section and myomectomy (Figure 1).

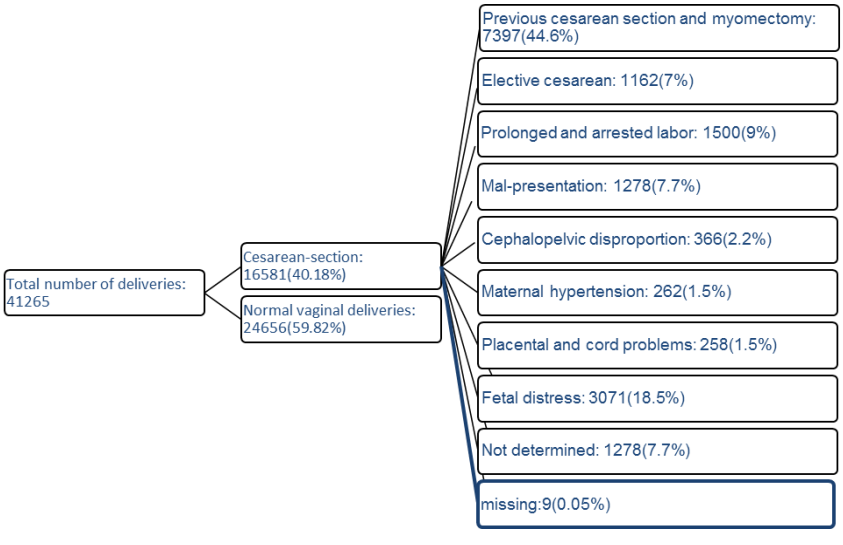

Figure 1: Profile of deliveries in Zanjan, Iran

To analyze the data, the prevalence of C–section was calculated using descriptive analysis and reported by number, percentage, mean, and standard deviation (SD). The relationship between the variables and C–section was determined using univariate and multivariate logistic binominal regression. Using Backward LR methods, the variables including age, education, place of

residence, insurance, years of study (2014-2016), chronic hypertension, preeclampsia, thyroid disorders, diabetes and other diseases, gravidity, parity, gestational age, birth weight, sex, malformations, and induced and stimulation of labor pains entered the final logistic regression model. These variables determined 22.8% of C–section changes. The significance level was considered as $P<0.05$.

Results

From 21 March 2014 to 19 March 2016, a total of 41, 265 deliveries were registered in Zanjan Province, of which 16, 581 were C–section (prevalence 40.18%) and 24,656 were vaginal deliveries. Of 16,581 C–sections, 7, 410 (44/6%) were due to repeated C–section and myomectomy, 49.4% of the deliveries occurred in 2015 and 50.6% in 2016, and 99.9% of deliveries were performed in the hospital. Birth attendants in 77% of normal deliveries were midwives, 21% obstetricians, and 2% others including general practitioners, village midwives, and community health workers. The most common causes of C–section included previous C–section and myomectomy (44.6%), fetal distress (18.5%), arrested labor (9%), and mal-presentation (7.7%) (Table 1 and figure 1).

Table 1: Maternal characteristics in 41,265 births in Zanjan Province, Iran between 2014 and 2016

Variables	Number (41265)	Percentage
Year		
2015	20236	49
2016	21029	51
Mother's nationality (Non-Iranian)	6	0.01
Mother's age (mean, SD) year	27.78	6.13
Mother's education		
Illiterate	1274	3.1
Elementary school	9149	22.2
Middle and high school	9609	23.3
High school graduate	13380	32.4
Bachuler of science and master of science	7521	18.2
PhD	80	0,2
Others	252	0.6
Place of residence (rural)	16195	39.2
Place of delivery		
Maternity facilities	2	0.0
On the way to the hospital	32	0.1
Hospital	41204	99.9
Home	9	0.0
Type of delivery*		
Normal vaginal delivery	24656	59.82
Cesarean section	16581	40.18
Causes of cesarean section		
Elective cesarean	1162	7
Previous cesarean section and	7397	44.6
myomectomy	1500	9
Prolonged and arrested labor	1278	7.7
Mal-presentation	366	2.2
Cephalopelvic disproportion	262	1.5
Maternal hypertension	258	1.5
Placental and cord problems	3071	18.5
Fetal distress	1278	7.7
Not determined	9	0.05

Variables	Number (41265)	Percentage
missing		
Childbirth attendant in normal vaginal deliveries		
Obstetricians	5386	21
Midwives	19228	77.9
Others**	38	0.1
Childbirth interventions		
Episiotomy	8055	19.52
Induction of labor	5113	12.39
Stimulation of labor	9075	21.99
Forceps or vacuums delivery	498	1.21
Complications of childbirth		
Grades III or IV rupture	268	0.65
Transfusion of blood or its products	83	0.20
Other cases	76	0.18

*missing
**General practitioners, village midwives, and community health workers

The results of univariate regression showed a significant association between C–section and gestational age, birth weight, boy sex, and congenital malformations. ($p<0.05$) (Table 2).

Table 2: Factors affecting cesarean section based on univariate logistic regression

Variables	Odds ratio	95% Confidence Interval
Mother's nationality (Non-Iranian)	0	0
Mother's age*	1.026	1.022, 1.030
Gravidity*	0.670	0.652, 0.689
Parity*	0.533	0.514, 0.551
Abortions*	1.087	1.036, 1.140
Gestational age*	0.932	0.923, 0.941
Birth weight (grams)		
Less than 2500	1	
2500 to 4500*	0.473	0.436, 0.514
More than 4,500*	2.663	1.602, 4.428
Sex (Boy)*	1.107	1.055, 1.162
Mother's disease		
Chronic hypertension*	1.983	1.602, 2.454
Preeclampsia or eclampsia*	2.350	2.060, 2.680
Diabetes*	1.990	1.719, 2.305
Thyroid disease*	2.289	2.021, 2.592
Heart disease	1.223	0.914, 1.638
Anemia	0.813	0.563, 1.176
HIV +	1.79	0.299, 10.713
VDRL +	0.373	0
Other diseases*	1.552	1.353, 1.781
Congenital anomalies (Yes)	1.913	1.491, 2.453
Mother's education		
Illiterate	1	
Elementary school*	0.851	0.724, 1.000
Middle and high school	0.941	0.802, 1.104
High school graduate*	1.185	1.013, 1.386
Associate to master*	3.064	2.615, 3.592
PhD*	4.955	2.935, 8.365
Others*	2.537	1.850, 3.481
Consanguineous marriage (yes)*	0.728	0.671, 0.790

Variables	Odds ratio	95% Confidence Interval
Place of residence (Urban)*	1.855	1.762, 1.952
Insurance		
Urban Health Insurance	1.094	0.914, 1.308
Rural Health Insurance*	0.708	0.606, 0.828
Social Security Insurance*	1.184	1.020, 1.375
Others[a*]	1.381	1.166, 1.636
Imam Khomeini Insurance and without Insurance	1	
Childbirth interventions		
Induction of labor*	1.131	1.059, 1.208
Stimulation of labor*	0.269	0.251, 0.288
Year		
2015	1	
2016	1.025	0.977, 1.075

univariate logistic regression
***p<0.05**
a: Armed Forces, Oil, and Bank employer-based Insurances

After being adjusted to the variables including insurance, consanguineous marriage, congenital malformations, other diseases, and years, the results of multivariate logistic binominal regression analysis showed an increased C–section rate in higher maternal age with an odds ratio of 1.088 (95% CI: 1.079–1.096, P<0.001). For each gravidity, the odds ratio of C–section increased to 1.079–fold (95% CI: 1.004–1.161, P=0.039) and for each parity decreased to 0.352–fold (95% CI: 0.387–0.319, P<0.001). With increasing gestational age, the ratio of C–section increased to 1.030-fold (95% CI: 1.010–1.050, P=0.003). Compared to illiterate cases, the ratio of C–section was 0.657 at elementary educational levels (95% CI: 0.518–0.833, P=0.001), 0.723 in middle and high school educational levels (95% CI: 0.569–0.920, P=0.008), and 0.738 in high school graduates (95% CI: 0.580–0.938, P=0.013). However, in higher education levels the ratio of C–section increased to 2.941-fold (95% CI: 1.773–4.878, P<0.001). Residence in urban areas increased the ratio of C–section to 1.206-fold (95% CI: 1.088–1.336, P<0.001). Among maternal diseases, diabetes increased the ratio of C–section to 1.685-fold (95% CI: 1.342–2.115, P<0.001), preeclampsia or eclampsia to 2.393-fold (95% CI: 1.973– 2.904, P<0.001), hypertension to 1.671-fold (95% CI: 1.186–2.354, P=0.03), and thyroid diseases to 1.555-fold (95% CI: 1.268–1.906, P<0.001).

Compared to weights of less than 25,00 grams, birth weight of 2,500 and 4,500 grams decreased the ratio of C–section to 0.571-fold (95% CI: 0.488–0.668, P<0.001) and birth weight of more than 4,500 grams increased the ratio of C–section to 2.691-fold (95% CI: 1.302–6.732, P=0.010). Male newborns compared to female newborns increased the ratio of C–section to 1.144-fold (95% CI: 1.068–1.226, P=0.001).

Among the interventions during labor, labor induction decreased the odds ratio of C–section to 0.621-fold (95% CI: 0.566–0.68, P<0.001) and stimulation of labor to 0.226-fold (95% CI: 0.204–0.249, P<0.001) (Table 3).

Table 3: Factors affecting cesarean based on multivariate logistic binominal regression

Variable	Odds ratio	95% Confidence Interval
Mother's age*	1.088	1.079, 1.096
Gravidity*	1.079	1.004, 1.161
Parity*	0.352	0.319, 0.387
Gestational age*	1.030	1.010, 1.050
Birth weight (grams)		
Less than 2500	1	
2500 to 4500*	0.571	0.488, 0.668
More than 4,500*	2.691	1.302, 6.732
Sex (Boy)*	1.144	1.068, 1.226
Pregnancy risk factor		
Chronic hypertension*	1.671	1.186, 2.354
Preeclampsia or eclampsia*	2.393	1.973, 2.904
Diabetes*	1.685	1.342, 2.115
Thyroid disease*	1.555	1.268, 1.906
Mother's education		
Illiterate	1	
Elementary school*	0.657	0.518, 0.833
Middle and high school*	0.723	0.569, 0.920
High school graduate*	0.738	0.580, 0.938
Associate to master	1.164	0.909, 1.491
PhD	1.510	0.776, 2.935
Others*	2.941	1.773, 4.878
Place of residence (Urban)*	1.206	1.088, 1.336
Childbirth interventions		
Induction of labor*	0.621	0.566, 0.681
Stimulation of labor*	0.226	0.204, 0.249

multivariate logistic binominal regression: Adjusted for insurance, Consanguineous marriage, Congenital anomalies, other diseases, and year
***p<0.05**

Discussion

The results of this study showed that 40.18% of deliveries were performed by C–section. Delivery by C–section increased with increasing maternal age, gravidity, and gestational age, and decreased with increased parity. With increasing educational level up to high school graduate, the odds of C–section reduced, while in educational levels higher than high school graduate, the odds of C–section increased. Besides, residence in urban areas increased the ratios of C–section. Suffering from diabetes, preeclampsia or eclampsia, hypertension, and thyroid disorders increased the odds of C–section. Newborns with low birth weight or macrosomia as well as boys were delivered more via C–section. Of the interventions during labor, the induction and stimulation of labor reduced the ratios of C–section. WHO concludes that C–section decreases maternal and infant mortality and morbidity when C-section is medically indicated. In fact, the C–section rates higher than 10% do not decrease maternal and infant mortality and morbidity [1].

This study showed that 40.18% of deliveries were performed using C–section. In line with the results of this study, previous studies have reported the prevalence of C–section as 48% in Iran [17]. Latin America and the Caribbean region include about 40% deliveries performed by C–section. In the last 24 years, the C–section rate has increased 12.4% in the world based on the data from 121 countries [13]. In developed countries, C–section rate is reported between 14.8 to 52.2% [14], in the United States (US) 28% [15], and in

Brazil between15.6 to 50% [3] ,which constitutes one-third of all births in the US [16]. In Iran, the prevalence of C–section has been triple to quadruple that of recommended by international standards [1], which is the highest prevalence of C–section in Asia [11]. In Iran, social and demographic factors, obstetric-medical causes, and non-obstetric-medical causes are effective in the prevalence of C–section [17]. There are discrepancies between Iran and other countries in terms of the above-mentioned factors which seem to be more effective in increasing C–section rate in Iran. In Iran, while one of the main goals of HSEP is to reduce C–section rate up to 10%, the results of this study showed that the ongoing state is still much far from the objectives of WHO programs. To reduce the adverse consequences of C–sections, health planners and policymakers need to pay more attention to this fact and closely examine issues related to its prevalence. Previous C–section, fear of pain in vaginal delivery, and physician's recommendations are the main reasons for C–section in Iran [17]. Thus, effective strategies may increase the quality of vaginal delivery services, psychological counseling and education, and legislation in order to preventing doctors from suggesting their personal opinions.

In this study, the mean age of the participants was 27 year and C–section rate increased via the rise in maternal age. Increased C–section via the enhanced number of pregnancies can also be affected by age rise. These results are consistent with several previous studies [18]. Women in developing countries tend to conceive at an older age and the tendency of having their first child at the age of >35 years old has increased [19]. Increased pregnancy complications in older and multipara women can lead to an increased rate of C–section [20].

The rate of C–section delivery increased through increasing gestational age and decreased through increasing parity, which seems logical. In line with the results of this study, Harrison et al (2017) showed a higher rate of cesarean section in nulliparous women and justified it as a lack of pelvic development at an early age that causes labor and delivery complications [21].

In this study, via increasing educational level up to high school, the ratios of C–section reduced, while in educational levels higher than high school graduates, its ratios increased. Harrison et al. (2017) also showed that women with lower educational levels had a lower rate of C–section, which was higher among women with higher education [21]. Women of lower social classes have less access to birth centers where the probability of a C–section delivery is reduced. Additionally, women with higher educational level have a greater decision-making power about their health; thus, the rate of elective C–section is higher in this cases.

On the other hand, women with higher educational levels are usually older which also increases the rate of C–section. Furthermore, residence in the urban areas increased the ratios of C–section. Kozhimannil et al. (Year 2013) demonstrated varied cesarean rates in different geographic areas and among hospitals [22], while Zandvakili et al. (year 2017) showed that there was no significant association between place of residence and parity [23]. Perhaps the cause of higher rate of C–section in the urban areas can be the wider health insurance coverage, better access to health centers, greater pregnancy problems, complications, and elective C–section request.

Low birth weight Newborns with low birth weight, boys, and newborns suffering from macrosomia were delivered more via C–section that could be due to higher complications in such births. In smaller newborns, mal-presentation, growth retardation, maternal hypertension, and other disorders occur more frequently, that can be the main reason for performing C–section [21]. In larger newborns, due to delivery problems such as prolonged labor and fear of damage to the fetus and mother, C–section delivery is normally selected.

Maternal diseases such as diabetes, preeclampsia or eclampsia, hypertension, and thyroid disorders increased the ratios of in C–section. An increase in C–section rates in mothers suffering from different diseases has been shown previously [24]. WHO recommended C–section in high-risk situations such as bleeding during delivery, dystocia, hypertension, and fetal abnormalities can prevent maternal mortality, morbidity, and fetal and neonatal complications [25]. Women suffering from underlying diseases have better

control and interventions; therefore, the possibility of delivery by C–section increases in such cases.

Contrary to the general beliefs, in this study, induction and stimulation of labor was associated with reduced C–section rate. These findings are consistent with the results of some other studies [26]. Mishanina et al. (year 2014), in a meta-analysis of 157 clinical trials, showed that induction of labor in term and post-term pregnancies led to a reduction in C–section, but had no such effect in preterm newborns. Also, induction improved fetal outcomes without any increase in maternal mortality [27].

One of the limitations of this study includes dissimilarities in the precision in medical personnel as well as the data entry system. The researchers tended to use the Robson classification, recommended by WHO for examining the prevalence of C–section in different subgroups [1], which was not possible, according to the available data. Therefore, future researchers are suggested to edit the IMAN registry checklist to include the data such as presentation, positions, and the number of embryos in order to be able to extract the data required in accordance with the recommended international classification in this study, The high prevalence of C–section confirmed the cesarean epidemic in Iran. The association of C–section with different variables can be a basis for planning and policy-making to reduce C–section in this province (Zanjan). Dimensions of C-section and its association with other factors should be taken into serious consideration and a solution needs to be designed forward in case of each factor and in accordance with the WHO action plan.

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