

Caesarean Delivery in South-Western Iran: Trends and Determinants in a Community-Based Survey

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Key Words

Caesarean delivery · Iran · Trend

Abstract

Objective: To assess trends in caesarean delivery and its associated factors in south-western Iran. **Subjects and Methods:** This cross-sectional study was conducted from January 2007 to January 2010 in Fars province, Iran. All deliveries recorded in public and private hospitals were included. The Mann-Whitney U test, χ^2 test and multivariate logistic regression models were used for analysis of data. A p value less than 0.05 was considered significant. **Results:** The rate of caesarean section for the whole sample of 139,159 increased from 51.6% in 2007 to 53.3% in 2009, which was statistically and clinically significant. The rate of caesarean delivery was significantly higher in primiparous compared to multiparous mothers. The rate increased steadily with the mother's age. The most prevalent recorded reason for caesarean delivery was maternal request. Logistic regression analysis showed that maternal age, previous abortions, underlying maternal disease, gestational age and number of living children were key contributing factors to the choice of mode of delivery. **Conclusion:** This study showed an increasing rate of caesarean delivery which should draw the attention of policymakers to factors associated with this mode of delivery.

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Introduction

Caesarean delivery has several medical and non-medical indications [1, 2]. Medical indications are divided into two subcategories: definite medical indications such as foetal distress syndrome, breech presentation or placenta previa, and vague medical indications such as previous caesarean delivery, failure to progress during labour and presumed foetal compromise [1, 2]. One of the main non-medical reasons for caesarean delivery is maternal request [1, 2].

The rate of caesarean delivery is increasing worldwide [2]. For example, in the United Kingdom in 1953, only 2% of all recorded deliveries were caesarean deliveries, but the rate reached 18% in 1997 and 21% in 2001 [2]. In Iran, a developing country, the rate rose from 35% in 2000 [3] to 47% in 2005 [4]. In addition, surveys report higher percentages of caesarean deliveries in private hospitals compared to governmental facilities [5, 6].

Caesarean delivery, including elective caesarean delivery, is a risky procedure for both the mother and child [2, 7]. However, maternal requests for elective caesarean delivery are becoming the leading cause for this choice, which now accounts for between 0.3 and 14% of all caesarean deliveries worldwide [8]. According to the World Health Organization, the maximum acceptable rate of caesarean delivery is 15% [9]. However, this goal may not

Table 1. Characteristics of primiparous versus multiparous mothers

	Primiparous mothers (n = 102,443)		Mothers who had 4 or more pregnancies (n = 6,337)		All mothers (n = 138,666)	
	mean \pm SD	median (range)	mean \pm SD	median (range)	mean \pm SD	median (range)
Maternal age, years	26.74 \pm 5.5	26 (12–52)	27.17 \pm 5.59	27 (12–52)	26.87 \pm 5.51	26 (12–52)
Gestational age, weeks	38.54 \pm 2.41	39 (24–42)	38.41 \pm 2.58	39 (24–42)	38.53 \pm 2.41	39 (24–42)
Number of pregnancies	1	1	4.8 \pm 1.2	4 (4–14)	1.45 \pm 0.96	1 (1–14)
Number of abortions	0	0	3.62 \pm 1.57	4 (1–4)	0.16 \pm 0.49	0 (0–8)
Number of living children	0	0	3.19 \pm 1.85	3 (0–14)	0.90 \pm 1.08	1 (0–14)

have been achieved in countries like Iran, where the rate of caesarean delivery was remarkably high [3]. To our knowledge, since 2005 no community-based surveys have been published. Therefore, in this study we aimed to measure the rate of caesarean delivery in a community-based survey in Fars province, south-western Iran. We also tried to identify factors associated with this mode of delivery.

Subjects and Methods

Design and Setting

A descriptive-analytical cross-sectional study was conducted in Fars province, Iran. The total population and the number of childbearing women, obtained from the report of the Iranian Census of Population and Housing 2006, were 4,500,000 and 1,334,046, respectively. The total number of deliveries from January 1, 2007 to December 31, 2009 in all public and private hospitals and delivery facilities in the province was the study denominator. Other deliveries performed outside these hospitals and facilities (e.g. home deliveries) were excluded. Therefore, a total of 139,266 deliveries were recorded in Fars province from January 1, 2007 to December 31, 2009, and the data for 138,666 individuals were usable.

Data Collection

Detailed information was obtained for each delivery. At each hospital and delivery facility at least one trained nurse extracted the information from the prenatal care cards and surgical reports in the mother's hospital record. The nurse then recorded the information on a standardized computerized form and sent it daily to the deputy of clinical affairs of Shiraz University of Medical Sciences and the Statistics and Registration Administration Office. After the survey was approved by the Shiraz University of Medical Sciences, to ensure appropriate access to the clinical information, a midwife or a gynaecologist explained the purpose of the study to each woman at the time of delivery and asked her to provide her consent for data about her delivery to be included in the study.

Each computerized form contained demographic and obstetric information. The demographic data included the woman's

first and last name, hospital file code, city, age and underlying diseases (hypertension, diabetes mellitus, ischaemic heart disease and asthma). The obstetric information consisted of past obstetric history including the number of pregnancies, number of living children, abortions, and present obstetric history, i.e. delivery date and gestational age, and reasons (if any) for choosing caesarean instead of vaginal delivery.

Statistical Analysis

The data were analysed with SPSS version 15 software. The Mann-Whitney U test was used to compare age, gestational age and number of pregnancies and abortions between the women who had a normal vaginal delivery and those who had a caesarean delivery. The χ^2 test was used to identify differences in the rates of caesarean delivery between public and private hospitals as well as between the years 2007 and 2009. Outcome-specific multivariate logistic regression models with the backward and forward stepwise method were used to identify the main reasons why the women chose caesarean delivery. Differences with a p value <0.05 were considered statistically significant. The data are reported as the mean \pm standard deviation.

Results

The overall mean rate of caesarean delivery was 52.2%. The mean age of the women was 26.87 \pm 5.51 years (range 12–52) at the time of delivery. The mean gestational age was 38.53 \pm 2.41 weeks (range 24–42). Demographic information regarding the number of pregnancies, living children and abortions are shown in table 1.

The rate of caesarean delivery increased significantly ($p < 0.001$) in the 3 years of this study from 51.6% in 2007 and 2008 to 53.3% in 2009. Most of the mothers (102,443; 73.8%) were primiparous. In this group, more than half of the women (54,659; 53.4%) gave birth by caesarean delivery, and maternal request was the most frequently recorded reason (38.4%). Of the 6,337 mothers who had been pregnant 4 times or more, 2,853 (45%) had a caesarean de-

Table 2. Characteristics of mothers who had a normal vaginal delivery versus a caesarean delivery

	Normal vaginal delivery (n = 66,296)	Caesarean delivery (n = 72,370)	p value
Age group			
<19 years	3,098 (57.6%)	2,279 (42.4%)	<0.001
19–34 years	56,727 (47.5%)	62,666 (52.5%)	
>34 years	6,471 (46.6%)	7,425 (53.4%)	
Gestational age			
<28 weeks	1,120 (64%)	630 (36%)	<0.001
28–36 weeks	4,269 (41.5%)	6,006 (58.5%)	
37–40 weeks	54,738 (46.8%)	62,149 (53.2%)	
>40 weeks	6,169 (63.2%)	3,585 (36.8%)	
Number of pregnancies			
1	47,784 (46.6%)	54,659 (53.4%)	<0.001
2	10,576 (49.7%)	10,713 (50.3%)	
3	4,281 (51.8%)	3,991 (48.2%)	
4 or more	3,484 (55%)	2,853 (45%)	
Number of living children			
0	23,614 (44.9%)	28,949 (55.1%)	<0.001
1	17,956 (43.7%)	23,112 (56.3%)	
2	8,568 (50.6%)	8,374 (49.4%)	
3	3,215 (56.2%)	2,508 (43.8%)	
4 or more	1,973 (61.5%)	1,235 (38.5%)	
Number of abortions			
0	51,943 (45.7%)	61,632 (51.5%)	<0.001
1–2	10,641 (56.1%)	8,343 (57.3%)	
3 or more	3,541 (61.2%)	2,241 (58.9%)	

p < 0.05 according to the χ^2 test was considered significant.

livery, and the reason recorded most frequently was previous caesarean delivery. This reflected an increasing trend towards normal vaginal delivery among the women who had a higher number of pregnancies. However, this is secondary to many factors such as maternal age and maternal underlying diseases. The comparison of primiparous and multiparous mothers is summarized in table 1. There was a tendency towards normal vaginal delivery in the younger age groups (15–18 years; p < 0.001; 95% CI: 1.43–1.44); however, as the mother's age increased the rate of caesarean delivery also increased significantly (p < 0.001). For gestational ages of 27 weeks or less and 41 weeks or more, the rate of normal vaginal delivery was higher than caesarean delivery (64 vs. 63.2%, respectively). In contrast, between the gestational ages of 28 and 40 weeks, the rate of caesarean delivery was higher (52.4%) than the rate of normal vaginal delivery. About one quarter of all deliveries (37,078; 27.6%) were performed in the 39th week of pregnancy, and of these 21,825 (58.9%) were caesarean de-

liveries. The most prevalent reason recorded for caesarean delivery in this group was maternal request (29.1%).

The higher the number of abortions, the higher was the rate of caesarean delivery. In mothers with no living children or 1 living child, the rate of caesarean delivery was significantly (p < 0.001) higher than normal vaginal delivery (55.1 vs. 56.3%, respectively). In mothers with 2 or more living children, however, the rate of normal vaginal delivery was higher.

The following were the recorded reasons for caesarean delivery: elective caesarean delivery (36.3%), previous caesarean delivery (28.1%), foetal complications (19.1%) and maternal complications (16.4%). The frequencies of these categories differed significantly (p < 0.001).

A small proportion of mothers (2,182 out of 138,666; 1.57%) reported at least one underlying disease. Of 136,484 mothers who had no underlying disease, 71,290 (52.2%) underwent caesarean delivery, whereas this rate was 49.5% in mothers with underlying diseases. It should be noted that maternal underlying disease was found in 1,080 out of 72,370 caesarean deliveries (1.5%), compared to 1,102 normal vaginal deliveries (1.7%).

The comparison between maternal age, gestational age, number of pregnancies, number of living children and number of abortions in mothers who gave birth by normal vaginal delivery and those who had caesarean delivery is listed in table 2.

Logistic regression analysis showed that maternal age, number of living children, number of previous abortions, maternal underlying disease and gestational age were found to be associated with the choice of mode of delivery (table 3).

Discussion

In this study, the rate of caesarean delivery in Fars province was 52.2%, which is substantially higher than the World Health Organization's recommended rate of 15% [9]. Furthermore, the rate of caesarean delivery was significantly higher than the 26.3% estimates for South-east Asian countries [10] and also for Middle East countries [11]. However our findings are similar to the previous study conducted in Fars province (66.4%) [12].

Although there was an increase in the rate of caesarean delivery (3.3%) between 2008 and 2009, a similar increase has been observed in most countries, both developed and developing [11–18]. The slope of the increase in Fars province was not as steep as in some countries such as China, where the rise in caesarean delivery rates ranged from 36.3

Table 3. Associations between maternal factors and mode of delivery using logistic regression analysis

Variables	Significance	Odds ratio (caesarean/vaginal delivery)	95% CI for odds ratio
Number of living children			
4 or more ^a	<0.001	1	
3	<0.001	1.256	1.14–1.37
2	<0.001	1.561	1.44–1.68
1	<0.001	2.078	1.92–2.23
0	<0.001	2.036	1.89–2.19
Maternal age			
Less than 19 years ^a	<0.001	1	
19–34 years	<0.001	1.531	1.43–1.63
35 years and over	<0.001	1.593	1.48–1.71
Gestational age			
41 weeks and over ^a	<0.001	1	
37–40 weeks	<0.001	2.230	2.12–2.34
29–36 weeks	<0.001	2.941	2.74–3.14
Less than 28 weeks	0.002	1.222	1.07–1.38
Number of abortions			
0 ^a	<0.001	1	
1 or 2	<0.001	1.32	1.27–1.37
3 or more	<0.001	1.35	1.18–1.55
Maternal underlying disease			
Yes ^a	<0.001	1	
No	0.005	1.13	1.04–1.24

^a The reference point in this category upon which other sub-groups are analysed.

to 131.3% from 2001 to 2007 [12] and Jordan, where it rose by 209% from 1990 to 2002. The reasons for these increases are complex, and can be attributed to maternal requests, the reluctance of the providers to try a complicated normal vaginal delivery due to possible legal issues [16, 17], maternal underlying disease or foetal problems [3, 17, 18].

The most prevalent yet preventable factor leading to the decision to use caesarean delivery was elective. Caesarean delivery was due to a variety of reasons such as maternal request [15] and the willingness of the providers to comply with the mother's request [10]. Since repeated caesarean delivery is associated with a higher risk of maternal and neonatal morbidity compared to repeated normal vaginal delivery [10], the increasing global trend towards caesarean delivery merits wider attention [10].

It is worth pointing out that another study [17] reported that elective caesarean delivery was the most prevalent reason for caesarean delivery. What we could not determine in the present study was whether the providers encouraged women to opt for caesarean delivery or wheth-

er it was simply a matter of maternal choice. However, Janssens et al. [16] reported that pregnant women who had chosen private providers for delivery belonged to higher socioeconomic classes and were less likely to undergo an unwanted caesarean delivery. Furthermore, it has been reported that the increase in the rate of caesarean delivery was not only associated with problematic maternal or foetal conditions [14]. Therefore, interventions aimed at reducing the rate of caesarean delivery merit additional attention.

Of the total deliveries, 52.2% were performed by caesarean delivery, of which 37.7% were performed electively. On the other hand, 19.7% of all deliveries were performed by elective caesarean delivery. However, the actual rate of elective caesarean delivery can be assumed to be higher than the estimated 37.7%. The reason for this may be related to legislation passed in 2006 indicating that 'no payment will be provided by insurance companies if the recorded reason for caesarean delivery is elective'. Hence, our data may have been biased by the fact that some private centres might have provided false reasons for choosing caesarean delivery instead of normal vaginal delivery.

As mentioned, the pregnant women who underwent caesarean delivery were significantly older than those with normal vaginal delivery, consistent with several other studies [7, 12, 13, 17, 19, 20, 21]. One of the reasons could be that mothers over the age of 34 were labelled as a high risk group for whom caesarean delivery was performed more frequently. However, our findings are incongruent with the results of a number of surveys conducted in settings where teenage pregnancies are common, particularly Sudan [11].

Most of our findings regarding the characteristics of women who underwent caesarean delivery are supported by other studies in which lower parity [17, 19–23], lower gestational age and a lower number of living children [17] were associated with caesarean delivery. However, none of these studies investigated the possible influence of previous abortions.

Several characteristics were predictors of caesarean delivery, such as increased maternal age, lower gravidity, gestational age, number of abortions, giving birth at a private hospital and maternal underlying disease. Some of these factors were also identified in other studies, e.g. maternal age [20–22], gravidity [22], gestational age [23], number of abortions [17], giving birth in a private hospital [17] and underlying disease [20, 23]. In contrast to our findings, no correlation was found between maternal age and type of delivery in a study by Flores Padilla et al. [20] in 2008. We did not find any relationship between the

number of living children and mode of delivery, in contrast to a study by Hsu et al. [23]. However, our analysis involved a census population-based dataset for 3 years, so our findings may be more conclusive compared to the data reported by Hsu et al. [23], which were based on a small fraction of deliveries in their centres.

Our study has several limitations, the most important of which is the use of previously recorded data. In addition, due to the large sample size, even slight changes in the rates of normal vaginal or caesarean delivery rates may result in statistically significant differences that lack clinical significance. However, the increasing trend towards caesarean delivery is not only statistically significant but also alarming.

The main strength of this study is that it included all recorded deliveries in Fars province for 3 consecutive years from the beginning of 2007 to the end of 2009. Therefore, we could reach a good estimation of caesarean and normal vaginal delivery rates in Fars, the fourth largest populated province in Iran. Our sample was also large enough to allow statistical comparisons between subgroups. Further-

more, by using logistic regression to consider all factors together and decrease the effect of confounding factors, our study provides a solid evidence base for health policy makers who need to develop interventions that can influence demographic predictors of caesarean delivery.

Conclusion

This study found a high prevalence of caesarean delivery and an alarming upward trend in Fars province in the 3 years between January 2007 and January 2010. Therefore, particular attention should be directed towards mothers who are nulliparous or whose pregnancies are labelled high risk.

Acknowledgments

This study was supported by the Health Policy Research Centre. We would also like to express our special thanks to K. Shashok for her contribution to editing the manuscript.

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