

Changes in cesarean section rates and its indications among primiparous women during each implementation phase of Chinese two-child policy: a retrospective study

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To the Editor: Cesarean section (CS) is among the most important and safe procedures in obstetrics. When medically indicated, CS can be a life-saving intervention. During the Chinese one-child policy, couples tended to choose CS for various reasons. In 2010, the CS rate in China rose to among the world's highest.^[1] Yet, CS can also have various adverse maternal and neonatal consequences. Maternal mortality and maternal and infant complications are higher with CS compared with vaginal delivery.^[2] Over the past several decades, CS rates have increased sharply worldwide, and controlling these rates has become among the most prominent obstetric issues.

Since the change in China's birth policy, which began in 2011 through the gradual implementation and then universality of the two-child policy, the number of pregnancies after CS has increased sharply. Thus, risks from uterine scarring including abnormal placental attachment must be addressed. Several studies have shown that the overall CS rate in China is declining. Few studies have examined the impacts of China's two-child policy on either CS rates or CS indications among primiparous women. This study describes the changes in CS rate and indications for CS among primiparous women during ten consecutive years, across the implementation of the two-child policy, to identify the impacts of such policies and better coordinate the implementation of relevant practices.

This research undertook a retrospective analysis of CS rates and indications among primiparous women delivering before and across the implementation phases of the two-child policy from January 2010 to December 2019 in Beijing Obstetrics and Gynecology Hospital, Capital Medical University. Changes in rates and composition

ratios for CS indications among primiparous women were compared in 2010 (before implementation of the two-child policy), 2012 (after policy implementation for couples in which both parents were only children), 2015 (after policy implementation for couples in which one parent was an only child), 2017 (after universal policy implementation), and 2019 (extension period after full policy implementation).

This study was approved by the Medical Ethics Committee, Beijing Obstetrics and Gynecology Hospital, Capital Medical University (2022-KY-023-01).

We collected data from the Hospital Information System of 110,365 primiparas in our hospital from January 1, 2010, to December 31, 2019. Based on the inclusion criteria of (1) primipara; (2) live birth at gestational age ≥ 28 weeks; and (3) CS delivery, there were 40,722 eligible cases. Parity, maternal age, gestational age, clinical diagnoses, and indication for CS were analyzed.

As there is no internationally recognized CS classification system, the 2017 report by Liu *et al*^[3] was applied. Our hospital personnel coded a cumulative 16 indications for CS: (1) fetal distress; (2) cephalopelvic disproportion; (3) malpresentation; (4) multiple gestation; (5) failed labor induction; (6) pregnancy complications; (7) intrauterine infection; (8) macrosomia; (9) placenta previa or vasa previa; (10) precious infant (history of adverse pregnancy); (11) placental abruption; (12) maternal request; (13) advanced maternal age (≥ 35 years); (14) oligohydramnios; (15) high myopia; and (16) other indications. Umbilical cord prolapse was classified as fetal distress.

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Birth canal malformation, vulva diseases, and reproductive tract infectious diseases were classified as “other indications.” In the event of multiple indications, only the first indicator was included in analyses and descriptive statistics. Changes in rates and composition ratios for CS indications among primiparous women were compared in 2010, 2012, 2015, 2017, and 2019.

All data were entered into and analyzed with SPSS (version 26.0, IBM, Armonk, NY, USA). Categorical variables were compared between groups using Pearson’s chi-squared test, the continuity correction test, or Fisher’s exact probability test. A *P* value <0.05 was considered statistically significant.

The total number of deliveries between 2010 and 2019 was 139,757, of which 110,365 (80.0%) were primiparous women. At the beginning of 2010, the proportion who were primiparas was 89.8% (10,317/11,490). After 2011, as the two-child policy was gradually implemented, the proportion of primiparas decreased incrementally. After full implementation of the universal two-child policy, the rate dropped to 65.6% (9975/15,203) in 2017 and was 70.3% (10,841/15,413) in 2019. The total number of CS deliveries among primiparas was 40,722 and the average annual CS rate was 36.9% (40,772/110,356). The proportion was 49.6% in 2010, after which gradual implementation of the two-child policy began in 2011, when the rate gradually decreased. After full implementation of the two-child policy, the rate dropped to 27.2% (2912/10,721) in 2016 and 27.4% (2736/9975) in 2017, and was 33.7% (3657/10,841) in 2019.

There was a statistically significant difference in the component ratio of primipara CS indications during the five times ($\chi^2 = 2006.09$, *P* < 0.001) [Table 1]. Pairwise comparison of the composition ratio of CS indications showed statistical differences (all *P* value < 0.001). According to these data, as the two-child policy was

gradually implemented, the proportion of CS indicators related to attempted vaginal delivery (i.e., fetal distress, failed labor induction, intrauterine infection) increased, as did the proportion of CS indication related to multiple gestation. The top five CS indications among primiparas changed significantly across the two-child policy phases [Supplementary Figure 1, <http://links.lww.com/CM9/B229>]. After the two-child policy was implemented, CS indication based on maternal request and advanced maternal age both dropped from the top five, to below the top ten. During this period, multiple pregnancies and failed labor induction joined the top five indications.

Necessary CS can reduce maternal and infant mortality and improve outcomes for both, while unnecessary CS has no obvious benefit to either. A high rate of CS also means an undue burden on the allocation and utilization of medical resources. Therefore, CS rates should be maintained within a reasonable range. Since 1985, the international healthcare community has considered the ideal rate for cesarean sections to be between 10% and 15%.^[4] At present, global CS rates show a rising trend. CS rates rose rapidly in China during the early 20th century, with reports as high as 46.2%.^[1] This has decreased in recent years but remains high. Sun *et al*^[5] reported declines in CS rates among primiparas in Wuhan from 2010 to 2016. Consistent with those investigators, our study shows CS rates among primiparas decreased from 49.6% in early 2010 to 31.9% in 2015 (after the second phase of the two-child policy) and then to 27.2% and 27.4%, respectively, in 2016 and 2017 after the two-child policy became universal. Nevertheless, the overall CS rates have not reached the WHO recommendation. While the global rate and that for China specifically require further research.

The CS rate is largely influenced not only by accurate physician assessment of CS indications but also by multiple social factors including birth policies. Our

Table 1: Changes in the composition ratio of CS indications among primiparas in 2010, 2012, 2015, 2017, and 2019, reflecting before and during each implementation phase of the second-child policy.

Indication for CS	2010 (N= 5115)	2012 (N= 5127)	2015 (N= 2919)	2017 (N= 2736)	2019 (N= 3657)
Cephalopelvic disproportion	1090 (21.3)	1063 (20.7)	383 (13.1)	388 (14.2)	621 (17.0)
Fetal distress	671 (13.1)	639 (12.5)	436 (14.9)	449 (16.4)	815 (22.3)
Malpresentation	590 (11.5)	605 (11.8)	520 (17.8)	464 (17.0)	541 (14.8)
Maternal request	568 (11.1)	453 (8.8)	106 (3.6)	83 (3.0)	72 (2.0)
Advanced maternal age	495 (9.7)	336 (6.6)	135 (4.6)	69 (2.5)	53 (1.5)
Pregnancy complication(s)	235 (4.6)	225 (4.4)	173 (5.9)	180 (6.6)	228 (6.2)
Failed labor induction	234 (4.6)	189 (3.7)	154 (5.3)	151 (5.5)	262 (7.2)
Oligohydramnios	222 (4.3)	292 (5.7)	103 (3.5)	36 (1.3)	45 (1.2)
Macrosomia	213 (4.2)	321 (6.3)	178 (6.1)	130 (4.8)	140 (3.8)
Multiple gestation	203 (4.0)	255 (5.0)	268 (9.2)	333 (12.2)	323 (8.8)
Precious infant	174 (3.4)	193 (3.8)	109 (3.7)	100 (3.7)	86 (2.4)
High myopia	131 (2.6)	107 (2.1)	16 (0.6)	5 (0.2)	9 (0.3)
Placenta previa or vasa previa	105 (2.1)	130 (2.5)	91 (3.1)	90 (3.3)	112 (3.1)
Placental abruption	68 (1.3)	88 (1.7)	67 (2.3)	58 (2.1)	76 (2.1)
Intrauterine infection	55 (1.1)	138 (2.7)	117 (4.0)	143 (5.2)	201 (5.5)
Other indication(s)	61 (1.2)	93 (1.8)	63 (2.2)	57 (2.1)	73 (2.0)

Data are presented as *n* (%). *P* = 0.001 among the five groups. CS: Cesarean section.

findings show that there were significant differences in the constituent ratio of indications for CS across the implementation phases of the two-child policy. Table 1 suggests that the constituent ratio of CS based on either maternal request (CDMR) or advance maternal age decreased significantly. These factors accounted for 11.1% and 9.7%, respectively, in 2010, and gradually fell to under 2% each in 2019. Corresponding attempted vaginal delivery-based CS indications of fetal distress, failed labor induction, and intrauterine infection all increased. In the USA, nearly 80% of CS among primiparas are for the delay in labor progress, poor fetal condition, or fetal malpresentation.^[6] Non-medical indications like CDMR are relatively lower in the USA. During the Chinese one-child policy, primiparous women and their families prioritized infant safety; in addition, the psychological pressures during the childbirth process (including pain and anxiety) may lead to a high proportion of laboring women to CDMR.

Following the implementation of the two-child policy, the intent to have a second child increased among Chinese women of childbearing age. The first child's birth and choice of delivery type are considered important events for primiparous women. They will try to achieve vaginal delivery during their first-term pregnancy. At the same time, the government, society, and medical personnel now intervene to promote vaginal delivery. The Chinese government vigorously promotes nutrition clinics, childbirth education, simulated delivery, and other education efforts. Such interventions provide preconception and prenatal nutrition education for women of childbearing age, to raise their awareness about its importance during pregnancy and birth. Simultaneously, various training, seminars, and other approaches are used to improve doctors' medical technology and midwife qualifications. Obstetricians now implement rigorous technologies like new labor pattern, external cephalic version, amniotic cavity perfusion, Doula, and labor analgesia. These methods significantly eased the labor process, reduced fear of childbirth, strengthened confidence in vaginal delivery, and greatly reduced CDMR.

Our study shows that after the implementation of the universal two-child policy, fetal distress became the top indication for CS (22.9%, slightly lower than reported in other countries).^[7] If fetal distress occurs during induced labor or vaginal delivery, vaginal delivery cannot be accomplished quickly and CS must be chosen. In one French study that reported an overall CS rate of 21.0% among induced women, nulliparous women with a term singleton cephalic fetus accounted for two-thirds of CS deliveries after labor induction.^[8] This emphasizes that maximizing the likelihood of vaginal delivery after induction can be a clinical goal. Specific actions could be implemented among this population to weigh the benefits and risks of induction and improve the management of labor induction. Finally, our study shows that post-implementation of the two-child policy, the CS rate in China was also influenced by multiple gestation. Assisted reproductive technology is now widely used in China, and the delivery mode for this population should be on a case-by-case basis.

This study also shows that the rate of CS among primiparous women delivering in our hospital decreased to a minimum in 2016, which was early in the universal two-child policy implementation. Rates were 32.14% and 33.73% in 2018 and 2019, respectively, 3 and 4 years after the implementation of the universal two-child policy. CS rates among primiparas then rose modestly in 2018 and 2019, consistent with a report by Sun *et al*.^[5] Therefore, it is necessary to further study the reasons for the small increase of CS rate among primiparas.

There were some limitations to our study, which should be considered when interpreting our findings. First, our study was conducted in a single center, and randomization was not possible. Second, the study was conducted in a maternal tertiary hospital in Beijing, so it may not represent all changes in China. A multicenter, randomized trial, featuring a large patient sample, is now needed to further explore the changing trends in CS rates and indications among primiparous women in China.

In conclusion, the rate of CS among primiparous women declined as changes in the Chinese birth policy were implemented. The proportion of medical indications for CS significantly increased, as non-medical indications concomitantly decreased. Further, clinicians should pay particular attention to these trends following the implementation of the "third-child" policy.

Conflicts of interest

None.

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