

Financial Incentives and Use of Cesarean Delivery: Taiwan Birth Data 2003 to 2007

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Since 2000, the annual Cesarean section (CS) rates in Taiwan have exceeded 30%.¹ By comparison, in the 2000s, the CS rate in the US was 25% to 30%, but in some European countries, such as England, Germany, and Denmark, it was lower. Obviously, the CS rate in Taiwan has been higher than in many other countries for decades.² To lower the CS rate, the Bureau of National Health Insurance (BNHI) in Taiwan adopted 2 important policies to encourage more vaginal deliveries (VDs). First, they raised the payment to healthcare providers for VD in May 2005. Second, they increased the insured's copayment for elective CS in May 2006.

Taiwan's National Health Insurance (NHI) system adopted a case payment mechanism, the diagnosis-related groups system, to reimburse hospitals for deliveries (including both VD and CS). In addition, the BNHI regulates the medical indications of CS. The insured's copayment for childbirth is zero if the delivery mode is VD or CS-recommended because of medical indications. However, a number of pregnant women ask for CS, even though their clinical conditions do not coincide with the medical indications of CS.³ These cases are categorized as "elective CS." The CS cases recommended because of medical indications are categorized as "indicated CS." The payment for indicated CS cannot be applied directly to elective CS.

Prior to May 1, 2005, the provider payment for "indicated CS" was approximately US \$911 to \$1132 but the payment for VD was only US \$506 to \$609. The payment rate for "indicated CS" was nearly 80% greater than that for VD. On May 1, 2005, the BNHI raised the payment rate for VD by approximately 80%, but sustained the rate for CS. This payment adjustment raised a typical obstetrician's income by approximately 17%. The payment of VD and indicated CS for healthcare providers has been equal since that time. The cost of performing a CS is often higher than that of performing a VD. The BNHI hoped that the May 2005 policy change would provide the supply side with the financial incentive to recommend VD.

The BNHI also hoped to provide the demand side with a financial incentive to accept VD through a policy change in May 2006. Before May 2006, the provider payment for elective CS was equal to that for

VD. If laboring women asked for elective CS, they had to pay the hospital the difference between the rates for indicated CS and VD, and this amount

Objectives: The Cesarean section (CS) rate in Taiwan has exceeded 30% since 2000. To lower the CS rate, the Bureau of National Health Insurance in Taiwan raised the payment for vaginal delivery (VD) in May 2005, and also increased the insured's copayment for elective CS in May 2006. This study clarifies the influences of these financial incentives, and explores whether the 2 policies lowered the CS rate.

Study Design: The materials used are birth cases obtained from a systematic sampling of the original inpatient claim data in the National Health Insurance research database between 2003 and 2007. The empirical analysis of this study groups the birth data into 4 types: VD, unplanned CS, planned CS, and elective CS.

Methods: The 4 delivery types represent the dependent variable. A multinomial logistic regression model was adopted as the empirical method. The policy changes, hospital attributes, and insured status were considered independent variables.

Results: Results indicate that the supply-side policy change in May 2005 reduced the number of CS cases. However, the policy effect was not very significant, and the CS rate decreased mainly because of planned CS cases. The demand-side policy change in May 2006 did not lower the rate of elective CS.

Conclusions: The results imply that the financial incentives were not the main consideration for both the demand and supply sides. To encourage more VDs and lower the CS rate, the authorities could consider mechanisms other than adjusting the payment or changing the copayment.

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Take-Away Points

The objective of policy changes in May 2005 and May 2006 was to lower the Cesarean section (CS) rate in Taiwan by providing financial incentives for supply and demand sides.

- This study clarifies the influences of financial incentives for both the demand and supply sides, and explores whether the 2 policy changes lowered the CS rate.
- The results indicate that the financial incentives were not the main determinant in choosing the delivery mode.
- To encourage more vaginal deliveries and lower the CS rate, the authorities could consider mechanisms other than adjusting the payment or changing the copayment.

was equivalent to the insured's copayment for elective CS. Before May 2005, the copayment for elective CS was US \$404 to \$523, and that was roughly 1.4% to 1.8% of the average annual income per household. However, because of the payment adjustment in May 2005, the rate difference between indicated CS and VD, which was the copayment for elective CS, became zero between May 2005 and May 2006. To expand the insured's copayment for elective CS, the BNHI set a lower payment rate for hospitals in May 2006. This policy change reduced the payment rate for elective CS to US \$506 and required laboring women to pay the rate difference between indicated CS and elective CS. This means that the insured's copayment for elective CS had been increased to US \$475 to \$697, which was approximately 1.5% to 2.2% of the average annual income per household. **Table 1** lists the details of payment and copayment for different delivery modes before and after these 2 policy changes.

Reviewing the literature on the high CS rate in Taiwan revealed several causes for elective CS: preferring an auspicious delivery time, arranging delivery time easily, avoiding delivery pain, worrying about the influence of VD on sex life, suggestions from relatives, and reimbursement of supplemental insurance. Among these causes, the financial burden or copayment of elective CS did not seem to have significant influence on the decision of the demand side.^{4,6} The evidence from Australia and Norway also showed that maternal requests, delivery experience, and fear of a trying labor might make an important contribution to elective CS.^{7,8} However, decisions on delivery mode are also correlated with recommendations from physicians. Furthermore, policy changes, such as the payment for childbirth, might have affected the physicians' financial incentives and their recommendations.^{5,9,10}

Other researchers have also verified the effects of financial incentives and personal motives by physicians practicing CS. Gruber and Owings explored the birth data of different states in the United States from 1970 to 1982. During this period, the birth number fell by 13.5%, and the CS rate increased significantly. They indicated that obstetricians might have substituted CSs for some VDs to balance off their income loss because payment for CS was higher than that for VD.¹¹ More-

over, Gruber et al and Grant confirmed that a higher payment for CS would induce a greater increase in the CS rates.^{12,13} Spetz et al examined the likelihood of CSs being performed at particular times of the day. They found that physicians' time preference and financial incentives affected their decision to perform a CS.¹⁴

Table 2 displays the underlying motives for the supply and demand sides before and

after the 2 policy changes in May 2005 and May 2006. Compared with the period before May 2005, hospitals or physicians now have the financial incentive to recommend VD. However, the financial incentives for the demand side are slightly complex. Between May 2005 and May 2006, the insured's copayment for elective CS was zero. In this period, the demand side had the financial incentive to request elective CS. Before May 2005 and after May 2006, laboring women had to pay the copayment for elective CS, and the demand side may have been less likely to ask for elective CS. Furthermore, both the supply and demand sides had the convenience incentives to perform CS or ask for elective CS because the timing of CS could be arranged easily.

Before and after the 2 policy changes in May 2005 and May 2006, the convenience incentives for the supply and demand sides remained unchanged. However, some changes occurred in the financial incentives for both sides. If the financial incentives were the important determinants for the decisions of physicians and women in labor, this study proposes the following 2 hypotheses: First, compared with the period before May 2005, indicated CS would decrease, but elective CS would increase between May 2005 and May 2006. The overall CS rate might not necessarily be reduced. Second, relative to the period before May 2005, indicated CS and elective CS would decrease after May 2006.

The objective of both policy changes in May 2005 and May 2006 was to lower the CS rate in Taiwan by providing financial incentives for supply and demand sides. This study clarifies the influences of financial incentives on determining the delivery mode, and explores whether the 2 policies lowered the CS rate.

Data and Methods

The empirical materials are 51,085 birth cases obtained from a systematic sampling of the original inpatient claims data in the Taiwan NHI research database between 2003 and 2007. The data set contains 5% of inpatient admission records, extracted by systematic sampling method on a monthly basis, together with the related details of inpatient orders. The registry data of the insured and contracted hospitals have been adopted together.

Financial Incentives and CS Rate

■ **Table 1.** Payment for Different Delivery Modes and the Copayment of Elective CS (Unit: US Dollar)

Period	Institution	Payment ^a			Copayment ^b
		VD	Indicated CS ^c	Elective CS	Elective CS
Before May 2005	Medical Center	609	1132	609	523
	Regional Hospital	571	1072	571	502
	Local Hospital	550	1013	550	464
	Clinic	506	911	506	404
Between May 2005 and May 2006	Medical Center	1132	1132	1132	0
	Regional Hospital	1072	1072	1072	0
	Local Hospital	1013	1013	1013	0
	Clinic	911	911	911	0
After May 2006	Medical Center	1203	1203	506	697
	Regional Hospital	1143	1143	506	637
	Local Hospital	1084	1084	506	578
	Clinic	981	981	506	475

CS indicates Cesarean section; NHI, National Health Insurance; VD, vaginal delivery.

^aThe NHI system in Taiwan reimburses hospitals for deliveries according to the payment rates in this table.

^bThe insured's copayment for childbirth will be zero if the delivery mode is VD or indicated CS. However, the insured copayment for elective CS is the rate difference between elective CS and indicated CS.

^c"Indicated CS" means the CS cases recommended by the obstetricians according to the medication indications.

The birth sampling data from 2003 to 2007 are grouped into 4 types, which are VD, unplanned CS, planned CS, and elective CS. Both types of unplanned CS and planned CS are considered indicated CS, which was recommended by obstetricians according to the medical indications of CS. Following the study by Henry et al, the cases of indicated CS cord prolapse, fetal distress, long labor, disproportion, obstructed labor, and failed induction of labor are categorized as unplanned CS.¹⁵ The *International Classification of Diseases, Ninth Edition, Clinical Modification (ICD-9-CM)* codes of unplanned CS included 653, 652 (except 652.1, 652.2, 652.5), 656.3, 659.0, 659.1, 660, 661 (except 661.3), 662, and 663.0. Other indicated CS cases are categorized as planned CS. The 4 delivery types are defined as the dependent variable. The multinomial logistic regression model was adopted as the empirical method and the standard errors were adjusted at the hospital level to account for the correlation of the data.

Because the BNHI adopted 2 policies in May 2005 and May 2006 to lower the CS rate, the period from 2003 to 2007 could be divided into 3 segments by the 2 time points of policies. Period I represents the segment of 28 months before May 2005. Period II represents the segment of 12 months between May 2005 and May 2006. Period III represents the segment of 20 months following May 2006. Period I served as the benchmark, and 2 dummy variables (also known as indicator variables), Period II and Period III, were adopted to show the difference between those periods and Period I.

This study also controls the influences of hospital attributes, the clinical conditions, and the insured status. Because all medical institutes can be classified according to the scale, there are 4 types of institutes: medical center, regional hospital, local hospital, and clinic. Three dummy variables, Medical Center, Regional Hospital, and Local Hospital, were adopted to show how they differed from the clinics in the

■ **Table 2.** Underlying Incentives for Supply and Demand Sides

	The Motives for Supply Side to Do CS		The Motives for Demand Side to Ask for Elective CS	
	Financial Incentive ^a	Other Convenience Incentive	Financial Incentive ^a	Other Convenience Incentive
Before May 2005	Yes	Yes	No	Yes
Between May 2005 and May 2006	No	Yes	Yes	Yes
After May 2006	No	Yes	No	Yes

CS indicates Cesarean section.

^aThe financial incentives in this table are based on Table 1.

CS rates. In Taiwan, the ownership of a medical institute is public, private, or juristic person. Public institutes are operated by the public sector, whereas private and juristic-person institutes are not. The owner of a private institute is a natural person, and the owner of a juristic-person institute is a juristic person (legal person). Two dummy variables, Public and Juristic-Person, were adopted to test how the public or juristic-person institutes differ from private institutes. The location of the medical institutes was also considered. According to the urbanization level, the locations of all institutes are categorized into 3 types: 1) Metropolitan Area, 2) Second Metropolitan Area, and 3) Rural Area. Two dummy variables of Metropolitan Area and Second Metropolitan Area were adopted to examine whether CS rates in metropolitan areas were higher than those in rural areas.

Furthermore, the pregnant women might be registered in the NHI through their employers (or their occupational unions) or be enrolled as dependents of their employed spouses (or direct blood relatives). Therefore, 1 dummy variable, Dependent, was adopted to show the effects of the insured's status. According to the records of inpatient claims and the insured, the age of each laboring woman was calculated and considered as being an independent variable in the regression analysis. Because obstetricians usually recommended the delivery method based on clinical conditions, a dummy variable of High Risk was considered to identify whether the clinical conditions of a laboring woman satisfied the characteristics of high-risk pregnancy. Following the studies by Lin et al and Han and Lien,^{16,17} this analysis also includes 2 dummy variables: 1) Weekend or Holiday and 2) Ghost Month. The former identified whether the birth date was a weekend or a holiday; the latter identified whether the birth date belonged to the ghost month. Ghost month is the Chinese lunar month of July. Many Taiwanese believe that the door of hell opens and wandering ghosts visit the human world during this month. Thus, ghost month is discouraging for hospitalization and elective surgery.

RESULTS

The numbers of the sampling birth cases in periods I, II, and III are 24,624, 9958, and 16,503, respectively. In Period I, the case numbers of VD, unplanned CS, planned CS, and elective CS were 16,524, 2930, 4716, and 454, respectively. In Period II, the case numbers of VD, unplanned CS, planned CS, and elective CS are 6610, 1186, 1997, and 165, respectively. In Period III, the case numbers of VD, unplanned CS, planned CS, and elective CS are 10,939, 1978, 3229, and 357, respectively.

Table 3 shows the results of the multinomial logistic regression for 4 delivery modes, with VD the base group. The

odds ratios of Medical Centers, Regional Hospitals, and Local Hospitals are less than 1 for the 3 CS types. The probability ratio of unplanned CS versus VD in medical centers is approximately 37% smaller than the ratio in clinics. The probability ratio of planned CS versus VD in regional hospitals is roughly 17% smaller than that in clinics. Regarding hospital ownership, the coefficients of Public and Juristic-Person for unplanned CS are positive, and those for planned CS are negative. The probability ratios of unplanned CS versus VD in public and juristic-person institutes are 21% to 24% greater than the ratio in private institutes. The probability ratios of planned CS versus VD in public and juristic-person institutes are 11% to 15% smaller than the ratio in private institutes. For elective CS, the odds ratios of Metropolitan Area and Second Metropolitan Area are 2.754 and 3.142, respectively.

For Unplanned CS and Planned CS, the coefficients of Weekend or Holiday are significantly negative. On weekends and holidays, the probability ratio of unplanned CS or planned CS versus VD is 10% to 11% smaller than the ratio on weekdays. For the 3 CS types, the effects of Ghost Month were not significant and the odds ratios are close to 1. Regarding the characteristics of women in labor, the coefficients of Dependent are negative. The factors of a high-risk pregnancy increased the probabilities of the 3 CS types, especially for Planned CS. For women with high-risk pregnancy, the probability ratio of planned CS versus VD is roughly 3.35 times the ratio for women without high-risk characteristics. In addition, the probabilities of Planned CS and Elective CS significantly increased with the age of pregnant women.

Furthermore, the odds ratios of Period II and Period III were used to test the 2 hypotheses proposed in Rationale, and examine the effects of the policy changes in May 2005 and May 2006. For Unplanned CS, the odds ratios of Period II and Period III are 0.978 and 0.960, respectively. The probability ratio of unplanned CS versus VD decreased only 2% to 4% since May 2005. For Planned CS, the odds ratios of Period II and Period III are 0.995 and 0.942, respectively. Relative to the period before May 2005, the probability ratio of planned CS versus VD did not change significantly between May 2005 and May 2006, but the ratio decreased by approximately 6% since May 2006. Some of the results for Unplanned CS and Planned CS coincide with the 2 hypotheses regarding indicated CS. For Elective CS, the odds ratio of Period II was 0.861, but the ratio of Period III was 1.083. Compared with the period before May 2005, the probability ratio of elective CS versus VD between May 2005 and May 2006 decreased by 14%, but the ratio after May 2006 increased by 8%. The results for Elective CS do not coincide with the 2 hypotheses on elective CS.

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Table 3. Results of the Multinomial Logistic Regression for 4 Delivery Modes^a

Variables	Unplanned CS		Planned CS		Elective CS	
	Coefficient (SE) ^b	OR (95% CI)	Coefficient (SE) ^b	OR (95% CI)	Coefficient (SE) ^b	OR (95% CI)
Period II	-0.022 (0.0439)	0.978 (0.90, 1.07)	-0.005 (0.0343)	0.995 (0.09, 1.06)	-0.149 (0.1103)	0.862 (0.69, 1.07)
Period III	-0.041 (0.0437)	0.960 (0.88, 1.05)	-0.060 ^c (0.0337)	0.942 (0.88, 1.00)	0.080 (0.1131)	1.083 (0.87, 1.35)
(reference: period I)						
Medical Center	-0.469 ^d (0.1571)	0.626 (0.50, 0.85)	-0.117 (0.1093)	0.890 (0.72, 1.10)	-0.191 (0.4457)	0.826 (0.34, 1.98)
Regional Hospital	-0.206 (0.1266)	0.813 (0.63, 1.04)	-0.189 ^c (0.0879)	0.828 (0.70, 0.98)	-0.259 (0.3822)	0.772 (0.36, 1.63)
Local Hospital	-0.057 (0.0886)	0.945 (0.79, 1.12)	-0.110 (0.0776)	0.896 (0.77, 1.04)	-0.242 (0.3006)	0.785 (0.44, 1.42)
(reference: clinic)						
Public	0.191 (0.1362)	1.210 (0.92, 1.58)	-0.113 (0.0888)	0.893 (0.75, 1.06)	-0.091 (0.3172)	0.913 (0.49, 1.70)
Juristic-Person	0.218 (0.1416)	1.243 (0.94, 1.64)	-0.161 (0.0927)	0.851 (0.71, 1.02)	0.124 (0.3065)	1.132 (0.62, 2.06)
(reference: private)						
Metropolitan Area	0.093 (0.0823)	1.097 (0.93, 1.29)	0.063 (0.0604)	1.065 (0.95, 1.20)	1.013 ^d (0.5030)	2.754 (1.65, 4.59)
Second Metropolitan Area	-0.036 (0.1763)	0.965 (0.68, 1.36)	-0.039 (0.117)	0.962 (0.76, 1.21)	1.145 ^d (0.3434)	3.142 (1.60, 6.16)
(reference: rural area)						
Weekend or Holiday	-0.103 ^d (0.035)	0.902 (0.84, 0.97)	-0.118 ^d (0.0287)	0.889 (0.84, 0.94)	-0.117 (0.0830)	0.889 (0.76, 1.05)
(reference: weekdays)						
Ghost month	-0.005 (0.0481)	0.995 (0.91, 1.09)	-0.024 (0.0407)	0.976 (0.90, 1.06)	-0.078 (0.1146)	0.925 (0.74, 1.16)
(reference: other months)						
Dependent	-0.130 ^d (0.0298)	0.878 (0.83, 0.93)	-0.032 (0.0306)	0.969 (0.91, 1.03)	-0.225 ^d (0.0736)	0.799 (0.69, 0.92)
(reference: registered through their employers)						
High Risk	0.961 ^d (0.0697)	2.614 (2.28, 2.99)	1.210 ^d (0.0715)	3.354 (2.91, 3.86)	0.739 ^d (0.1319)	2.094 (1.62, 2.71)
(reference: low risk)						
Age	0.004 (0.0043)	1.004 (0.99, 1.01)	0.045 ^d (0.0044)	1.046 (1.04, 1.06)	0.042 ^d (0.0092)	1.043 (1.02, 1.06)

CI indicates confidence interval; CS, Cesarean section; OR, odds ratio; SE, standard error; VD, vaginal delivery.
^aThe base group is VD.
^bThe SEs were adjusted at the hospital level to account for correlation of observations.
^cP values smaller than 5%.
^dP values smaller than 1%.

DISCUSSION

Regarding hospital attributes, the results mean that the CS rates of medical centers, regional hospitals, and local hospitals are all less than the rate of clinics. This is consistent with the results obtained by Xirasagar et al.¹⁸ Group practices of hospitals show lower CS rates than individual practice ob-

stetric clinics. Moreover, the public or juristic-person institutes have a higher probability of unplanned CS than private institutes. This is because most private institutes are individual practices, and public or juristic-person hospitals have better emergency departments to handle unscheduled cases.

The rates of 3 CS types on weekends and holidays were less than those on weekdays, because the timing of planned CS

and labor induction could be scheduled in advance. Obstetricians usually scheduled these services on weekdays.^{6,14,19-21} However, although obstetricians could schedule cases of planned CS and elective CS, a main consideration would have to be the baby's maturity, such as being at least 37 weeks, and the obstetricians could not advance or postpone the birth date substantially. This could explain the insignificant figures during ghost month.

From 2003 to 2007, the obstetricians' legal concerns, time preference, or other convenience motives did not change. In addition, the indications of CS and the monitoring methods adopted by the authorities remained unchanged. The BNHI increased the payment for VD for hospitals by nearly 80% in May 2005, and equalized the provider payment for VD and indicated CS. The results indicate that this supply-side policy slightly lowered the probability of planned CS, but did not reduce the probability of unplanned CS significantly. The policy effect was not great, and the decreasing CS rate was concentrated in planned CS cases. These results imply that the recommendations of unplanned CS cases and most planned CS cases were not affected by this supply-side policy. In other words, the high CS rate in Taiwan could not be attributed totally to the higher payment for indicated CS or to the physicians' financial incentives.

Moreover, the BNHI increased the insured's copayment for elective CS in May 2006. From 2003 to 2007, no other event affected the insured's attitude toward elective CS. After this demand-side policy change, the rate of elective CS did not decrease. Contrarily, elective CS seemed to increase slightly. This implies that the financial burden might not be an important consideration for women in labor choosing elective CS. Actually, the birth rate in Taiwan has been decreasing yearly. For most families, the medical expenditure of delivery was not a long-run financial burden. The influences of financial burden, such as copayment, might be offset by the joy of giving birth. Therefore, other demand-side considerations, such as preferring an auspicious time or avoiding delivery risk, might be more responsible for the high CS rate in Taiwan.

Most studies on Taiwan birth data merely discussed supply-side incentives (such as the payment adjustment in May 2005) or focused on demand-side incentives (such as the attitudes of pregnant women).^{4,5,9,10,16,17} Studies discussing the policy effects of the copayment change in May 2006 are scant. This study explores not only the supply side policy in May 2005, but also the demand side policy in May 2006. This is an important difference between this study and relevant literature.

The analyses for both policies show that the financial incentives were not the main determinant for either the demand side or the supply side in choosing the delivery method

(CS or VD). The relevant studies have indicated that fear of delivery would induce the pregnant women's preference for CS, and obstetricians' choice of delivery method was influenced by their risk attitude.^{8,22} To encourage more VD and lower the CS rate in Taiwan, the authorities should consider mechanisms other than adjusting the payment or changing the copayment. For the demand side, a comfortable environment with enough staff and obstetricians within sight of women in labor would attenuate their anxiety and frustration. For the supply side, providing delivery rooms with enough staff, who are also supportive, and 24-hour emergent facilities could help obstetricians lower the perceived risk of complaints and malpractice litigations. These approaches might help to increase the number of VDs.

This study does not review all the inpatient records, but adopts the systematic sampling data set as the empirical materials. However, the sampling could represent the population well. The distribution of delivery modes and the characteristics of laboring women in this study are similar to those in the study by Han and Lien, which reviewed all first-birth records between 2003 and 2007.¹⁷ Moreover, the analyses of this study lack a control group because the empirical materials were obtained from the NHI research database. NHI in Taiwan is a compulsory program, and more than 99% of the citizens are covered under the NHI system. This study could not observe and discuss the CS rates of women who were not enrolled in NHI and have been absent from these policy changes. Thus, the limitation of this study is that the analysis results might not act as a reference for the delivery modes and incentives of women who are not enrolled in the NHI system.

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