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ORIGINAL ARTICLE

Association between maternal age and the likelihood of a cesarean section: a population-based multivariate logistic regression analysis

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Background. A majority of studies examining the relationship between advancing maternal age and the likelihood of cesarean section (CS) use data from regional samples or from a limited number of medical institutions. This study uses population-based data from Taiwan to explore the relationship between maternal age and the likelihood of a CS.
Methods. The National Health Insurance Research Database (NHIRD) on registries of medical facilities and board-certified physicians and monthly claim summaries for inpatients were used. In total, 502 524 singleton deliveries were included in the study. Multivariate logistic regressions were performed with the presence of CS as the dependent variable and maternal age (<20, 20–29, 30–34 and >34 years) as the independent variable. The study controlled for maternal indications, institution characteristics, maternal requests and attending physician characteristics.
Results. CS rates for the age groups <20, 20–29, 30–34 and >34 years were 17.7, 27.4, 37.4 and 47.5%, respectively. The regression analyses consistently showed that the likelihood of a CS significantly increased with advancing maternal age within each category of complication after adjusting for medical institution characteristics and characteristics of the attending physician.
Conclusions. This study found that, after adjusting for maternal indications, and healthcare institution and physician characteristics, there was a significant relationship between advancing maternal age and an increased likelihood of a CS. This finding, together with the high CS rate of 32.1% in Taiwan, one of the highest reported in the world today, highlights an imperative need to devise interventions to reduce the frequency of CSs.

Key words: cesarean section; maternal age; cesarean section rate

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The increasing worldwide cesarean section (CS) rate has become a concern in public health and obstetrics. CSs are reported to be associated with higher maternal morbidity and mortality when compared to vaginal deliveries (VDs) (1,2). To lower the CS rate, efforts have been made to explore the factors involved in the decision to perform a CS. Many studies have demonstrated that CS rates are influenced by maternal indications, a patient's socioeconomic status, specific aspects of the admitting medical institution, and the attending physician's personal preferences (3–6).

Advancing maternal age is another important factor that leads to high CS rates (7). In an industrialized society, delayed childbearing is a result of increasing numbers of late and second marriages, women's growing concentration on their careers, and advanced assisted reproductive technologies, as well as increasing financial concerns

that create disincentives for raising children (8,9). Although previous studies concentrating on the pregnancy outcomes of older women yielded conflicting results (7,10), advancing maternal age has consistently been reported to be associated with a higher CS rate (11,12).

However, the majority of studies examining the relationship between advancing maternal age and the likelihood of CS merely used regional samples or data from a limited number of medical institutions. In addition, very few studies have taken into account specific characteristics of the medical institution and the attending physician that may confound results, causing bias in the statistical analysis. To further elucidate the reasons for higher CS rates in older women, we conducted this study with a very large population-based sample. The effects of the physician and institution characteristics were adjusted by logistic regression analysis.

Materials and methods

Data collection

This study used the National Health Insurance Research Database (NHIRD) for the years 2000 and 2001, which is published by Taiwan's National Health Research Institutes. This database provides registries of medical facilities contracted with the Bureau of the National Health Insurance (BNHI) and board-certified physicians, as well as monthly claim summaries for inpatient claims for a population of over 20 million people. One principal International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis and up to four secondary diagnoses are listed for each patient.

In this study, we included all cases that were admitted to hospitals or obstetric clinics for deliveries. These parturients were identified by diagnosis-related group (DRG) codes 0371A (CS) or 0373A (VD). Criteria for exclusion from the study were: patient age below 15 or over 50 years; attending physician age below 26 or over 75 years; and women whose deliveries involved more than one child (such women might have different obstetric considerations as to mode of delivery compared with women who had singleton gestations). In addition, one study conducted by Lo indicated that maternal request plays an important role in the choice of delivery mode among Chinese women (13). Therefore, women assigned to the DRG code 0373B (CS per maternal request, $n = 11\,463$, accounting for 6.6% of all CSs) were not included in this study in order to exclude the effect of maternal choice on the mode of delivery. Ultimately, 502 524 singleton deliveries fulfilled our criteria and were included in our study.

Maternal complications for CS

All deliveries were sorted according to mutually exclusive complications into one of five groups using the following adaptation of Anderson and Lomas' hierarchical scheme: previous CS (ICD-9-CM 654.2), breech presentation (652.2 and 669.6), dystocia (653 and 660–662, except 661.3), fetal distress (656.3) and others (14). The first four conditions form the hierarchy in that order, so that any case with two or more complications was allocated to the complication that takes precedence over the others. The category of "others" included complications not ordinarily indications for CS as well as no complication.

Institutional and physician characteristics

The healthcare institution's characteristics include level (medical center, regional hospital, district hospital, clinic), ownership (public, voluntary, private), geographic location (north, center, south, east) and qualifications as a teaching institution (yes and no). A healthcare institution's level was defined based on its capacity, facilities, quality of performance and administration. For example, with regard to bed number, the minimal requisite number of beds was 500 for a medical center, 250 for a regional hospital and 20 for a district hospital. Information on physician age and gender was also recorded for analysis.

Statistical analysis

Statistical analysis was conducted using the SAS statistical package (SAS System for Windows, V8). Bivariate analyses were used to assess the associations between age and the likelihood of a CS. Multiple regression analyses were also performed to explore the relationship between advancing maternal age and the likelihood of CS within each category of complications after adjusting for medical institution characteristics and characteristics of the attending physician. Significance was set at $p \leq 0.05$.

Results

Table I summarizes the profile of patients sampled according to mode of delivery. Of the 502 524 singleton deliveries in the years 2000 and 2001, 32.1% were performed by CS and 67.9% were VDs. The majority (57%) of parturients belonged to the age group 20–29 years. The CS rates for the age groups <20, 20–29, 30–34 and >34 years were 17.7, 27.4, 37.4 and 47.5%, respectively. There was an upward trend in the CS rate with advancing maternal age. The table also summarizes the distribution of hospital level, ownership, geographic location and teaching status of the healthcare institution, as well as characteristics of the attending physician by delivery mode.

Table II illustrates frequencies of maternal indication, institutional level, ownership, location and teaching status, and physician's gender according to age group. There were statistically significant relationships between the likelihood of a CS and maternal indication, institutional level, ownership, location, teaching status and physician's gender as demonstrated by Pearson's χ^2-test (all $p < 0.001$).

Table III summarizes the complication-specific CS rates by age group. As expected, overall CS rates were high in the categories of previous CS, breech presentation, dystocia and fetal distress (range 89.8–97.9%). The age effect on CS rates

Table I. Profiles of sample patients ($n = 502\,524$)

Variables	Cesarean delivery *n* (%)	Vaginal delivery *n* (%)
Delivery mode	161 263 (100)	341 261 (100)
Age (years)		
<20	2919 (1.8)	13 588 (4.0)
20–29	78 490 (48.7)	207 856 (60.9)
30–34	55 285 (34.3)	92 651 (27.2)
>34	24 569 (15.2)	27 166 (7.9)
Maternal indication		
Previous CS	59 084 (36.3)	1247 (0.4)
Breech presentation	31 111 (19.3)	405 (0.1)
Dystocia	37 885 (23.5)	2615 (0.8)
Fetal distress	11 194 (6.9)	1279 (0.4)
Others	21 989 (13.6)	335 715 (98.4)
Institution level		
Medical center	25 129 (15.6)	50 332 (14.8)
Regional hospital	36 204 (22.5)	80 692 (23.7)
District hospital	44 173 (27.4)	93 154 (27.3)
Obstetric and gynecology clinic	55 757 (34.6)	117 083 (34.3)
Institution ownership		
Public	25 011 (15.5)	53 532 (15.7)
Voluntary	83 979 (52.1)	176 653 (51.8)
Private	52 273 (32.4)	111 076 (32.6)
Institution geographic location		
North	72 609 (45.0)	150 073 (44.0)
Center	35 977 (22.3)	92 735 (27.2)
South	49 490 (30.7)	89 675 (26.4)
East	3187 (2.0)	8778 (2.6)
Qualification as a teaching hospital		
Yes	74 932 (46.5)	157 601 (46.2)
No	86 331 (53.3)	183 660 (53.8)
Attending physician gender		
Male	151 052 (93.7)	317 114 (92.9)
Female	10 211 (6.3)	24 147 (7.1)

was not evident in these four categories. The CS rate was low in the "others" category. A significant relationship between age and CS rate was found in the "others" category ($p < 0.001$).

Table IV illustrates the adjusted relationships between maternal age and the likelihood of a CS in the different complication categories. All regression analyses showed that a significant relationship existed between maternal age and the likelihood of a CS after adjusting for healthcare institutional and physician characteristics. Our results also demonstrated that decisions about delivery were significantly influenced by the healthcare institution level, location, and qualifications as a teaching institution. In particular, CSs were more likely to be performed in obstetric and gynecology (ob/gyn) clinics than in hospitals. Physician age and gender were of little consequence to the likelihood of a CS.

Discussion

This study used a large sample involving more than 500 000 singleton deliveries to examine the relationship between the CS rate and maternal age. This population-based study found that the statistical likelihood of a CS significantly increased with advancing maternal age in Taiwan after adjusting for maternal complications, and healthcare institution and physician characteristics. This finding is in accordance with those of previous studies conducted by Ecker et al. (11) and Peipert and Bracken (7) in the US, Lialios et al. in Greece (10), Cnattingius et al. in Sweden (15), and Kozinszky et al. in Hungary (16). They all consistently reported that the increased likelihood of a CS is significantly associated with advancing maternal age, although CS rates differed in these countries.

Many previous studies have speculated about the relationship between maternal age and the likelihood of a CS. For example, studies by Parrish et al. (17) and Ecker et al. (11) both proposed that physiological factors related to aging may account for the high number of CSs among older women. Irwin et al. also hypothesized that the high risk of a CS among women over the age of 30 could be explained by medical conditions that are not identified as complications of pregnancy or delivery (18). In addition to medical factors, there has been much speculation about other factors such as socioeconomic status, parental anxiety, previous infertility and physician beliefs that might contribute to this high CS rate among older women (7,19,20). However, although many studies have proposed different explanations for the relationship between CS rate and maternal age, there is no consensus on the specific reasons contributing to the high CS rate for women aged over 30 years.

We hypothesized that one other reason contributing to the high CS rate among older women in Taiwan could be physician preference. Many previous studies conducted in other countries have proposed a similar rationale to account for the high CS rate among older women (7,20). A majority of obstetricians may believe that older women are more likely to be at risk for adverse pregnancy outcomes, even though findings regarding the relationship between advanced maternal age and adverse outcomes are, in fact, still mixed. Therefore, this perception on the part of physicians produces a greater tendency to perform CSs on older women, with the intention of preventing potential long-term perineal damage from a vaginal delivery (21). In particular, according to data released in 2000 by the Department of Health in Taiwan, the number of malpractice lawsuits increased 58.5% after the inception of the National Health Insurance program in 1995 (22). Obstetricians may therefore be driven to perform more CS for older women in order to prevent lawsuits. Studies in

Table II. Frequencies of maternal indication, institutional level, ownership, location, and teaching status, and physician's gender according to age group

Variable	Age (years) <20 *n* (%)	20–29 *n* (%)	30–34 *n* (%)	>34 *n* (%)	χ^2
Maternal indication					13 706*
Previous CS	397 (0.6)	24 820 (41.1)	23 950 (39.7)	11 164 (18.5)	
Breech presentation	729 (2.3)	16 533 (52.5)	9893 (31.4)	4361 (13.8)	
Dystocia	1074 (2.7)	22 325 (55.1)	12 436 (30.7)	4665 (11.5)	
Fetal distress	368 (3.0)	6911 (55.4)	3735 (29.9)	1459 (11.7)	
Others	13 939 (3.9)	215 757 (60.3)	97 922 (27.4)	30 086 (8.4)	
Institution level					12 956*
Medical center	1020 (1.4)	32 834 (43.5)	28 831 (38.2)	12 776 (16.9)	
Regional hospital	3127 (2.7)	63 443 (54.3)	37 070 (31.7)	13 256 (11.3)	
District hospital	5181 (3.8)	82 320 (60.0)	37 920 (27.6)	11 906 (8.7)	
Ob/gyn clinic	7179 (4.2)	107 749 (62.3)	44 115 (25.5)	13 797 (8.0)	
Institution ownership					3395*
Public	1858 (2.4)	40 836 (52.0)	26 199 (33.4)	9650 (12.3)	
Voluntary	6012 (3.7)	100 367 (61.4)	43 947 (26.9)	13 023 (8.0)	
Private	8367 (3.3)	145 143 (55.7)	77 790 (30.0)	29 062 (11.2)	
Institution location					4832*
North	5989 (2.7)	117 456 (52.8)	71 947 (32.3)	27 290 (12.3)	
Center	5119 (4.0)	78 924 (61.4)	34 197 (26.6)	10 472 (8.1)	
South	4657 (3.4)	82 859 (59.5)	38 912 (28.0)	12 737 (9.2)	
East	742 (6.2)	7107 (59.4)	2880 (24.1)	1236 (10.3)	
Qualification as a teaching hospital					8577*
Yes	5834 (2.5)	119 046 (51.2)	77 470 (3.33)	30 183 (13.0)	
No	10 673 (4.0)	167 300 (62.0)	70 466 (26.1)	21 552 (7.9)	
Physician gender					51*
Male	15 474 (3.3)	267 276 (57.1)	137 385 (29.4)	48 031 (10.3)	
Female	1033 (3.0)	19 070 (55.5)	10 551 (30.7)	3704 (10.8)	

Ob/gyn clinic, obstetrics and gynecology clinic. *$p < 0.001$.

Table III. Indication-specific cesarean rates by age group in all deliveries

Maternal indication	Age (years) <20 *n* (%)	20–29 *n* (%)	30–34 *n* (%)	>34 *n* (%)	Total *n* (%)
Previous cesarean					
Cesarean section	387 (97.5)	24 286 (97.9)	23 489 (98.1)	10 922 (97.9)	59 084 (97.9)
Vaginal delivery	10 (2.5)	534 (2.1)	461 (1.9)	242 (2.2)	1247 (2.1)
Total	397	24 820	23 950	11 164	60 331
Breech presentation					
Cesarean section	705 (96.7)	16 332 (98.8)	9778 (98.8)	4296 (98.5)	31 111 (98.7)
Vaginal delivery	24 (3.3)	201 (1.2)	115 (1.2)	65 (1.5)	405 (1.3)
Total	729	16 533	9893	4361	31 516
Dystocia					
Cesarean section	966 (89.9)	20 734 (92.9)	11 749 (94.5)	4436 (95.1)	37 885 (93.5)
Vaginal delivery	108 (10.1)	1591 (7.1)	687 (5.5)	229 (4.9)	2615 (6.5)
Total	1074	22 325	12 436	4665	40 500
Fetal distress					
Cesarean section	331 (90.0)	6290 (91.0)	3293 (88.2)	1280 (87.7)	11 194 (89.8)
Vaginal delivery	37 (10.0)	621 (9.0)	442 (11.8)	179 (12.3)	1279 (10.3)
Total	368	6911	3735	1459	12 473
Others					
Cesarean section	530 (3.8)	10 848 (5.0)	6976 (7.1)	3635 (12.1)	21 989 (6.2)
Vaginal delivery	13 409 (96.2)	204 909 (95.0)	90 946 (92.9)	26 451 (87.9)	335 715 (93.9)
Total	13 939	215 757	97 922	30 086	357 704

Table IV. Adjusted odds ratio of cesarean delivery by maternal age, medical institutional characteristics, and physician characteristics for parturients in different complication categories

	Complication				
Variable	Previous cesarean OR (95% CI)	Breech presentation OR (95% CI)	Dystocia OR (95% CI)	Fetal distress OR (95% CI)	Others OR (95% CI)
Maternal age (years)					
<20	0.8 (0.4–1.6)	0.3 (0.2–0.5)	0.7 (0.6–0.9)	0.7 (0.4–1.0)	0.8 (0.7–0.8)
20–29 (ref. group)					
30–34	1.3 (1.2–1.6)	1.2 (1.0–1.7)	1.5 (1.4–1.7)	1.1 (1.0–1.3)	1.4 (1.3–1.4)
>34	1.4 (1.2–1.6)	1.3 (0.9–1.5)	1.8 (1.5–2.1)	1.3 (0.9–1.5)	2.4 (2.3–2.5)
Institution level					
Medical center	0.2 (0.1–0.3)	0.1 (0.1–0.2)	0.1 (0.1–0.1)	0.5 (0.3–0.8)	0.7 (0.5–0.8)
Regional hospital	0.8 (0.6–0.9)	0.2 (0.1–0.4)	0.2 (0.1–0.2)	0.3 (0.2–0.5)	0.7 (0.7–0.8)
District hospital	0.3 (0.3–0.4)	0.4 (0.3–0.8)	0.1 (0.1–0.1)	0.3 (0.2–0.5)	0.9 (0.9–0.9)
Ob/gyn clinic (ref. group)					
Institution ownership					
Public hospital	1.0 (0.8–1.2)	0.9 (0.6–1.3)	0.4 (0.3–0.4)	0.4 (0.3–0.5)	1.0 (0.9–1.0)
Voluntary hospital	0.9 (0.7–1.1)	0.9 (0.6–1.4)	0.3 (0.2–0.3)	0.3 (0.2–0.3)	1.0 (0.9–1.0)
Private hospital (ref. group)					
Institution location					
North (ref. group)					
Center	1.7 (1.4–2.0)	1.0 (0.8–1.4)	0.4 (0.3–0.4)	5.2 (3.9–6.9)	0.8 (0.8–0.9)
South	1.3 (1.1–1.5)	0.7 (0.6–0.9)	1.0 (0.9–1.0)	1.9 (1.6–2.2)	1.1 (1.1–1.2)
East	0.9 (0.7–1.2)	0.2 (0.1–0.4)	0.7 (0.5–0.9)	2.6 (1.5–4.6)	0.7 (0.6–0.8)
Qualification as a teaching institution					
Yes	0.6 (0.4–0.7)	0.4 (0.3–0.7)	0.6 (0.6–0.7)	0.2 (0.1–0.2)	1.3 (1.2–1.3)
Physician gender					
Male	0.9 (0.7–1.1)	1.3 (0.9–1.8)	1.3 (1.1–1.5)	1.0 (0.8–1.2)	1.3 (1.2–1.3)
Female (ref. group)					
Physician age	1.0 (1.0–1.0)	1.0 (1.0–1.0)	1.0 (1.0–1.0)	1.0 (0.9–1.0)	1.0 (1.0–1.0)

OR, odds ratio; Ob/gyn clinic, obstetrics and gynecology clinic.

other countries have demonstrated that a physician's fear of litigation is associated with the likelihood of performing a CS (23,24).

This study also found that ob/gyn clinics were more likely to perform CSs compared to all levels of hospitals in Taiwan. Ob/gyn clinics are considered the least qualified in terms of medical equipment and clinical capability, and provide the least sophisticated clinical care among all medical institutions. Our findings are consistent with those of Di Lallo et al., who found that unclassified private units, which provided the lowest level of obstetric care, had higher CS rates compared to those of higher-level maternal care units (25). The possible explanation for the high likelihood of CS being performed at ob/gyn clinics is that all hospitals have specific accreditation requirements (suggesting a 30% ceiling on cesarean rates) and undergo periodic scrutiny by the BNHI, but clinics are not subject to accreditation. The accreditation process may drive hospitals to remain within the norms to avoid attracting negative attention from the BNHI. However, clinics have no incentive to review their clinical decisions to avoid stepping beyond the suggested norm.

Policy implications and limitations

The data suggest that older women are more likely to deliver by CS for other than medical reasons such as previous CS, breech presentation, dystocia and fetal distress. This finding, together with the high CS rate of 32.1%, one of the highest ever reported, highlights an imperative need to devise interventions to reduce the frequency of CSs in Taiwan. It is recommended that a second medical opinion be required before nonemergency CS, especially for women aged over 30 years. In addition, it is essential to identify the factors contributing to the high CS rate among older women by well-designed clinical and questionnaire surveys before the government can adopt a principled policy stand on CS.

There are some limitations to this study. First, the study suffers from a lack of data on the mother's socioeconomic characteristics, parity and birthweight, which may influence the choice of delivery type (19,26). This information is currently not available or not released from the NHIR database. Second, the possibility of differential misclassification in complication categories

might exist in the database. It is likely that some women who underwent a VD and had a complication might not have had the complication recorded on the medical claims, while very few of the complications of those undergoing a CS would be missing under the National Health Insurance program. Although this misclassification may not necessarily have affected the relationship between maternal age and the likelihood of a CS found in this study, it might possibly bias the associations between the various complications and CS rates.

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References

1. Schuitemaker N, van Roosmalen J, Dekker G, van Dongen P, van Geijn H, Gravenhorst JB. Maternal mortality after cesarean section in the Netherlands. Acta Obstet Gynecol Scand 1997; -76: 332–4.
2. Center for Disease Control. Rates of cesarean delivery – United States, 1991. Morb Mortal Wkly Rep 1993; 42: 285–9.
3. Dumont A, De Bernis L, Bouvier-Colle MH, Breart G; Le groupe MOMA. Estimate of expected cesarean section rate for maternal indications in a population of pregnant women in West Africa (MOMA survey). J Gynecol Obstet Biol Reprod 2002; 31: 107–12.
4. Gould JB, Davey B, Stafford RS. Socioeconomic differences in rates of cesarean section. N Engl J Med 1989; 321: 233–9.
5. Newton ER, Higgins CS. Factors associated with hospital-specific cesarean birth rates. J Reprod Med 1989; 34: 407–11.
6. Burns LR, Geller SE, Wholey DR. The effect of physician factors on the cesarean section decision. Med Care 1995; 33: 365–82.
7. Peipert JF, Bracken MB. Maternal age: an independent risk factor for cesarean delivery. Obstet Gynecol 1993; 81: 200–5.
8. Dulitzki M, Soriano D, Schiff E, Chetrit A, Mashiach S, Seidman DS. Effect of very advanced maternal age on pregnancy outcome and rate of cesarean delivery. Obstet Gynecol 1998; 92: 935–9.
9. Dildy GA, Jackson GM, Fowers GK, Oshiro BT, Varner MW, Clark SL. Very advanced maternal age: pregnancy after age 45. Am J Obstet Gynecol 1996; 175: 668–74.
10. Lialios G, Kaponis A, Adonakis G. Maternal age as an independent risk factor for cesarean delivery. Int J Gynaecol Obstet 1999; 67: 187–8.
11. Ecker JL, Chen KT, Cohen AP, Riley LE, Lieberman ES. Increased risk of cesarean delivery with advancing maternal age: indications and associated factors in nulliparous women. Am J Obstet Gynecol 2001; 185: 883–7.
12. Kirchengast S, Hartmann B. Advanced maternal age is not only associated with newborn somatometrics but also with the mode of delivery. Ann Hum Biol 2003; 30: 1–12.
13. Lo JC. Patients' attitudes vs. physicians' determination: implications for cesarean sections. Soc Sci Med 2003; 57: 91–6.
14. Anderson GM, Lomas J. Determinants of the increasing cesarean birth rate. Ontario data 1979 to 1982. N Engl J Med 1984; 311: 887–92.
15. Cnattingius R, Cnattingius S, Notzon FC. Obstacles to reducing cesarean rates in a low-cesarean setting: the effect of maternal age, height, and weight. Obstet Gynecol 1998; 92: 501–6.
16. Kozinszky Z, Orvos H, Zoboki T. Risk factors for cesarean section of primiparous women aged over 35 years. Acta Obstet Gynecol Scand 2002; 81: 313–16.
17. Parrish KM, Holt VL, Easterling TR, Connell FA, LoGerfo JP. Effect of changes in maternal age, parity, and birth weight distribution on primary cesarean delivery rates. J Am Med Assoc 1994; 271: 443–7.
18. Irwin DE, Savitz DA, Bowes WA, St Andre KA. Race, age, and cesarean delivery in a military population. Obstet Gynecol 1996; 88: 530–3.
19. Martel M, Wacholder S, Lippman A, Brohan J, Hamilton E. Maternal age and primary cesarean section rates: a multivariate analysis. Am J Obstet Gynecol 1987; 156: 305–8.
20. Ezra Y, McParland P, Farine D. High delivery intervention rates in nulliparous women over age 35. Eur J Obstet Gynecol Reprod Biol 1995; 62: 203–7.
21. Al-Mufti R, McCarthy A, Fisk NM. Survey of obstetricians' personal preference and discretionary practice. Eur J Obstet Gynecol Reprod Biol 1997; 73: 1–4.
22. Lin HC, Chang WY, Tung YC. Factors related to dissatisfaction with the National Health Insurance among primary care physicians in Taiwan. Chang Gung Med J 2003; 26: 81–90.
23. Localio AR, Lawthers AG, Bengtson JM, Hebert LE, Weaver SL, Brennan TA et al. Relationship between malpractice claims and cesarean delivery. J Am Med Assoc 1993; 269: 366–73.
24. Baldwin LM, Hart LG, Lloyd M, Fordyce M, Rosenblatt RA. Defensive medicine and obstetrics. J Am Med Assoc 1995; 274: 1606–10.
25. Di Lallo D, Perucci CA, Bertollini R, Mallone S. Cesarean section rates by type of maternity unit and level of obstetric care: an area-based study in central Italy. Prev Med 1996; 25: 178–85.
26. Gomes UA, Silva AA, Bettiol H, Barbieri MA. Risk factors for the increasing caesarean section rate in Southeast Brazil: a comparison of two birth cohorts, 1978–1979 and 1994. Int J Epidemiol 1999; 28: 687–94.

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