

*The second article*

## DEMOGRAPHIC DETERMINANTS FOR CESAREAN DELIVERY IN PATTANI HOSPITAL

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**Abstract.** We investigated demographic determinants for cesarean delivery based on a database of 25,829 singleton births at Pattani Hospital from October 1, 1996 to September 30, 2005. This database includes demographic information about the mother and delivery type outcomes. Using logistic regression analysis to adjust each factor for possible confounding effects of other factors, we found that Islamic women were less likely to give birth by cesarean section and older mothers were more likely to give birth by cesarean section. There was also an association between higher education and cesarian section.

### INTRODUCTION

Cesarean delivery is a common surgical procedure and has helped to decrease maternal and fetal mortality and morbidity in appropriate cases (Lee-Parritz, 2004). However, the worldwide increase in the number of cesarean section deliveries since the 1970s in heavily populated nations such as China (Notzon *et al.*, 1994; Cai *et al.*, 1998), Brazil (Gomes *et al.*, 1999), Mexico (Gonzalez-Perez *et al.*, 2001) and the US (Spaans *et al.*, 2002), has become a major public health concern. There are many risks to the mother from cesarean section, such as intra- and post-operative maternal hemorrhage, wound infection and deep vein leg thrombosis. The indications for cesarean delivery include placenta previa, previous cesarean delivery and malpresentation (Kor-

anantakul *et al.*, 2008). There are other reasons why cesarean section is performed. In a survey in the Netherlands it was noted "a woman can always find a gynecologist willing to perform a cesarean section for non-medical reasons" and recommended that guidelines be established for cesarean surgery (Kwee *et al.*, 2004).

Advanced health-care technologies are becoming more widely available in parts of Thailand. The number of cesarean-section births has increased sharply, particularly among urban women (Hanvoravongchai *et al.*, 2000). Tangcharoensathien *et al.* (2002) found that in Thailand private hospitals have higher cesarean delivery rates than provincial hospitals. Chanthasenanont *et al.* (2007) found increasing cesarean delivery rates at Thammasat University Hospital due to patient preferences. Standardized labor management to reduce unnecessary primary cesarean sections was recommended by Chanrachakul *et al.* (2000).

Pattani Province, located in southern Thailand has, since 1996, been recording data regarding demographic factors and birth

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outcomes for all women delivering their babies at its major hospital in Pattani City (Rachatapantanakorn *et al.*, 2005). We examined the demographic factors affecting cesarean delivery rates at this hospital over a 9-year period from October 1, 1996 to September 30, 2005.

## MATERIALS AND METHODS

## Selection of data

Data were collected from 25,829 women who delivered at Pattani Hospital. The only exclusions were 329 women who had multiple births during the study period. These data included information from that hospital's database for women who went into labor at Pattani Hospital. Complete labor charts, maternal demographic characteristics and reproductive history were available for these women.

## Determinant and outcome variables

The main outcome variable was the delivery type (cesarean section or not). Since referral from another hospital was likely to be an intervening variable in the path between demographic determinants and cesarean delivery outcomes, cases were separated into six groups. First, we classified the mother's reproductive history into three groups: (1) first pregnancy, (2) subsequent pregnancy but no previous cesarean, and (3) subsequent pregnancy and previous cesarean delivery. Each of these groups was then subdivided according to whether the case was new (N) or referred/transferred (R).

Six variables were recorded from each woman: religion (Islamic or other), education completed (primary school, junior high school, senior high school, diploma/bachelor's degree, or other), occupation (housewife, government officer, farmer/gardener, in business, worker, or other), mother's age group (less than 20, 20-24, 25-29, 30-34, or 35 or more) and budget year of delivery (defined as the period

from October 1, in the preceding calendar year to September 30, in the current year) from 1997 to 2005 inclusive, and residence. Nine residence groups were formed based on the twelve districts of Pattani Province, the three other neighboring provinces (Songkhla, Narathiwat and Yala) and an "other" location category. The "other" category included the variable "not stated". Where numbers were small, data were combined to make a single residence group category.

The binary outcome was the type of delivery: (1) surgical delivery of a baby through an incision in the abdomen and the uterus (cesarean section delivery), or (2) other delivery.

## Statistical methods

Preliminary statistical analysis involved examining the frequency distributions of the determinants and their univariate associations with the outcome. To handle the masking effect of the intervening variable, these associations were examined separately in the six case groups.

Logistic regression (Hosmer and Lemeshow, 2000; Kleinbaum and Klein, 2002) was then used to estimate the proportions of cesarean section outcomes in cells defined by combinations of the six demographic factors, using the additive model:

$$\ln\left(\frac{P_{ijklmn}}{1-P_{ijklmn}}\right) = \mu + \alpha_i + \beta_j + \gamma_k + \delta_l + \varepsilon_m + \zeta_n \quad (1)$$

In this model  $\mu$  is a constant and the terms  $\alpha_i$ ,  $\beta_j$ ,  $\gamma_k$ ,  $\delta_l$ ,  $\varepsilon_m$  and  $\zeta_n$  refer to religion, age group, residence, education, occupation and budget year, respectively. To avoid over-specification of the parameters, each set of coefficients was constrained to have a mean equal to 0. To calculate the proportion of cesarean deliveries for each factor after adjusting for the effects of the other factors, equation (1) was used with the terms associated with the other factors replaced by a constant,

chosen to make the sum of the expected number of cesarean deliveries based on the model equal to the observed number, using a Newton-Raphson iterative procedure with Marquardt damping.

All relevant data were stored in a MySQL database and statistical analysis was performed using R (R Development Core Team, 2007).

## RESULTS

Table 1 shows the frequency distributions of the determinants. Most mothers were of Islamic religion (61.3%). A total of 37.6% of mothers were above 30 years of age, 34% of mothers were below 25 years and 28.4% of mothers were between ages 25-29 years.

Approximately half (50.4%) of the mothers lived in Pattani City; 42.2% were living in other districts of Pattani Province and 7.4% either lived outside Pattani Province or their residence was not stated.

Nearly one-third of mothers (30.7%) had completed primary school education, 36.6% had completed some secondary or tertiary education, and 32.7% were recorded as "other" or not stated.

Housewives were 43.6%, 31.5% gave their occupation as government officer, farmer, business person, or worker and 24.9% were recorded as "other" or unstated occupations.

The percentage of deliveries that were by cesarian section per year at the hospital remained fairly stable, varying between 30.5% and 38.8%, with the highest percentage occurring in the year 2002.

Table 2 shows the *p*-values for the overall associations between the demographic factors and the cesarian outcomes for each of the six groups, after adjusting for other factors. Of the 36 associations, 20 were highly

significant ( $p < 0.01$ ), and four more are significant at the 0.05 level.

Fig 1 (with labels for referent groups in Table 3) shows the fitted cesarean delivery rates for each category of each demographic factor, based on the logistic regression model. The dotted horizontal line on each graph gives the overall rate for the group. The left panels show the proportion of mothers having cesarean deliveries among new cases and the right panels show the same proportions among transferred and referred cases.

The highest overall rates of cesarean deliveries occurred among mothers with previous cesarean deliveries (92% for new cases and 82% for referred/transferred cases), where the rates were uniformly high in all demographic groups. The lowest overall rate (18%) occurred among new cases with no previous cesarean delivery. In all groups except referred/transferred cases with no previous cesarean delivery, where numbers were too small to give a conclusive result, Islamic mothers were less likely to have cesarean deliveries. Among those with no previous cesarean delivery, the older mothers were more likely to have a cesarean delivery. There were only slight fluctuations in the annual rates during the first five years, but there is evidence of a downward trend after 2001.

Table 4 shows the odds ratios for each risk factor found in Table 1, together with the corresponding 95% confidence intervals and *p*-values, after adjusting for the other risk factors using logistic regression. The results from Table 4 are summarized as follows:

For Group 1: 1<sup>st</sup> New (first pregnancy mothers, new cases), after adjusting for all the other factors, mothers older than 25 years, government officers and those with occupation "other/not stated", were more

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Table 1  
Number of non-cesarean and cesarean section deliveries at Pattani Hospital in 1997- 2005  
classified by first delivery, previous cesarean, referral status and demographic factors.

Factors	1:1 <sup>st</sup> New		2:1 <sup>st</sup> Ref		3:2+NoCNew		4:2+NoCRef		5:2+PrCNew		6:2+PrCRef	
	notC	Ces	notC	Ces	notC	Ces	notC	Ces	notC	Ces	notC	Ces
<b>Religion</b>												
Islamic	2,971	996	548	644	6,194	1,094	866	719	155	1,289	84	279
Other relig	2,045	1,220	89	126	3,640	1,108	128	130	68	1,305	3	128
<b>Age group</b>												
>20	1,380	265	181	158	283	26	26	12	4	27	2	7
20-24	2,082	742	277	279	1,997	299	141	92	42	373	20	73
25-29	1,155	721	127	197	3,122	554	222	168	80	834	30	112
30-34	335	334	34	95	2,675	681	269	236	63	869	18	136
≥35	64	154	18	41	1,757	642	336	341	34	491	17	79
<b>Residence</b>												
Mueang(City)	2,962	1,208	35	56	6,034	1,179	50	44	97	1,288	1	70
Yaring	509	218	84	116	1,042	225	153	105	46	275	17	40
Nong Chik	388	195	56	72	701	191	112	92	18	212	11	45
KP/Mae Lan	271	195	86	100	508	169	123	95	6	239	12	45
Pattani East	229	147	116	131	409	158	127	157	16	236	20	73
Yarang	166	70	115	99	363	81	187	108	17	103	6	31
Pattani South	112	42	69	109	173	56	134	128	4	75	11	47
Songkhla	151	78	62	68	228	86	92	109	4	86	8	38
Nar/Yala/NS	228	63	14	19	376	57	16	11	12	80	1	18
<b>Education</b>												
Primary	1,096	402	245	308	3,352	658	465	403	72	714	45	157
Junior high	874	275	119	129	1,284	241	105	101	36	369	22	44
Senior high	624	288	78	87	881	220	60	37	20	338	4	41
Dipl/Bach	791	531	42	85	780	263	30	44	17	523	0	78
Other/NS	1,631	720	153	161	3,537	820	334	264	78	650	16	87
<b>Occupation</b>												
Housewife	2,201	762	372	421	4,320	802	512	454	93	1,083	55	187
Govt officer	179	172	3	20	288	102	15	28	3	228	1	54
Farmer/G	45	25	48	53	133	57	157	139	10	76	12	43
Business	283	149	28	38	792	218	81	50	22	264	7	34
Worker	956	469	88	133	1,547	381	107	88	34	425	6	55
Other/NS	1,352	646	98	105	2,754	642	122	90	61	518	6	34
<b>Budget year</b>												
1997	596	287	26	39	1,130	259	38	21	28	186	0	4
1998	497	233	47	39	1,118	257	61	43	22	211	3	12
1999	525	245	52	54	998	254	62	63	16	226	2	38
2000	462	222	51	60	1,049	245	83	85	20	297	4	38
2001	515	231	76	70	1,093	240	117	85	26	317	10	35
2002	526	271	72	139	1,119	294	157	122	13	318	11	60
2003	571	249	82	116	1,103	239	140	162	28	355	9	64
2004	637	238	97	119	1,111	216	149	126	29	335	29	78
2005	687	240	134	134	1,113	198	187	142	41	349	19	78

Table 2  
Prevalence of overall statistically significant factors based on chi-square test.

Risk factors	First pregnancy		Second or later pregnancy no previous cesarean		Previous cesarean delivery	
	New	Transfer/refer	New	Transfer/refer	New	Transfer/refer
Religion	0.000	0.820	0.000	0.570	0.000	0.000
Age group	0.000	0.000	0.000	0.001	0.146	0.105
Residence	0.000	0.050	0.000	0.000	0.000	0.084
Education	0.000	0.162	0.000	0.108	0.025	0.000
Occupation	0.004	0.138	0.000	0.058	0.059	0.105
Year	0.005	0.001	0.000	0.037	0.034	0.056

Table 3  
Labels for referent groups and demographic factors.

Risk factor	Labels	Risk factor	Labels
Religion	1.Non-Islamic <sup>a</sup> 2.Islamic	Education	1.Primary <sup>a</sup> 2.Junior high 3.Senior high 4.Dipl/Bach 5.Other/NS
Age group	1.>20 2.20-24 <sup>a</sup> 3.25-29 4.30-34 5.≥35	Occupation	1.Housewife <sup>a</sup> 2.Govt officer 3.Farmer/G 4.Business 5.Worker 6.Other/NS
Residence	1.Pattani City 2.Yarang <sup>a</sup> 3.Nong Chik 4.KP/Mae Lan 5.Pattani East 6.Yarang 7.Pattani South 8.Songkhla 9.Narathiwat/Yala/NS	Budget year	1.1997 2.1998 3.1999 4.2000 5.2001 <sup>a</sup> 6.2002 7.2003 8.2004 9.2005

<sup>a</sup> Largest group

likely to give birth by cesarean delivery. The budget year was not a significant factor for this group. Mothers coming from Narathiwat and Yala or "not stated" residence, and Islamic mothers, were less likely to deliver by cesarean section.

For Group 2:1<sup>st</sup> Ref (first pregnancy mothers referred or transferred to the delivery room), mothers older than 25 years were more likely to give birth by cesarean section. The peak for cesarean deliveries was in 2002. Occupation was not statistically significant