The Thai Anesthesia Incidents Study (THAI Study) of Anesthetic Outcomes: I Description of Methods and Populations

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Background and rationale : *Since anesthesia, unlike medical or surgical specialties, does not constitute treatment, The Royal College of Anesthesiologists of Thailand host the Thai Anesthesia Incidents Study (THAI Study) of anesthetic outcomes to determine factors related to anesthesia related adverse events.*
Material and Method : *A prospective descriptive study of occurrence screening was conducted in 20 hospitals comprised of 7 university, 4 general and 4 district hospitals across Thailand. Anesthesia personnels were required to fill up patient-related, surgical-related, anesthesia-related variables and adverse outcomes on a strutured data entry form. The data included preanesthetic evaluation intraoperative period and 24 hr post-operative period. Adverse events specific form was recorded when adverse events occurred. All data were keyed in data management unit with double entry technique and descriptive statistics was used in the first phase of this study.*
Results : *A total of 163403 consecutive cases were recorded in one year. The mean (S.D.) of age, weight and height of patients were 38.6(2.3) yrs, 53.9(17.7) kgs and 153.4(22.7) cm respectively. There were more female (52.9%) than male (47.1%) patients with ASA PS 1, 2, 3, 4, 5 = 50.8%, 36.3%, 10.7%, 2.0%, 0.2% respectively. Hypertension (11.6%), anemia (7.7%) and diabetes melitus (6.8%) were the three most common abnormalities in preanesthetic history taking. Mallampati score of 111870 patients grade 1, 2, 3, 4 were 54.0%, 39.7%, 5.6%, 0.7% and laryngoscopic grade 1, 2, 3, 4 of 74888 patients were 81.0%, 15.5%, 3.0% and 0.5% respectively.*
Conclusion : *The first phase of THAI study epidemiological project can represent both the anesthesia and surgical profiles in Thailand. The collected data available should be useful for the improvement of the quality of anesthesia, guidelines for clinical practices, medical education and for further research.*

Keywords : *Anesthesia, outcome, Complication, Adverse events, Multicenter, Epidemiology*

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The maintenance of quality in medical practice requires that those providing care define an acceptable standard of care, and take steps to meet that standard. Unfortunately the recognition of quality is not always easy in practice particularly in a specialty such as anesthesia which does not deal directly

with the diseases or cures , and facilitates treatments of patients rather than providing primary therapeutic benefit. To overcome such a problem the specialty has chosen to utilize indicators of quality care, usually the presence or absence of adverse outcomes, as reflections of the care provided. If these measures are to be at all useful in comparisons between individuals or departments they must be shown to be both reliable (reproducible) and valid reflections of the care provides[1]. It has been estimated that around one million anesthesia per year are conducted in Thailand, however there has not been any large-scale study of anesthesia related adverse outcome. Therefore, The Royal College of Anesthesiologists of Thailand initiated a multicentered study of anesthetic outcomes to develop and institute a methodology for the study of anesthetic outcomes which could be used as a basic for quality improvement activities. The results of the outcome analyses will be presented in subsequent manuscripts.

Material and Method

This study has been approved by all the institutional ethic committees of hospitals and medical institutes affiliated with the study. The basic design of the study was occurrence screening that is, all consecutive patients receiving an anesthetic at any of 20 hospitals were followed and included in the study.[1] The hospitals in this multicentered study comprised of 7 university hospitals (Chieng Mai University, Chulalongkorn University, Khon Kaen University, Mahidol University : Siriraj Hospital and Ramathibadi Hospital, Pramongkutklao Medical College, Prince of Songkhla University), 5 tirtiary hospitals (Buddhachinaraj Hospital, Ratchaburi Hospital, Nakon Sri Thammarat Hospital, Khon Kaen Hospital and Neurology Institution), 4 general hospitals (Lampoon Hospital, Pichit Hospital, Baanpong Hospital and Trang Hospital) and 4 district hospitals (Sanpatong Hospital, Nakorn-Thai Hospital, Kranuan Hospital and Nampong Hospital) across Thailand. In this study, adverse events are determined in a prospective manner and since all patients are included, the adventage of the study design is that important events are much less likely to be missed.

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For each patient undergoing a surgical procedure, anesthesiologist or nurse anesthetist completed a preplanned structured data entry form (form 1) which included a series of patient-related, surgical-related and anesthesia-related variables. Anesthesiologists or nurse anesthetists used form 1 in addition to the usual anesthetic record.

The early phase of the study was to develop the preplanned structure data entry form (form 1). The form had to be relatively short and allow enough space for hand-written documentation. Several meetings were held to determine the items that would be included and to set definitions for the variables. Since we were relying on compliance by all anesthesia personnel, not just volunteers, workshop and internal audit were held to acquaint the anesthesia personnel with form 1 and the interpretation of the variables. After the development of form 1, the new form was piloted in 6 university hospitals before adoption at the other sites.

For the recording of patient-related variables, the attending anesthesia personnel or site managers were requested to check-off preoperative medical conditions, preoperative factors which may have affected the administration of that anesthetic such as smoking, alcohol or drug dependency. They also rated each patient preoperatively by the American Society of Anesthesiologists physical status scores.[2] Moreover, demographic characteristics of the patients including age and sex, preanesthetic airway assessment and laryngoscopic view were also recorded. With regard to the surgical procedure, the operations were recorded by converting the written operative procedure into groups of sites of operation.

The factors recorded relating to anesthesia included anesthesia team, monitors, main anesthetic technique, additional anesthetic technique employed, airway equipment, special anesthetic technique, performer of intubation or regional anesthesia and drugs utilized.

For in-patients, within 24 hr after the surgical procedure, the anesthesia personnels or research nurses visited the patient to record 24-hr anesthesia related adverse outcomes. For outpatients, however, follow-up of all patients was not possible. The adverse outcomes of interested included. To ensure the reliability of data among participating institutions, there were training in each centre, and the project manager visited each hospital to help institute the study protocols. As well, internal audit was done by project quality assurance team. External audit was also done in 6 university hospitals by external evaluators from the

Clinical Research Collaboration Network.

All forms were reviewed by research nurse and/or site manager for completeness. Corrections were then made by each centre including verification of the major adverse event recorded. In addition, further data quality checking and the addition of missing data were made at the end of the data collection period by the site managers. To allow for problems with training of staff, the first month of data for each hospital were not used.

Data analysis. The data collected from each hospitals were keyed at the data management centre with double entry technique to ensure the reliability of data entry. Descriptive statistics was used for demographic, surgical anesthetic data.

Results

At 20 hospitals in Thailand from February 2003 to January 2004, a total of 163403 anesthetics were enrolled. Table 1 shows some of the characteristics of the study hospitals classified by geographical distribution. There were 98839 (60.5%), 43126 (26.4%), 19536 (12.0%) and 1902 (1.2%) anesthetics in university, regional (tirtiary), general (or provincial) and district hospitals respectively. Regarding the demographic characteristics the mean (S.D.) of age, weight and height of the population were 38.6 (2.3) yrs., 53.9 (17.7) kgs. and 153.4 (22.7) cm. respectively. Percentages of patients classified by age groups in each type of hospitals were shown in Figure 1. There were more female (52.9%) than male (47.1%) with detailed gender distribution classified by type of hospitals as shown in Figure 2. The patients in this study were generally healthy ; 87.1% of them were ASA Physical status 1 or 2. The ASA physical status of patients stratified by type of hospital and emergency status is shown in Table 2. The anesthesia services were provided during official times for 114902 (71.9%) anesthetics and classified to be 152679 (95.0%) in-patients and 7971 (5.0%) out-patients or ambulatory surgery. Types of operation and sites of surgery are shown in Table 3.

Table 1. Characteristics of 20 study hospitals classified by geographic distribution (2003)

	Type of hospital	No. of beds	Anesthesiologists (n)	Residents	Nurse Anesthetists	Operating room	Case per day
Central Thailand							
Chulalongkorn	university	1500	24	27	14	45	80-90
Phramongkutklao	university	800	5	2	37	16	30-40
Ramathibodi	university	1000	26	28	38	30	50-80
Siriraj	university	2400	57	53	55	48	100
Ratchaburi	regional	899	4	2	26	14	20
Banpong	general	420	3	0	10	4	10-15
Neurological institute	tirtiary	300	2	0	8	4	6-8
The North							
Buddhachinaraj	regional	948	6	0	22	14	30-40
Chiang Mai	university	2000	16	30	51	22	43
Lamphun	general	402	0	0	8	4	8-24
Nakhonthai	district	60	0	0	2	1	1
Phichit	general	405	1	0	14	6	20
Sanpatong	district	120	0	0	3	1	2-3
The North-eastern							
Khon Kaen	regional	900	6	0	24	16	50
Kranuan	district	90	0	0	3	2	2-3
Nampong	district	60	0	0	3	2	1-2
Srinagarind	university	770	12	12	37	20	40
The South							
Nakon Si Thammarat	regional	863	3	62	28	15	26
Songklanagarind	university	799	13	13	33	13	30
Trang	general	500	2	0	15	9	25

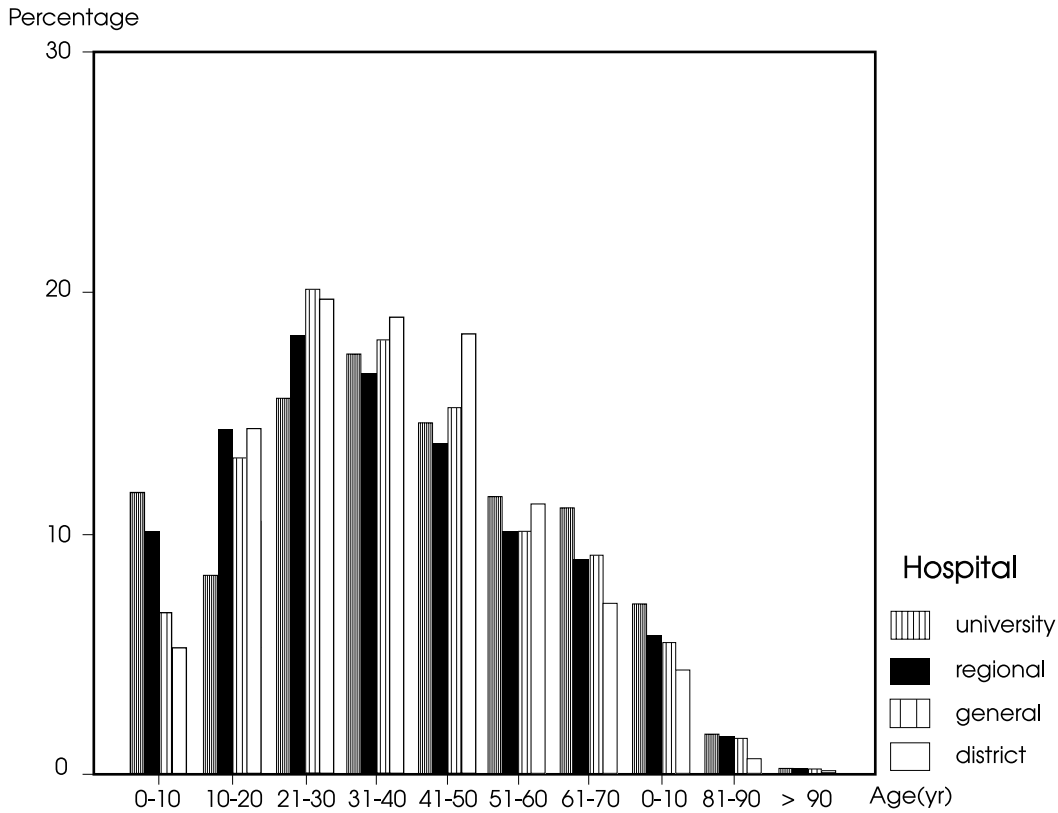


Fig 1. Percentages of patients classified by age groups within each type of hospital

Table 2. ASA physical status and elective or emergency anesthesia stratified by types of hospitals

Type of hospital	ASA Physical Status					emergency	elective
	1	2	3	4	5		
University hospital	45250 (46.8%)	37647 (39.0%)	11647 (12.1%)	1882 (1.9%)	215 (0.2%)	22210 (22.9%)	74607 (77.1%)
Regional hospital	24370 (56.6%)	13222 (30.7%)	4361 (10.1%)	1019 (2.4%)	121 (0.3%)	18373 (42.6%)	24750 (57.4%)
General hospital	10767 (55.2%)	7203 (36.9%)	1188 (6.1%)	307 (1.6%)	34 (0.2%)	9052 (46.3%)	10483 (53.7%)
District hospital	1433 (75.3%)	415 (21.8%)	52 (2.7%)	2 (0.1%)	0 (0.0%)	1084 (57.0%)	818 (43.0%)
Total	81820 (50.8%)	58487 (36.3%)	17248 (10.7%)	3210 (2.0%)	370 (0.2%)	44810 (28.1%)	114902 (71.9%)

Table 3. Sites of operation and/or procedure stratified by types of hospitals

Site of operation and/or procedure	Type of hospital n (%)				
	university n=98839	regional n=43126	general n=19536	district n=1902	Total n=163403
Maxillo-facial	2474 (55.1%)	1633 (36.4%)	377 (8.4%)	5 (0.1%)	4489 (3.0%)
Intraoral	1712 (64.4%)	736 (27.7%)	209 (7.9%)	0 (0.0%)	2657 (2.0%)
Neck resection	1217 (77.8%)	242 (15.5%)	102 (6.5%)	3 (0.2%)	1564 (1.0%)
Intracranial	4051 (58.5%)	2014 (29.1%)	855 (12.4%)	3 (0.0%)	6923 (5.0%)
Intrathoracic	1421 (80.4%)	270 (15.3%)	77 (4.4%)	0 (0.0%)	1768 (1.0%)
Cardiac	3483 (99.3%)	17 (0.5%)	7 (0.2%)	0 (0.0%)	3507 (3.0%)
Perineal-anal	5845 (62.8%)	2325 (25.0%)	1001 (10.8%)	134 (1.4%)	9305 (6.0%)
Eye	3280 (84.4%)	394 (10.1%)	210 (5.4%)	1 (0.0%)	3885 (3.0%)
Ear	587 (71.7%)	153 (18.7%)	76 (9.3%)	3 (0.4%)	819 (1.0%)
Cesarean-section	9104 (58.3%)	3991 (25.5%)	2281 (14.6%)	253 (1.6%)	15629 (10.0%)
Upper abdomen	6086 (57.5%)	2971 (28.1%)	1404 (13.3%)	121 (1.1%)	10582 (7.0%)
Lower abdomen (including kidney/ureter)	16079 (55.0%)	7988 (27.3%)	4254 (14.5%)	935 (3.2%)	29256 (18.0%)
Extremities	16494 (47.3%)	12770 (36.6%)	5488 (15.7%)	114 (0.3%)	34866 (22.0%)
Spine					
* Cervical Spine	676 (68.1%)	128 (12.9%)	185 (18.6%)	4 (0.4%)	993 (1.0%)
* Thoracic Spine	452 (75.7%)	88 (14.7%)	57 (9.5%)	0 (0.0%)	597 (1.0%)
* Lumbosacral	1670 (63.6%)	361 (13.7%)	590 (22.5%)	6 (0.2%)	2627 (2.0%)
Major vascular	832 (89.4%)	78 (8.4%)	20 (2.1%)	1 (0.1%)	931 (1.0%)
Superficial					
* Thyroid	1364 (67.2%)	421 (20.7%)	210 (10.3%)	35 (1.7%)	2030 (2.0%)
* Breast	2247 (70.5%)	627 (19.7%)	255 (8.0%)	57 (1.8%)	3186 (2.0%)
Airway					
* Micro DL	1826 (84.6%)	252 (11.7%)	80 (3.7%)	0 (0.0%)	2158 (2.0%)
* Bronchoscope	967 (75.8%)	241 (18.9%)	68 (5.3%)	0 (0.0%)	1276 (1.0%)
* Surgery of larynx / trachea	1256 (51.5%)	1013 (41.5%)	168 (6.9%)	2 (0.1%)	2439 (2.0%)
Remote service					
* X-ray	1046 (89.4%)	35 (3.0%)	87 (7.4%)	2 (0.2%)	1170 (1.0%)
* MRI	455 (97.8%)	0 (0.0%)	10 (2.2%)	0 (0.0%)	465 (1.0%)
* Cardiac Cath.	577 (99.0%)	1 (0.2%)	5 (0.9%)	0 (0.0%)	583 (1.0%)
* Cardioversion	15 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	15 (0.0%)
ECT	365 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	365 (1.0%)
Labor	185 (98.9%)	1 (0.5%)	0 (0.0%)	1 (0.5%)	187 (1.0%)

The anesthesia personnels performed preanesthetic visit at the hospital wards or emergency rooms for 62080 (38.0%) patients while 97853 (59.8%) patients received initial preanesthetic evaluation at the operating room. There were 83330 (51.3%) of patients who were assessed as normal preanesthetic condition. The details of preanesthetic history are shown in Table 4.

Preanesthetic airway assessment based on Mallampati classification is shown in Table 5. The overall results of Mallampati classification are also shown in Figure 2. Thyromental distance was not evaluated in 109427 (70.3%) patients of 146068 patients, 85.6% (39450 patients) had thyromental distance more than 5 cm or 3 fingerbreadths and 14.3%(6618 patients) had thyromental distance equal or less then 5cm or 3 fingerbreadths. Grading of laryngoscopic view of 78888 intubated patients were shown in Figure 3.

Discussion

It is generally agreed that the outcome study combined with a process review is a state of the art with regard to studies of the quality of medical care.[5,6,7] Since anesthesia does not deal with the treatment of

Table 4. Preanesthetic history stratified by types of hospitals

	Amount of Patients (%)				
	university n=98839	regional n=43126	general n=19536	district n=1902	Total n=163403
Normal	47448 (48.0%)	23865 (55.3%)	10752 (55.0%)	1265 (66.5%)	83330 (50.9%)
Abnormal or Risky	49201 (5.0%)	19240 (44.6%)	8765 (44.9%)	635 (33.4%)	77841 (47.6%)
• Respiratory					
Upper airway obstruction	659 (0.7%)	127 (0.3%)	24 (0.1%)	0 (0.0%)	810 (0.5%)
Upper respiratory tract infection	438 (0.4%)	141 (0.3%)	188 (0.9%)	1 (0.1%)	768 (0.5%)
Lower respiratory tract infection	640 (0.6%)	467 (1.0%)	67 (0.3%)	1 (0.1%)	1175 (0.7%)
Restrictive lung disease	400 (0.4%)	372 (0.9%)	48 (0.2%)	5 (0.3%)	825 (0.5%)
Asthma	1422 (1.4%)	569 (1.3%)	274 (1.4%)	16 (0.8%)	2281 (1.4%)
COPD	846 (0.9%)	362 (0.8%)	159 (0.8%)	10 (0.5%)	1377 (0.8%)
Difficult airway	749 (0.8%)	351 (0.8%)	70 (0.3%)	2 (0.1%)	1172 (0.7%)
Respiratory failure	385 (0.4%)	393 (0.9%)	140 (0.7%)	1 (0.1%)	919 (0.6%)
• Cardiovascular					
Hypertension	13674 (13.8%)	3346 (7.7%)	1807 (9.2%)	114 (6.0%)	18941 (11.6%)
CHF	624 (0.6%)	139 (0.3%)	57 (0.3%)	5 (0.3%)	825 (0.5%)
Congenital	1974 (2.0%)	56 (0.1%)	13 (0.1%)	2 (0.1%)	2045 (1.2%)
Shock impending shock	645 (0.7%)	659 (1.5%)	257 (1.3%)	10 (0.5%)	1571 (1.0%)
Vascular disease	823 (0.8%)	70 (0.2%)	19 (0.1%)	1 (0.1%)	913 (0.5%)
Ischemia MI	2487 (2.5%)	388 (0.9%)	147 (0.8%)	10 (0.5%)	3032 (1.8%)
Arrhythmias	1513 (1.5%)	1402 (3.2%)	615 (3.1%)	16 (0.8%)	3546 (2.2%)
Valvular heart disease	1828 (1.8%)	131 (0.3%)	38 (0.2%)	2 (0.1%)	1999 (1.2%)
• Neuro-muscular					
Alteration of consciousness	1843 (1.9%)	2261 (5.2%)	391 (2.0%)	4 (0.2%)	4499 (2.7%)
Previous or current CVA TIA	1230 (1.2%)	563 (1.3%)	135 (0.7%)	4 (0.2%)	1932 (1.2%)
Spinal cord injury disease	409 (0.4%)	276 (0.6%)	42 (0.2%)	0 (0.0%)	727 (0.4%)
Peripheral neuropathy myopathy	341 (0.3%)	161 (0.4%)	128 (0.6%)	0 (0.0%)	630 (0.4%)
Increased ICP	2160 (2.1%)	1948 (4.5%)	587 (3.0%)	0 (0.0%)	4695 (2.9%)
Convulsion	452 (0.5%)	117 (0.3%)	94 (0.5%)	7 (0.4%)	670 (0.4%)
Myasthenia gravis	107 (0.1%)	15 (0.0%)	1 (0.8%)	0 (0.0%)	123 (0.1%)

any specific diseases, the specialty has chosen to utilize indicators of quality care such as the presence or absence of adverse outcomes, as reflection of the care provided.

In the planning of this study, there were several research design which we considered. First was voluntary reporting of adverse events as done in the CEPOD study.[8] This has the advantages of cooperation and it is relatively less costly. However, the main problems with this approach are an underreporting bias, missing information due to the retrospective approach of data collection and the limitation in the inclusion of adverse events. As well the viewpoint of the consumer (the patient) cannot be determined through this approach.

The next design considered was that of studying a sample of anesthetics either in each hospital or all anesthetics in each hospital for a limited period of time.[9] Again, this approach had the advantage of being less costly, but had a drawback in the reliability of the data collectors. By the time the data collectors would be fully trained, the time for data collection would have elapsed. The sample size would also be limited, and seasonal variations might be missed.

The third design considered was that of the retrospective approach . All record such as hospital logs, hospital charts, PACU data and anaesthetic records would be searched for adverse events. Once found, the appropriate information could be assessed by a panel of experts to determine the anesthetic

Table 4. Preanesthetic history stratified by types of hospitals (continued)

	Amount of Patients (%)				
	university n=98839	regional n=43126	general n=19536	district n=1902	Total n=163403
• Hematology/Infection					
Anemia	8071 (8.2%)	3297 (7.6%)	1439 (7.4%)	52 (2.7%)	12859 (7.7%)
Coagulopathy	712 (0.7%)	488 (1.1%)	64 (0.3%)	2 (0.1%)	1266 (0.8%)
Hepatitis viral antigen (HBV,HAV,)	626 (0.6%)	63 (0.1%)	71 (0.4%)	1 (0.1%)	761 (0.5%)
Platelets < 100,000	497 (0.5%)	212 (0.5%)	38 (0.2%)	1 (0.1%)	748 (0.5%)
HIV^+	542 (0.5%)	193 (0.4%)	118 (0.6%)	11 (0.6%)	864 (0.5%)
• Endocrine/metabolic					
D M	7634 (7.7%)	2383 (5.5%)	962 (4.9%)	65 (3.4%)	11044 (6.8%)
Electrolyte Acid-Base imbalanced	1502 (1.5%)	1417 (3.3%)	480 (2.5%)	3 (0.2%)	3402 (2.1%)
Hyperthyroid	639 (0.6%)	203 (0.5%)	109 (0.6%)	15 (0.9%)	966 (0.6%)
Hypothyroid	326 (0.3%)	13 (0.0%)	24 (0.1%)	0 (0.0%)	363 (0.2%)
• Current Medication					
Antihypertensive	6564 (6.6%)	815 (1.9%)	458 (2.3%)	50 (2.6%)	7887 (4.8%)
Hypoglycemic drug	3222 (3.2%)	716 (1.7%)	276 (1.4%)	28 (1.5%)	4242 (2.6%)
Bronchodilator	444 (0.4%)	67 (0.2%)	45 (0.2%)	7 (0.4%)	563 (0.3%)
Steroid (ภายใน 1 ปี)	954 (1.0%)	261 (0.6%)	115 (0.6%)	5 (0.3%)	1335 (0.8%)
Anticoagulant (ภายใน 7วัน)	508 (0.5%)	63 (0.1%)	23 (0.1%)	2 (0.1%)	596 (0.4%)
NSAID including aspirin	390 (0.4%)	32 (0.1%)	40 (0.2%)	3 (0.2%)	465 (0.2%)
• Miscellneous					
Sepsis	666 (0.7%)	307 (0.7%)	76 (0.4%)	2 (0.1%)	1051 (0.6%)
Renal impairment	3974 (4.0%)	944 (2.2%)	461 (2.4%)	23 (1.2%)	5402 (3.3%)
Autoimmune disease	217 (0.2%)	22 (0.1%)	5 (0.0%)	2 (0.1%)	246 (0.1%)
Post-cardiac arrest	142 (0.1%)	65 (0.1%)	8 (0.0%)	0 (0.0%)	215 (0.1%)
Liver disease (cirrhosis, Abnormal LFT, jaundice)	2161 (2.2%)	710 (1.6%)	207 (1.0%)	5 (0.3%)	3083 (1.9%)
Ascites	267 (0.3%)	122 (0.3%)	19 (0.1%)	0 (0.0%)	408 (0.2%)
Morbid obesity	1012 (1.0%)	571 (1.3%)	290 (1.5%)	33 (1.7%)	1906 (1.7%)
Pregnancy	5042 (5.1%)	2583 (5.9%)	1811 (9.3%)	233 (12.2%)	9669 (5.9%)
• Smoking	6069 (6.1%)	3512 (8.1%)	2375 (12.1%)	218 (11.5%)	12174 (7.5%)
• Alcohol	2704 (2.7%)	1457 (3.4%)	1270 (6.5%)	124 (6.5%)	5555 (3.4%)

contribution. This method had the advantage of being relatively inexpensive. However, the disadvantages of the approach are bias in underreporting, missing information, small sample size and limited inclusion of events. Moreover, the participation of the attending staff would be limited, and may lead to noncooperation.

After considering various potential designs, we opted for occurrence screening where virtually all cases were followed up.[10,11] The advantages of occurrence screening are less problems with bias in reporting or case finding, and less problem with missing data. Many different outcomes can be considered including minor outcomes. Nevertheless, we encountered various barriers during the execution of this research. The first concerned was the design of structured data collection form (form 1) which was accomplished after months of consultation and meeting among principal investigators from several institutes. We tried to design the form to meet the requirements of both the investigator and attending anesthesiologists as well as nurse anesthetists; we were successful in

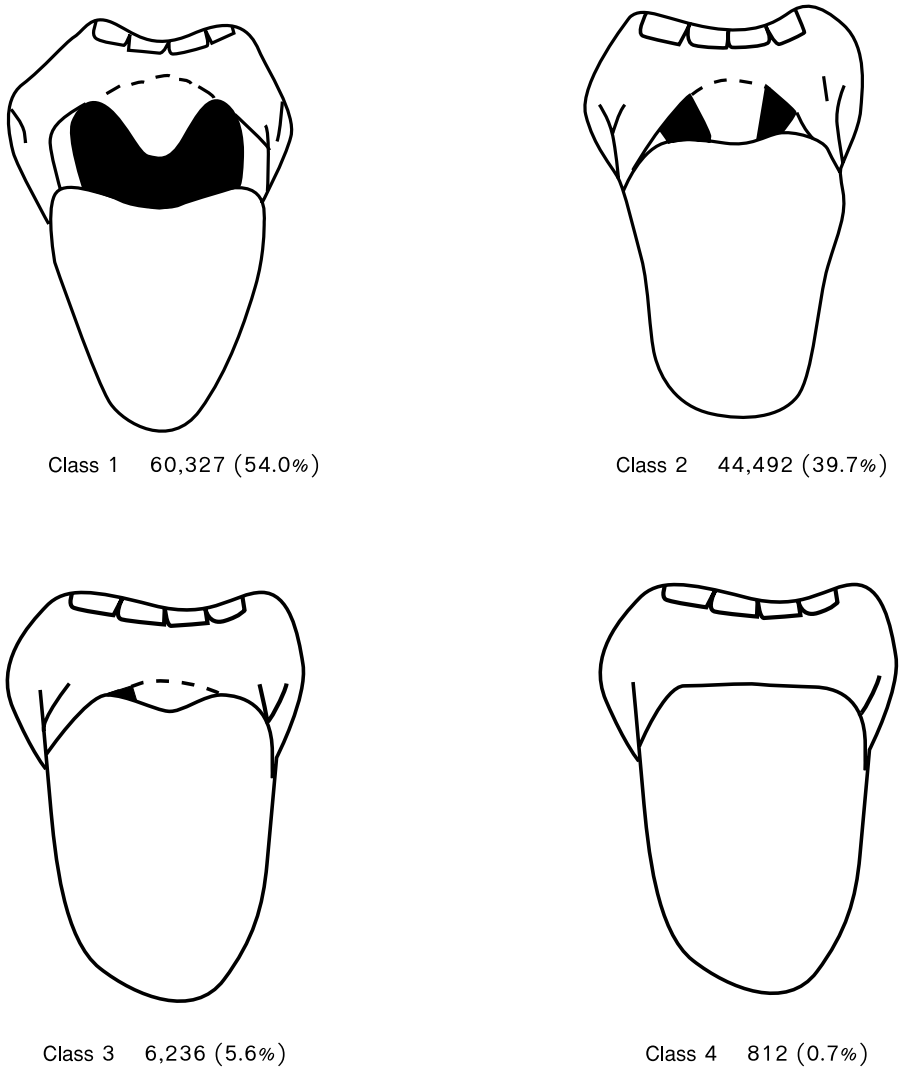


Fig 2. Mallampati classification of total 111,870 cases

having all hospital use exactly the same form. For details of adverse outcomes, we also used event specific data collection form (form 2) in all 20 hospitals. The next problem concerned compliance and reliability of anesthesia personnel. There were also other concerns such as possible medico-legal problems and difficulties with definitions. Therefore we organized workshop and internal audits in all sites and form 1 was piloted by staff of 6 university hospitals before it was employed at all sites.

According to geographic distribution all sites comprised of university hospitals, tritiary or regional hospitals, general or provincial hospitals and district hospitals across the country. This can represent anesthesia practice in the whole country. Proportion of cases anesthetized in university hospital was 60% because the first group of investigators was researchers from university hospitals and attending anesthesiologists from the ministry of public health were invited to join the study thereafter. For demographic characteristics, the mean (SD) of age, weight and height of cases represent data of Thai population. There were some missing data of some variables in form 1 particularly on height of the patients. These might be due to noncompliance of attending personnel or there were some situation that we could not obtain data such as emergency situation. The explanation of more proportion of extreme age patients in university and regional

Table 5. Mallampati classification of patients

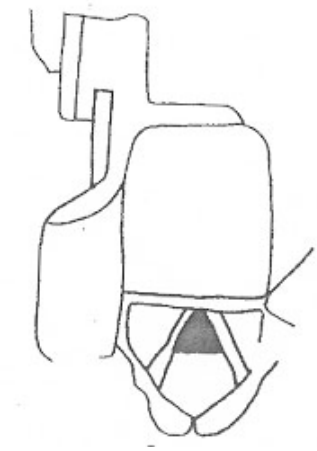
Type of hospitals	no Mallampati check (n=47888)		Mallampati classification (n=111870)				Total
	cannot evaluate	no evaluation	1	2	3	4	
university n=98839	4423 (4.5%)	16015 (16.2%)	38148 [50.9%]	32003 [42.7%]	4172 [5.6%]	565 [0.8%]	74888 (100%)
regional n=43126	3092 (7.2%)	14707 (34.1%)	17182 [68.2%]	6953 [27.6%]	914 [3.6%]	144 [0.6%]	25193 (100%)
general n=19536	743 (3.8%)	8690 (44.5%)	4298 [43.0%]	4587 [45.9%]	1028 [10.3%]	85 [0.8%]	9998 (100%)
district n=1902	27 (1.4%)	81 (4.3%)	699 [39.0%]	949 [53.0%]	125 [7.0%]	18 [1.0%]	1791 (100%)
Total	8285 (5.1%)	39493 (24.7%)	60327 [54.0%]	44942 [39.7%]	6239 [5.6%]	812 [0.7%]	111870 (100%)

hospitals was that these hospitals were set up as referral centers. Therefore, these hospitals should provide special or specific services in both equipment and personnel such as anesthesiologists who had experience in pediatric anesthesia. The possible reasons of high proportion of the female gender were:1) there are more women in Thailand[12] 2) there are more female specific operation such as gynecological surgery and cesarean section ; and 3) in Thailand, women have longer life expectation.[12]

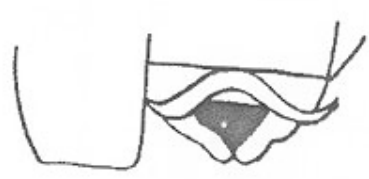
There were statistically significant differences in percentages of patients with different American Society of Anesthesiologists Physical Status or ASA PS ($p<0.001$) District hospitals had less severe ASA PS because of the fact that more severe patients were transferred to higher level hospitals in the ministry of public health s referral system due to lack of personnel and equipments. The problem of shortage of anesthesiologists and maldistribution of anesthesiologists still exists in Thailand. Despite there are more than 600 board qualified anesthesiogists in 2005, half of them are practising in the capital and big cities in each region of Thailand. There are several general or provincial hospitals with no board certified anesthesiologists which need some policy or strategy to cope with this problem. About half of patients in ministry of public health s hospital; regional hospitals, general hospitals and district hospitals, were anesthetized in emergency situation. Therefore, emergency anesthesia and surgery setting should be set up in these hospitals. About three quarters of the patients in university hospitals (Table 2) were anesthetized under elective schedule. This might be due to super-tirtiary condition of university hospitals with had less space for emergency services.

For sites of operations and/or procedure, the top five most common sites were extremities (22.0%), lower abdomen including kidney/ureter (7.0%), cesarean-section (10.0%), upper abdomen (7.0%) and perineal-anal (6.0%). There were 6923 patients (5.0%) with intracranial operation under anesthesia which was the sixth most common sites of operation. This should be considered as important issue because this group of operations was conducted in many hospitals which lacked of neurosurgeons and/or anesthesiologists[12]. Policy-maker should improved this critical situation by increasing the number of neurosurgeons and anesthesiologists and improved curriculum concerning anesthesia for neurosurgery in both residency training and nurse anesthetists training programs. The service of anesthesia in remote area or outside operating rooms has been increasing especially in university hospitals. This may also happen in regional or some general hospitals of the ministry of public health in future.

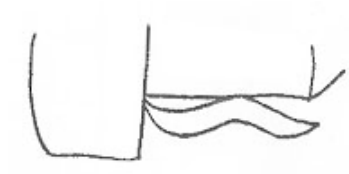
The anesthesia services were provided during official times for 71.9% anesthetics and classified to be 95% of the in-paitents and only 5% of the out-patients. This was considered to be less proportion of the out-patients. Anesthesia for ambulatory surgery has



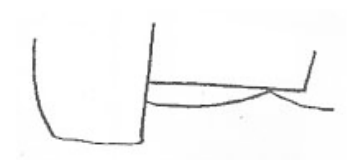
Grade 1 60,629 (81.0%)



Grade 2 11,576 (15.5%)



Grade 3 2,238 (3.0%)



Grade 4 445 (0.5%)

Figure 3. Laryngoscopic view of total 74,888 cases

potential to increase and become more important because of economic constrain.[13]

Only 38.0% of the anesthesia personnels performed preanesthetic visit at the hospital ward or emergency room. This was quite low and should be an agenda for quality improvement especialy in the ministry of public health s hospitals. Half of the patients were considered healthy which corresponded to ASA physical status classification of patients in this study. There were 7.5% and 3.4% of the patients who had history of cigarrette smoking and alcoholic ingestion respectively. The three most common preanesthetic abnormalities detected by preanesthetic evaluation were hypertension (11.6%), anemia (7.7%) and diabetes melitus (6.8%) respectively. This should be considered to construct clinical practice guidelines by the Royal College of Anesthesiologists of Thailand.

It has been accepted that difficult or failed intubation is one of the most common causes of morbidity related to anesthesia.[14, 15] Preoperative identification of those surgical patients who were at risk of difficult intubation still remains a significant task for anesthesia personnels. If these patient could be identified in advance, an anesthetic plan for induction of anesthesia and intubation could be made, the necessary personnel and equipment assembled, and the patient s state optimized for the choice of intubation procedures. Alternately, consideration can be given to local or regional anesthetic techniques in order to avoid manipulation of the airway. In this study there were 47,888 of 159,758 (29.9%) patients who were not evaluated by mean of Mallampati classification of which 8,285 (5.1%) patients who could not be evaluated due to any reasons and 39,493 (24.7%) patients who were not evaluated despite possible conditions. A larger proportions of patients who were not evaluated for Mallampati score were in regional hospitals (34.1%) and general or provincial hospital (44.5%) with may be due to high work load of anesthesia personnels, few or no MD anesthesiologists and higher proportion of emergency surgery. These percentages of patients with Mallampati score 1, 2, 3 and 4 (54.0%, 39.7%, 5.6% and 0.7% respectively) were the results of largest ever preanesthetic survey in Thailand. The percentage of preanesthetic airway evaluation by mean of morphometric measurement of thyromental distance was quite low (29.3%). Laryngoscopic views of Thai patients receiving intubation for anesthesia of 1, 2, 3 and 4 were 81.0%, 15.5%, 3.0% and 0.5% respectively. According to the Mallampati score modified by Samsoon and Young[16], the percentage of patients with score 3 and 4 with possible difficulty in laryngoscopy (6.3%) was similar to studies of Savva[17] (n=350) and Freck[18] (n=244) but this was lower than studies of Butler and Dhara[19] (n=220) and higher than study of Oates[20]. In this study preanesthetic airway evaluation should be encouraged and be considered to be one of anesthesia quality indices in the country.

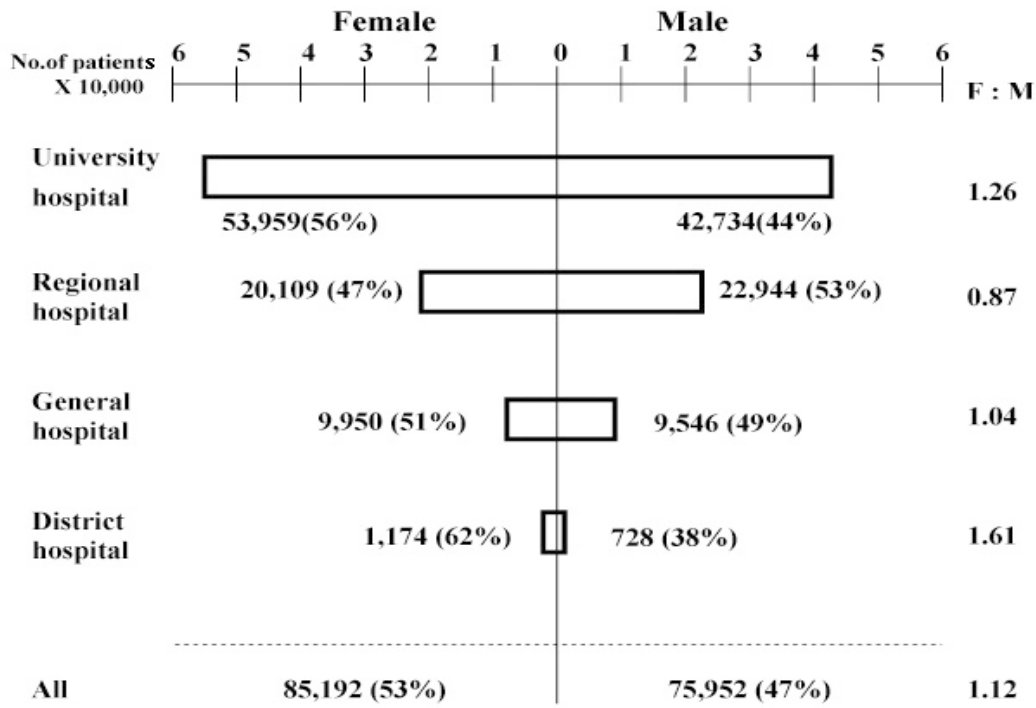


Fig 4. The number of female and male patients stratified by types of hospitals

Conclusion

We have accomplished the first ever parallel occurrence screening of anesthesia adverse outcomes in 20 hospitals in Thailand. The first phase consisted of 163,403 consecutive anesthetics during a one-year period representing country data. More female patients were anesthetised. More extreme aged patients and elective setting were operated in university and tirtiary hospitals. Outpatients or ambulatory surgery shared only 5% with potential to increase popularity ASA physical status was routinely used in all hospitals while half of patients were assessed to be healthy. Preanesthetic visit and preoperative airway evaluation were done in low percentages which should be changed for quality improvement.

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This research was accomplished by personal sacrifices and perpetual inspiration of attending anesthesiologists together with all personnel and by guidance of head of departments of all sites in this multicentered study. The Royal College of Anesthesiologists of Thailand and the THAI Study group wish to express deep gratitude to project advisors Professor Chitr Sitthi-Amorn and Associate Professor Joranit Kaewkungwal for their exceptionally wise, encourage criticism and advices. We also wish to thank Professor Pyatat Tatsanavivat, head of Clinical Research Collaborative Network (CRCN) for this continued support, encouragement and helpful suggestions.

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References

1. Cohen MM, Duncan DG. Pastoperative follow-up and quality of care. Seminars in Anesthesia 1988 ; 7 : 270-7.

2. Saklad M. Grading of patients for surgical procedures. Anesthesiology 1941 ; 2 : 281-5.
3. Mallampati SR, Gatt SP, Gugino LD, Waraksa B, Freiberger D, Liu PL. A clinical sign to predict difficult tracheal intubation : a prospective study. Can Anaesth Soc J 1985;32:429-34.
4. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. Anaesthesia 1984;39:1105-11.
5. Holland R. Anaesthetic mortality in New South Wales. Br J Anaesth 1987 ; 59 : 834-41.
6. Lohr KN. Outcome measurement : concepts and questions. Inquiry 1988 ; 25 : 37-50.
7. Brook RH, Lohr KN. Efficacy, effectiveness, variations and quality. Med Care 1985 ; 23 : 710-22.
8. Buck N, Devlin HB, Lunn JN. The report of a confidential enquiry into perioperative deaths. London : The Nuffield Provincial Hospital Trust. 1987.
9. Tiret L, Desmonts JM, Hatton F, Vourch h G. Complications associated with anaesthesia, a prospective study in France. Can Anaesth Soc J 1986 ; 33 : 336-44.
10. Cohen MM, Duncan PG, Tweed WA, Biehl D, Pope WDB, Perry M. The Canadian four-centre study of anaesthetic outcomes : I Description of methods and populations. Can J Anaesth 1992 ; 39 : 420-9.
11. Cohen MM, Duncan PG, Pope WDB, Biehl D, Tweed WA, William LM. The Canadian four-centre study of anaesthetic outcomes : II Can outcomes be used to assess the quality of anaesthesia care? Can J Anaesth. 1992 May ; 39 : 430-9.
12. Thailand : hospitals and public health statistics 2000-2001. Bangkok : Alpha Research, 2000 : 279-92.
13. Paul FW. Ambulatory anesthesia advances into the new millennium. Anesth Analg 2000;90:1234-5.
14. Wilson ME, Spiegelhalter D, Robertson JA, Lesser P. Predicting difficult intubation. Br J Anaesth 1988 ; 61 : 211-6.
15. Caplan RA, Posner KL, Ward RJ, Cheney FW. Adverse respiratory events in anesthesia : a closed claims analysis. Anesthesiology 1990 ; 72 : 828-33.
16. Samsoon GLT, Young JRB. Difficult tracheal intubation : a retrospective study. Anaesthesia 1987 ; 42 : 487-90.
17. Savva D. Prediction of difficult tracheal intubation. Br J Anaesth 1994 ; 73 : 149-53.
18. Freck CM. Predicting difficult intubation. Anaesthesia 1991 ; 46 : 1005-8.
19. Butler PJ, Dhara SS. Prediction of difficult laryngoscopy : an assessment of thyromental distance and Mallampati predictive tests. Anaesth Intens Care 1992 ; 20 : 139-142.
20. Oates JDL, Macleod AD, Oates PD, Dearsall FJ, Howie JC, Murray GD. Comparison of two methods for predicting difficult intubation. Br J Anaesth 1991 ; 66 : 305-9.

การศึกษาอุบัติการณ์เกิดภาวะแทรกซ้อนทางวิสัญญีในประเทศไทย (THAI Study) : I วิธีการศึกษาและลักษณะประชากร

สมรัตน์ จารุลักษณานันท์, สุวรรณี สุรเศรณีวงศ์, ยอดยิ่ง ปัญจสวัสดิ์วงศ์, วรรณา สมบูรณ์วิบูลย์, ธนา นิพิธสุขการฐิติมา, เทพกร สาธิตการมณี, มยุรี วศินานุกร, เทวารักษ์ วีระวัฒกานนท์, สุรศักดิ์ ถนัดศีลธรรม, วรินี เล็กประเสริฐ, ธนู หินทอง

ที่มาและเหตุผล: *งานบริการวิสัญญีแตกต่างจากเวชกรรมสาขาอื่น เนื่องจากเป็นวิชาชีพเวชกรรมส่วนสนับสนุน ไม่มีกระบวนการรักษาโรคเฉพาะของสาขาวิสัญญี ราชวิทยาลัยวิสัญญีแพทย์แห่งประเทศไทย จึงได้ริเริ่มโครงการศึกษาอุบัติการณ์เกิดภาวะแทรกซ้อนทางวิสัญญีในประเทศไทย (THAI Study) ขึ้น เพื่อศึกษาปัจจัยเกี่ยวข้อง*

วัสดุและวิธีการ: *เป็นการศึกษาแบบพรรณนาชนิดไปข้างหน้าแบบคัดกรองอุบัติการณ์ในผู้ป่วยทุกรายที่ได้ยาระงับความรู้สึกในโรงพยาบาล 20 แห่ง (โรงพยาบาลมหาวิทยาลัย 7 แห่ง, โรงพยาบาลตติยภูมิ 5 แห่ง, โรงพยาบาลทั่วไป 4 แห่ง และโรงพยาบาลชุมชน 4 แห่ง) จากทุกภูมิภาคของประเทศไทย ทำการกรอกข้อมูลที่เกี่ยวกับผู้ป่วย ข้อมูลทางศัลยกรรม และข้อมูลทางวิสัญญีและภาวะแทรกซ้อนที่เกิดขึ้นระหว่างผ่าตัด จนถึงหลังผ่าตัด 24 ชั่วโมงในแบบฟอร์มมาตรฐาน ในกรณีที่เกิดภาวะแทรกซ้อนบางประการจะทำการเก็บข้อมูลในแบบฟอร์มเฉพาะเรื่อง ที่หน่วยจัดการข้อมูลด้วยวิธีการกรอกข้อมูล 2 ครั้ง และใช้สถิติสำหรับข้อมูลแบบพรรณนาสำหรับการศึกษาในขั้นต้น*

ผลการศึกษา: *ในระยะ 12 เดือนแรกของการศึกษาเก็บข้อมูลผู้ป่วยที่ได้ยาระงับความรู้สึกทั้งหมด 163,403 ราย ค่าเฉลี่ย (ส่วนเบี่ยงเบนมาตรฐาน) ของอายุ น้ำหนัก ส่วนสูงของผู้ป่วยเท่ากับ 38.6(2.3) ปี, 53.9 (17.7) กก. และ 153.4 (22.7) ซม. ตามลำดับ มีผู้ป่วยหญิง (52.9%) มากกว่าชาย (47.1%) ซึ่งเมื่อจำแนกตามคำจำกัดความของสมาคมวิสัญญีแพทย์แห่งสหรัฐอเมริกา ระดับ 1, 2, 3, 4 และ 5 เท่ากับ 50.8%, 36.3%, 10.7%, 2.0% และ 0.2% ตามลำดับ ความผิดปกติจากการประเมินก่อนให้ยาระงับความรู้สึก 3 อันดับแรก ได้แก่ ความดันเลือดสูง (11.6%) ภาวะซีด (7.7%) และเบาหวาน (6.8%) ผลการประเมินทางเดินหายใจแบบ Mallampati ในผู้ป่วย 111,870 ราย เป็นระดับ 1, 2, 3 และ 4 เท่ากับ 54.0%, 39.7%, 5.6% และ 0.7% ในขณะที่ผลการส่องดูกล่องเสียงจำแนกเป็นระดับ 1, 2, 3 และ 4 เท่ากับ 81.0%, 15.5%, 3.0% และ 0.5% ของผู้ป่วยที่ถูกส่อง 74,888 รายตามลำดับ*

สรุป: *ผลการศึกษาภาวะแทรกซ้อนทางวิสัญญีในประเทศไทย (THAI Study) ระยะต้นปีสามารถเป็นตัวแทนประชากรที่ได้รับยาระงับความรู้สึก และผ่าตัดในประเทศไทย ข้อมูลที่ได้สามารถใช้เป็นฐานสำหรับการพัฒนาคุณภาพบริการ การสร้างแนวทางเวชปฏิบัติ การปรับปรุงการฝึกอบรม และทำการศึกษาวิจัยต่อไป*