A Multi-Center Thai University-Based Surgical Intensive Care Units Study (THAI-SICU Study): Methodology and ICU Characteristics

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Objective: *Although there were two large intra-operative observational studies on Thai surgical patients (THAI and THAI-AIMS), there has been no available study on critically ill surgical patients regarding their adverse events and outcomes. A THAI-Surgical Intensive Care Unit (SICU) study has been established for monitoring the occurrence of these adverse events and outcomes in the SICU. The objective of this report is to describe the methodology of the THAI-SICU study and participating SICUs' characteristics as well as the early recruitment results on patients enrolled in the present study.*

Material and Method: *The present study is designed as a multi-center, prospective, observational study. This report describes the method of case record form development and summarizes their collected parameters as well as the adverse event surveillance variables. All of nine SICU characteristics are described regarding their management systems, physicians' and nurses' work patterns. The final group of enrolled patients is reported.*

Results: *A total of nine university-based SICUs were included in the present study. All participating hospitals are residency training centers. Four of the SICUs, fulltime directors are anesthesiologists. Only one hospital's SICU is directed by a surgeon. Two SICUs were closed ICUs, three were mandatory consulting units, one was an elective consultation unit and the remaining three ICUs had no directors. Most of the participating SICUs had heterogeneity of surgical specialty patients. Six SICUs had regular resident rotations and only two of the SICUs had critical care fellowship training. There were significant differences regarding the nursing workload among the ICUs. The patient to registered nurse ratio ranged from 0.9-2.0. After a total of 19.7 months of a recruitment period, the total number of patient admissions was 6,548 (1,894 patients were excluded). A total cohort of 4,654 patients was included for further analytical processes.*

Conclusion: *There were differences in ICU management systems, physician and specialist coverage, nurse burdens, nurse sparing, and types of patients admitted in the university based SICUs. This presentation is the pioneer multi-center study on Thai SICUs in which adverse events and outcomes are reported.*

Keywords: *Surgical ICUs, Adverse events, Outcomes, ICU characteristic, Nurse*

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Surgical patients have three critical periods in their treatment and care. These are the pre-operative, intra-operative and post-operative periods. All of these are independent and correlate with each other to impact the patients' surgical outcomes. In regards to the intra-operative period as noted in Thai data; two large, multicenter, observational studies have been completed and published (THAI and THAI-AIMS study)[1,2]. Both cohort studies focus primarily on the intra-operative predictors of the outcome occurrences for all surgeries regardless of the severity of the disease. The surgical intensive care unit (SICU) is a specialized unit which receives critically ill, surgical patients. This includes both the pre- and post-operative periods as well as the other patients deemed critically ill. With these unique characteristics of concern, the admitted SICU patients are selected by indications which mainly focus on their illness, their close monitoring needs, organ support requirements or intra-operative complications. However, there are no data available on these specialized surgical patients here in Thailand. The differences between the THAI-SICU study and the recent intra-operative studies (THAI and THAI-AIMS) are demonstrated in Fig. 1. The main objectives of the THAI-SICU are to describe the overall outcomes and the incidence of adverse events (preventable and unpreventable) in university based SICUs. However, determination of outcomes is dependent on many factors which involve the physicians' and nurses' experience, the ICU management system and the units' working burdens[3,6]. Therefore, the objective of this report is to describe the flow of the THAI-SICU study, the surveillance of adverse event parameters, and its methods. This study also defines SICU characteristics in each of the participating ICUs.

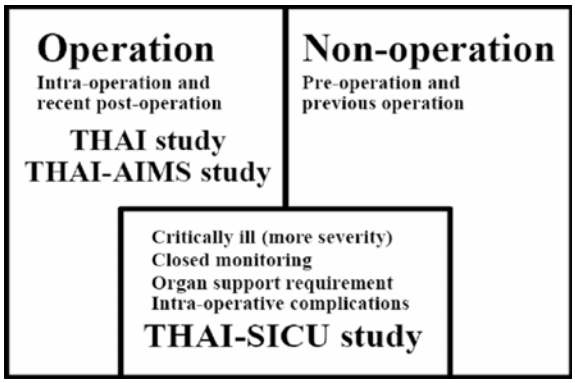

Fig. 1 Population included in large observation multi-center studies of Thai surgical patients.

Material and Method

The present study was designed as multi-center, prospective, observational study. Nine university-based surgical ICUs are included in this study. This article focuses on the ICUs' characteristics, working patterns of physicians and trainees as well as the researches methodology.

Definition of ICU working pattern

The intensivists' role is categorized into 4 groups: 1) "No" is defined as without intensivist coverage, 2) "Elective consultation" is defined as intensivists are consulted for the patients' ICU care and the intensivist provides opinions regarding some patients when the attending physician consults them, 3) "Mandatory consultation" is defined as the intensivist routinely schedules rounds on all ICU patients but does not participate in the role of attending physician, and 4) "Closed ICU" is defined as almost all intra-units of ICU care management are dependent on the intensivist. This includes patient selection, ICU care, treatment options and assuming the role of co-attending physician.

Nurse burden in this ICU is defined as the patient to bedside nurse ratio (PNR). The workloads of nurses are separated into two values depending on the type of nurse: registered nurses (RN) and practical nurses (PN). One was calculated solely from RNs and the other was estimated from summations of RNs and PNs. Higher PNR represents higher burdens of nursing care.

Nurse sparing capacity is calculated by the division of the number of total RNs by the number of total beds in the ICU. Higher values mean a higher sparing capacity of RNs in the ICU.

Nurse specialties were separated into two groups: 1) Critical care nurses (CCN) had post-graduate critical care nurse training which is, usually, a four-month course in Thailand and have received a certificate provided by the nursing faculty and 2) Advance practice nurses (APN) have completed a master's degree or higher in the field of nursing and have received certification from the Nursing Council of Thailand.

Case record form development

University-based hospitals from every region of Thailand were invited for the development of case record forms during the period of June, 2010 to March, 2011. At the conclusion, patient data were divided into three main phases; on admission, at discharge and all

daily recording data. On admission, the admission case record form (CRF) and nutritional CRF were used. During the ICU stay, daily CRFs were recorded. In these periods, the surveillance of 18 adverse events was observed (Table 2). Some events were investigated for details of the causes and whether or not these events involved health care personal. These events are recorded in the specially divided forms which include 13 adverse events; drug errors, unplanned extubation, re-intubation within 72 hours, pneumohemothorax, strokes, seizures with myoclonus, upper gastro-intestinal bleeding, intra-abdominal hypertension, infections or sepsis, acute kidney injury, myocardial infarction and delirium (Table 2). Definitions for each adverse event are defined in Table 2. The patients were followed until they were discharged from the ICU or up to 28 days of their ICU admission. Upon discharge from the ICU, the data was recorded on the ICU discharge form. These patients were followed-up to 28 days following discharge from the ICU if they survived. Recording parameters of the main CRF are summarized in Table 3. Detailing of all data record forms and the data record manual can be obtained at the website: http://thaisicu.crcthailand.com/index.php.

Study flow, selection of patients, data management and statistical analysis planning

All patients in this study have provided standard, informed consent. Research proposal and all CRF are approved by the Thailand Joint Research Ethics Committees (JREC) as well as each institution's Ethics Committee (EC) or Institutional Review Board (IRB) prior to the collection of any data. The Clinical Trials.gov identification number is NCT01354197.

All admitted patients with ages greater than 18 years of age in the ICUs during the recruitment period are included in the present study. Patients who may not benefit from an ICU admission were excluded. These include moribund patients, patients with previous cardiopulmonary resuscitation from elsewhere in the hospital or in the field without return of spontaneous circulation and the patient who had an ICU length of stay of less than six hours. The main outcomes of this study were all causes 28 day mortality, morbidity and incidences of adverse events of interest during this period. Secondary outcomes were the number of ventilator days, ICU and hospital lengths of stay. The expectations for enrolled patients in this study were 4,000-5,000 patients with an expectation of 15,000 to 20,000 ICU days.

The present study's quality control and data monitoring were established and performed by external surveyors; two from independent study sites and one from the Medical Research Network of the Consortium of Thai Medical Schools (MedResNet). Once data had been recorded by physicians, nurses or research assistants, the completed data were rechecked by trained research assistants, ICU attending physicians or fellows. The re-checked data were processed by an online medical research tool program, OMERET. All online data was clarified by the Central Data Monitoring Unit both were in Chulalongkorn University and MedResNet. Unclear data were sent to the study site for further confirmation and illumination.

Regarding analysis planning, the statistical program used in this study is STATA, version 11.0 (STATA Inc., College Station, TX). Descriptive data are reported as percentages in categorized data and mean $\pm$ standard deviation (SD) or median and interquartile range (IQR) for continuous data with parametric or non-parametric distribution. Univariable analysis is used for detecting the differences between the groups using a t-test, the Mann-Whitney U test, ANOVA or Kruskal-Wallis test for continuous variables at its distribution. The Chi-square or Fisher exact probability test is utilized for categorical data. Relationships between the predictor and outcome variables are analyzed by regression analysis with univariable or multivariable controls. Mixed model is used for repeated measurement variables and cluster analysis. Statistically significant differences are defined as $p<0.05$.

Results

Following a formal invitation in 2010, nine universities' surgical ICUs participated in this study. These were: [Siriraj (SI), Ramathibodi (RA), King Chulalongkorn (CU), Phramongkutklao (PMK), Vajira (BMU), Sirinthorn Medical Center (SWU), Maharaj Nakorn Chiang Mai (CMU), Srinagarind (KKU) and Prince of Songkhla (PSU)]. Table 1 demonstrates the ICUs' management characteristics, patient types, primary roles of ICU attending physicians and their specialties, intensivists' positions, trainee rotations, nurse burdens, and the proportion of specialties offered. All participating hospitals are residency training centers. Only SI, CU and PMK had a Critical Care Fellowship Training program during the recruitment period. All participating hospitals were considered large (>800 beds) or very large (>1,000 beds) with the exception of SWU. The capacity of each of the ICUs by bed count is between five and fourteen. This is

Table 1. Surgical ICUs included in this study

Hospital (University, Province)	Hospital size (ICU beds)[1]	Patient types	Specialty (n)[3] [Intensivist(%)][4]	Intensivist role [Work: Holliday: Cover][6]	Trainee rotation [Continuity: Day: Night (specialty)][7]	Nurse burden D:E:N[8] A. RN (PNR)[9] B. RN+PN (PNR)[10]	Nurse sparing and characters A. RN in unit (per bed)[11] B. Specialist (%) CCN:APN
1. Siriraj (SI) (MU, Bangkok)	2,221 (14)	Surgical	Anesthesiologist (6) [6 (100)]	Closed ICU [8:2:24]	Resident [All:6:2(A)] Fellow [All:1:1]	A. 1.0:1.4:1.4 B. 1.0:1.2:1.2	A. 51 (3.6) B. 27(52.9):0(0)
2. Ramathibodi (RA) (MU, Bangkok)	900 (8)	Surgical-Trauma[2]	Anesthesiologist (5) [4 (80)]	Mandatory consult [8:2:24]	Resident [All:2-3:1 (A)]	A. 1.0:1.0:1.14 B. 0.9:0.9:1.0	A. 30 (3.8) B. 12 (28.6):2 (4.8)
3. King Chulalongkorn (CU, Bangkok)	1,450 (8)	Surgical-Trauma	Anesthesiologist (6) [6 (100)]	Mandatory consult [8:2:24]	Resident [All:4:1(A)] Fellow [Some:1:0-1]	A. 0.9:0.9:0.9 B. 0.6:0.6:0.7	A. 36 (4.5) B. 1 (2.7):1 (2.7)
4. Phramongkutklao (PMK) (MU, Bangkok)	1,200 (8)	Surgical-Cardiac-Neuro[12]	Anesthesiologist (3) [3 (100)]	Mandatory consult [8:2:24]	Resident [All:3:1 (A,S)] Fellow [Some:1:0-1]	A. 1.3:1.6:1.6 B. 0.9:1.0:1.0	A. 16 (2.0) B. 7 (43.8):0 (0)
5. Vajira (BMU, Bangkok)	1,000 (7)	Surgical-Trauma	No[5]	Elective consult	Resident [Some:1:0(S)]	A. 1.0:1.4:1.4 B. 1.0:1.0:1.14	A. 19 (2.7) B. 4 (21.1):0 (0)
6. HRH (SWU, Nakhon Nayok)	320 (5)	Surgical-Trauma-Cardiac-Neuro [12]	No[5]	No	No	A. 1.3:1.3:1.3 B. 1.0:1.0:1.0	A. 10 (2.0) B. 2 (20.0):0 (0)
7. Maharaj Nakorn Chiang Mai (CMU, Chiang Mai)	1,400 (14)	Surgical-Trauma	Surgeon (1) [1 (100)]	Closed ICU [8:0-2:24]	Resident [All:2-4:1(S,EM,O)]	A. 2.0:2.0:2.0 B. 1.4:1.4:1.4	A. 32 (2.3) B. 7 (21.1):3 (9.4)
8. Srinagarind (KKU, Khon Kaen)	970 (8)	Surgical-Trauma--Cardiac-Neuro[12]	No[5]	No	Resident [All:1:0(S)]	A. 1.3:1.3:1.3 B. 1.0:1.0:1.0	A. 20 (2.5) B. 16 (80.0):5 (25.0)
9. Prince of Songkhla (PSU, Songkhla)	853 (10)	Surgical-Trauma-Cardiac-Neuro[12]	Anesthesiologist (15) [0 (0)]	No	Resident [Some:1:1(A,S)]	A. 1.1:1.0:1.1 B. 0.9:0.9:1.0	A. 42 (4.2) B. 12 (28.6):2 (4.8)

[1] ICU beds included in this study; [2] mixed ICU but medical patients were excluded; [3] specialty primary responsibility round in all cases in ICU (Number of physicians); [4] number of intensivist in primary responsibility physician; [5] no intensivist coverage each patient treatment depended on owner surgeon; [6] number of hours which intensivist standby in ICU or hospital: standby in ICU or hospital in holiday: number of hours of intensivist could be consulted; [7] continuity of all year rotation (All = all year rotation, Some = some month rotation depended on number of resident each year): number of resident in day time: number of resident in night time (Specialty of rotated resident); [8] nurse burden which was defined as number of patient per one bedside nurse on day shift: evening shift: night shift; [9] registered nurses were counted only; [10] registered nurses and practical nurses were counted; [11] total number RN in unit (ratio of total number of nurse per bed = total RN/total bed); [12] cardiac and neurosurgical patients were excluded.

A = anesthesiology resident; APN = advance practice nurse; BMU = Bangkok Metropolis University; Cardiac = cardiac surgical patients; CCN = critical care nurse certificate; CMU = Chiang Mai University; CU = Chulalongkorn University; E = emergency medical resident; KKU = Khon Kaen University; MU = Mahidol University; Neuro = neurosurgical patients; O = orthopedic resident; RA = Ramathibodi Hospital; RN = registered nurse; PMK = Phramongkutklao Hospital; PN = practical nurse; PNR = patient to bedside nurse ratio; PSU = Prince of Songkha University; S = surgical resident; SI = Siriraj Hospital; HRH = HRH Princess Maha Chakri Sirindhorn Medical Center; SWU = Srinakharinwirot University

Table 2. Daily adverse events observed in this study

Adverse or unplanned events	Definitions	Detailing form
Drug error	Error regarding type of drug, route, form, label and concentration	Yes
Unplanned extubation	Accidental or self during ICU stay	Yes
Re-intubation within 72 hours	Intubation after extubation within 72 hours in both ICU and ward	Yes
Pneumohemothorax	All causes of pneumohemothorax from every intervention in ICU such as central line insertion, mechanical ventilator setting	Yes
Pulmonary aspiration	Aspiration of gastrointestinal content into respiratory system including both witnessed and suspicious clinical symptoms	No
Stroke	New diagnosis of cerebrovascular accident occurring in ICU (infarction and hemorrhage)	Yes
Seizure or myoclonus	Abnormal and involuntary movement caused by seizure (clinical and electroencephalographic diagnosis) or muscular contractions or inhibitions	Yes
Upper gastrointestinal hemorrhage in ICU	Including both coffee ground contents or endoscopic diagnosis	Yes
Intra-abdominal hypertension	Intra-abdominal pressure $\geq$12 mmHg measured by standard method	Yes
Symptomatic deep venous thrombosis (DVT)	Thrombosis of leg vein (proximal or distal vein), diagnosis confirmed by ultrasound or imaging	No
Acute lung injury (ALI) and acute respiratory distress syndrome (ARDS)	Bilateral infiltration on CXR and no evidence of left atrial hypertension by clinical signs or PCWP $\leq$18 mmHg (ALI: PaO_2/FiO_2 $\leq$300 and ARDS:PaO_2/FiO_2 $\leq$200)	No
ICU acquired infection	Infection (clinically suspected given antibiotics or positive culture from sterile site)	Yes[1]
Sepsis	Together with both systemic inflammatory response syndrome and infection with/without organ failure or unstable hemodynamic	Yes[1]
Acute kidney injury	Using creatinine criteria by increasing of creatinine level more than 0.3 g/dL from baseline	Yes
Cardiac arrest	All sudden cardiac arrest or sudden cardiac death that occurred in ICU	Yes
Myocardial infarction	At least two of the following criteria: 1) Positive troponin-T, 2) Ischemic symptoms >20 min, 3) ECG alterations	Yes
New arrhythmia	Including atrial fibrillation, atrial flutter, multifocal atrial tachycardia, ventricular tachycardia, ventricular fibrillation, Torsad de pointes, atrioventricular block and sinus arrest	No
Delirium	At least four of the following criteria: 1) Consciousness alteration, 2) Inattention, 3) Disorientation, 4) Hallucination-delusion-psychosis, 5) Psychomotor agitation or retardation, 6) Inappropriate speech or mood, 7) Symptom fluctuation	Yes

[1] use the same detailing form

CXR = chest x-ray; PCWP = pulmonary capillary wedge pressure; PaO_2 = arterial oxygen partial pressure; FiO_2 = inspiratory oxygen fraction

dependent on the hospital's size. Almost all SICUs received both surgical and trauma patients except the participating ICUs in SI and PMK hospitals. Four full time intensivists in the participating ICUs were anesthesiologists with the exception being, CMU hospital. Three participating ICUs in this study do not have a primary physician (BMU, SWU and KKU; Table 1). An intensivist was not available in three of the participating ICUs (SWU, KKU and PSU as seen in Table 1). In the ICUs with an available intensivist, two ICUs are closed ICUs (SI and CMU), three ICUs have mandatory consultation (SI, RA and PMK) and one

ICU has elective consultation (BMU). All participating ICUs have a trainee rotation program with the exception of SWU. Of these, only two ICUs (BMU and PSU) do not have a regular annual rotation. Resident specialties in the ICUs were in anesthesia, surgery, emergency medicine and orthopedics. The emergency medicine and orthopedic residents are found only in CMU. An on call night resident was not available in three ICUs (BMU, SWU and KKU) and one ICU has a night resident but not on a regular basis (PSU).

Regarding nurse workload, the ranges of RNs and RNs + PNs were at 0.9-2.0 and 0.6-1.4, respectively. Both RNs and PNs are of highest numbers at CMU and have the lowest numbers at CU. Night shift has a tendency towards a higher PNR than the morning or evening shifts. Nurse sparing capacity is 2.0-4.5 per bed and is at the lowest values at PMK and SWU and the highest values are at CU. The percentage of CCN was 2.7%-80% in ranges which were the lowest in PMK and the highest in KKU. An APN was available in five ICUs (RA, PMK, CMU, KKU and PSU) which was 2.7-25% in ranges. Of these, there was the highest in KKU and the lowest in CU.

Following a 19.7 month recruitment period (April 2011 to January 2012), the total number of patients admitted in all of the ICUs was 6,548 patients. A total of 1,896 patients were excluded. The study flow and exclusions are demonstrated in Fig. 2. A final total cohort of 4,652 patients was included in the analytical process. Details of the beginning and the end of recruitment, the duration and number of patients in each ICU are demonstrated in Table 4. Recruitment time

Table 3. Collecting parameters of case record form (CRF)

Form	Summarized parameters
Admission CRF	1) Demographic data, 2) Hospital admission detail, 3) Underlying disease(s) and drug(s) usage, 4) Basic investigation including blood test, ECG, CXR, 5) Smoking history, 6) ICU admission detail, 7) Post-operative detail, 8) Diagnosis including principle and co-morbidity, 9) Severity of diseases
Nutrition CRF[1]	1) Body weight and height, 2) Intake history, 3) Nutritional grading, 4) Disease severity, 5) Intake record up to 28 days
Daily CRF	1) Adverse event surveillance (Table 2), 2) Common drug usage in ICU, 3) Blood and type of fluid intake, 4) Monitoring of all catheter(s) and equipment(s), 5) Anesthetic drug usage: NMBA, sedation, analgesia
Discharge CRF	1) ICU discharge detail, 2) Respiratory detail, 3) Hospital charge (cost), 4) Hospital discharge, 5) 28 days after discharge

[1] only site 1, 2 and 7 in Table 1
ECG = electrocardiography; CRF = case record form; CXR = chest x-ray; NMBA = neuromuscular blocking agent

Table 4. Recruiting patients detail in each site of this cohort

Site[1]	Starting date	End date	Duration[2]	n (%)[3]	Patient day (%)[4]
SI	18thApril 2011	13th November 2012	19	977 (21.0)	3,866 (22.0)
RA	18th April 2011	18th June 2012	14	419 (9.0)	1,103 (6.3)
CU	1st June 2011	31st May 2012	12	592 (12.7)	2,357 (13.4)
PMK	1st August 2011	1st November 2012	15.3	419 (9.0)	951 (5.4)
BMU	1st July 2011	26th June 2012	12	398 (8.6)	1,807 (10.3)
SWU	1st November 2011	30th November 2012	13	145 (3.1)	675 (3.8)
CMU	18th May 2011	25th September 2012	16	801 (17.2)	4,571 (26.0)
KKU	9th September 2011	30th November 2012	15	401 (8.6)	852 (4.8)
PSU	10th July 2011	13th November 2012	16	500 (10.8)	1,377 (7.9)
All	18th April 2011	30th November 2012	19.7	4,652 (100)	17,579 (100)

[1] Recruiting hospital detailing on Table 1; [2] Duration in months; [3] Total patient number (% at all patients); [4] Number of total observed patient day in ICU (% at all ICU days) but a total of 202 patients were admitted and discharged within 1 day and did not be included.

is a 12-19 month period. Of these, SI recruited the highest number of patients (21.0%); however, CMU had the most patient days in the ICU surveillance (26.3%). The relationship between the patient numbers and patient days are shown in Fig. 3. Equivalent proportions of the patient numbers and patient days were found in SI, CU and SWU. Increment trends were found in CMU and BMU. KKU, PMK, RA and PSU had decrement trends in terms of patient days (Fig. 3).

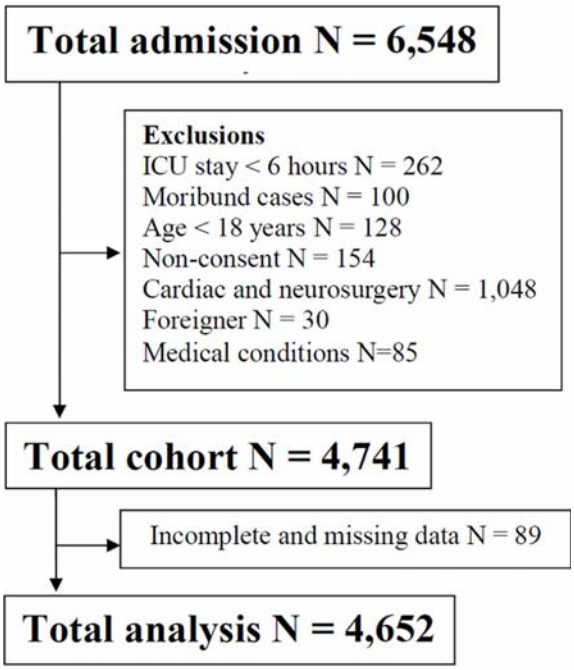

Fig. 2 Study flow.

Discussion

There are many different aspects of ICU characteristics. The types of admitted patients, ICU management systems, physicians' responsibilities, nurse burdens, and providers' specialties are some of the factors. Because of patients' disease heterogeneity in each SICU, particularly in smaller hospitals, this may distort the expected outcomes. Therefore, post-operative elective cardiac and isolated neurosurgical patients were excluded. In addition, some patients were admitted to SICU for a short term and their outcomes are possibly unrelated to the ICUs' care. The previous, general, Thai SICU report had found that there were no outcome alterations for the patients with short stays in the ICU of less than 48 hours[6]. However, the present study was based on a single institution's data and could not be generalized in regards to the different management systems present in Thai SICUs. Therefore, this study excluded the patients who were admitted to ICUs for a very short period (<6 hours).

In a large survey done by the Thai society of critical care medicine (ICU RESOURCE I study), a total of 82.8% of Thai SICUs had had no ICU director or presented with low intensity staffing in an open ICU

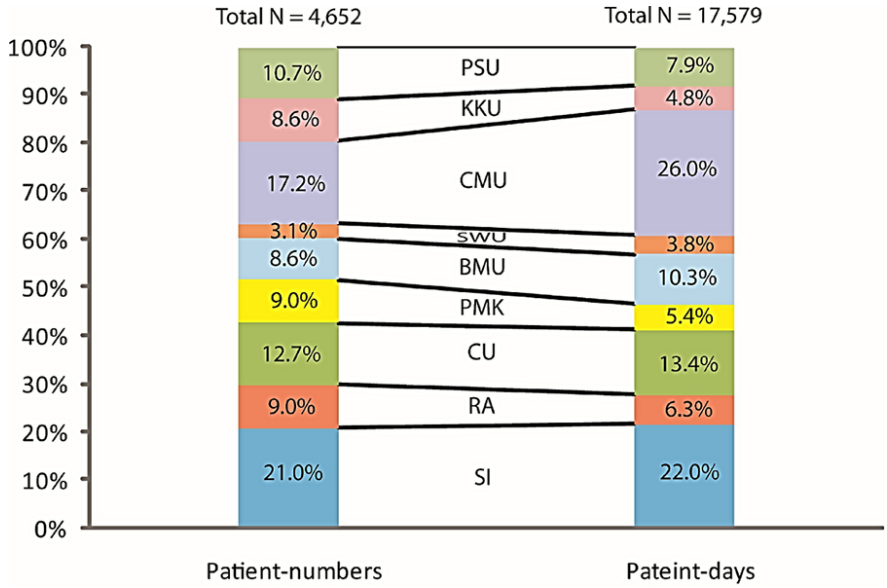

Fig. 3 Relations between proportion of patient numbers and patient day in each enrolled sites (Abbreviation as in Table 1).

management system or elective intensivist consultation. In the present study, these ICU types have been exhibited in four of the ICUs (44.4%) involving about one-third of the recruited patients. Of those with high intensity staffing, two ICUs were closed and three ICUs had mandatory consultation. Two specialties involved in SICU care are anesthesiologists and surgeons. Four ICUs were directed by an anesthesiologist-intensivist, the other was by a surgeon-intensivist. Of these, anesthesiologist-intensivists have played an important role in Thai academic SICUs. Surgeon-intensivists continue to be available only rarely. These proportions are in contrast to critical care services in the United State in which most SICUs are covered by a surgeon-intensivist[7,8]. The rotation of residents in each of the Thai SICUs is different regarding the number of residents in each shift, the type of specialty training, night coverage, and regularity. In addition, there are critical care fellowship rotations only in SI and CU. Although there have been no available data in Thailand regarding the different rotations and SICU outcomes, SICU night call duty could reduce the on call surgical residents' work load and lead to lower levels of fatigue. This may help result in fewer treatment mistakes and fewer clinical decision errors[9,10].

Nurse burden has an impact on critically ill, surgical patients' outcomes. Surgical patients usually need a higher level of care for wounds and the maintenance of tubes and drains when compared to other types of patients. Lower numbers of nurses in relation to the number of patients is associated with worse outcomes for major operative procedures[4,11,12].

The nurse burden can be measured by patient to bedside nurse ratios. A high nurse burden is usually defined as patient to registered nurse (RN) ratio >2:1. This is especially true on the night shift[4,12]. With this cut off point, all participating SICUs have an acceptable nurse workload. The maximum and minimum nurse burdens were noted at CMU and CU respectively. The nurse sparing capacity follows the same direction as its burdens (Table 1). In regards of nurse specialists, the critical care nurse certifications also have varied proportion in the range of 2% (CU) to 80% (KKU). There are no APNs in half of the participating ICUs. Within SICUs with APN available, there is a range of 4.8% (PSU) to 25% (KKU). With these findings, with the exception of university academic based ICUs, the authors can infer that there are no standard references and provider roles for desirable practice in Thai-SICU settings and these can possibly transmit as to different patient outcomes for each of the SICUs.

The strength of this multi-center study is that it is the largest cohort study done on SICU patients. The published reports could be used as reference numbers for Thai-SICUs' incidence rates and can be generalized for Thai academic hospitals. However, there are some inevitable limitations of the present study. First, there are differences in the ICU management characteristics, attending physicians, and nurse staffing patterns. These might confound the causal relationships between predictors and outcomes in each institute. Severity adjustments and cluster analysis could be used in the analysis process. Second, there was a large cohort in Thailand and certain uncommon, adverse events rarely occur. Additionally; certain screening procedures, intra-abdominal monitoring as one example, are not done on every patient who may have an indication for the test. The occurrence of these adverse outcomes is possibly lower than the true instances. Finally, despite using standard screening tools, the diagnosis of delirium might be confounded by the nurses' and health care providers' experiences. However, the results of this multi-center study are pioneer reference outcomes and indicate the major concerns for university-based Thai-SICUs.

Conclusion

There are differences in ICU management systems, physician and specialist coverage, nurse burdens and sparing, and types of patients admitted in university-based SICUs. This presentation is the pioneer, multi-center, prospective cohort for the surveillance of adverse events in Thai-SICUs. Further studies could indicate the priority of the problems and the progression of future developments in these fields.

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Potential conflicts of interest

None.

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การศึกษาสหสถาบันในหออภิบาลผู้ป่วยหนักทางศัลยกรรมของโรงพยาบาลมหาวิทยาลัยในประเทศไทย (THAI-SICU study): ระเบียบวิธีวิจัยและลักษณะของหออภิบาลผู้ป่วยหนัก

กวีศักดิ์ จิตตวัฒนรัตน์, อรอุมา ชัยวัฒน์, สัณฐิติ โมรากุล, ตันหยง พิมานเมฆาภรณ์, ธรรมศักดิ์ ทวิชศรี, เพชร วัชรสินธุ์, ภูษิต เฟื่องฟู, สุนิสา ฉัตรมงคลชาติ, โอสรี อัครบวร, ชมพูนุช ปธนสมิทธิ์, สุจารีย์ ภู่พิพัฒน์ภาพ, ศรินญา จันทะวงศ์, วราภรณ์ เชื้ออิน, ชัยพฤกษ์ กุสุมาพรรณโญ, ผกาพรรณ บุปผา, สมรัตน์ จารุลักษณานันท์, สุณีรัตน์ คงเสรีพงศ์

วัตถุประสงค์: แม้ว่าจะมีการศึกษาแบบสังเกตการณ์ไปข้างหน้าขนาดใหญ่ในผู้ป่วยศัลยกรรม 2 การศึกษาคือ THAI และ THAI-AIMS ก็ตาม แต่ยังไม่มีข้อมูลการศึกษาเกี่ยวกับการศึกษาแบบสหสถาบันในผู้ป่วยหนักทางศัลยกรรม หออภิบาลผู้ป่วยหนักทางศัลยกรรม เป็นหอผู้ป่วยจำเพาะที่รับเฉพาะผู้ป่วยหนักที่มีภาวะศัลยกรรม วัตถุประสงค์ของรายงานนี้เพื่อพรรณนาถึงระเบียบวิธีการวิจัยและลักษณะของหออภิบาลผู้ป่วยหนักที่เข้าร่วมในการศึกษาแบบสหสถาบันนี้

วัสดุและวิธีการ: การศึกษานี้เป็นการศึกษาแบบสหสถาบันไปข้างหน้า รายงานนี้จะบรรยายถึงวิธีในการพัฒนา แบบเก็บข้อมูลและสรุปตัวแปรที่ใช้ในการศึกษาดังกล่าวรวมถึงการเฝ้าติดตามภาวะแทรกซ้อนที่สนใจในช่วงที่ผู้ป่วยอยู่ในระยะติดตาม โดยมีหออภิบาลผู้ป่วยหนักจำนวน 9 แห่งที่เข้าร่วมในการศึกษา โดยรวบรวมข้อมูลรายละเอียดเกี่ยวกับหอผู้ป่วยดังกล่าวทั้งการบริหารการจัดการ ลักษณะการทำงานของแพทย์และพยาบาล และรายงานถึงรายละเอียดเกี่ยวกับการนำผู้ป่วยเข้ามาในการศึกษาดังกล่าว

ผลการศึกษา: หออภิบาลผู้ป่วยหนักของโรงพยาบาลมหาวิทยาลัยจำนวน 9 แห่ง เข้าร่วมในการศึกษาดังกล่าว โรงพยาบาลทุกแห่งเป็นสถาบันฝึกอบรมทางการแพทย์ ส่วนใหญ่แพทย์ที่ดูแลในหออภิบาลเป็นวิสัญญีแพทย์ยกเว้นโรงพยาบาลมหาวิทยาลัยในภาคเหนือของไทยที่มีศัลยแพทย์เป็นคนกำกับหอผู้ป่วย 2 แห่ง บริหารงานแบบปิด 3 แห่ง เป็นแบบปรึกษาทุกราย 1 แห่ง เป็นแบบปรึกษาในบางกรณี และ 3 แห่ง ไม่มีแพทย์ประจำกำกับหอผู้ป่วยเหล่านี้ส่วนใหญ่รับผู้ป่วยทางศัลยกรรมหลายสาขา 6 แห่ง มีแพทย์ประจำบ้านหมุนเวียนปฏิบัติงานเป็นประจำ และ 2 แห่ง เท่านั้นที่มีแพทย์ประจำบ้านต่อยอด หออภิบาลแต่ละแห่งมีความแตกต่างในภาระการดูแลของพยาบาลโดยสัดส่วนของผู้ป่วยต่อพยาบาลวิชาชีพอยู่ในสัดส่วนระหว่าง 0.9-2.0 ภายหลังการเก็บข้อมูลระยะเวลา 19.7 เดือน ผู้ป่วยทั้งหมด 6,548 คน รับเข้ามาในหออภิบาล โดยคัดออกจำนวน 1,894 คน ตามหลักเกณฑ์เหลือผู้ป่วยจำนวน 4,654 คน เพื่อนำเข้าสู่ขั้นตอนในการวิเคราะห์ต่อไป

สรุป: มีความแตกต่างกันของหออภิบาลผู้ป่วยหนักทางศัลยกรรมในประเทศไทย ทั้งในระบบการบริหารแพทย์และผู้เชี่ยวชาญที่เกี่ยวข้อง ภาระงานพยาบาลและชนิดของผู้ป่วยหนักที่เข้ารับการรักษา รายงานฉบับนี้เป็นการศึกษาบุกเบิกแบบสหสถาบันในหออภิบาลผู้ป่วยหนักทางศัลยกรรมในประเทศไทย ภาวะแทรกซ้อน และผลการรักษาจะได้ทำการวิเคราะห์และรายงานต่อไป