Effects of ICU Characters, Human Resources and Workload to Outcome Indicators in Thai ICUs: The Results of ICU-RESOURCE I Study

Kaweesak Chittawatanarat MD, PhD*[1], Dusit Sataworn MD*[2],
Chaweewan Thongchai RN*[3], Thai Society of Critical Care Medicine Study group*[4]

*[1] *Department Of Surgery, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand*
*[2] *Division of Pediatrics Critical Care, Department of Pediatrics, Phramongkutklao Hospital, Bangkok, Thailand*
*[3] *Department of Adult Nursing, Faculty of Nursing, Chiang Mai University, Chiang Mai, Thailand*
*[4] *The Thai Society of Critical Care Medicine, Bangkok, Thailand*

Objective: *There was a lack of available data regarding intensive care unit (ICU) characteristics, human resources, workload, and ICU outcomes in Thai ICUs. Therefore, the objectives of the present study were to describe these parameters and to demonstrate the association of these predictors to ICU outcome indicators including crude mortality, ventilator days and ICU length of stay (ICU-LOS).*

Material and Method: *Retrospective survey to 155 participated ICUs across Thailand. ICUs characters, physician and nurse staffing, patient density and ICU outcomes indicator at the year 2011 of monthly mortality, ventilator days and ICU length of stay were recorded. Multilevel mixed effect linear regression was used for cluster analysis. Statistical difference was defined as p-value <0.05.*

Results: *The 132 ICUs (85.16%) were identified as open ICU or low physician staffing. The ICUs were directed or consulted by intensivists or critical care physicians in 53 ICUs and nearly half of them were located in ICUs at academic hospitals. The median value of average daily nurse to patient ratio (NPR) was 0.5 (Inter-quartile range, IQR 0.23). The median crude mortality was 13.92% (IQR 10.16). Median ventilator days and ICU-LOS were 5.31 (IQR 4.42) and 5.8 (IQR 3.0), respectively. A multilevel mixed model demonstrated crude mortality benefit in groups of closed ICU management or high physician staffing, academic ICUs, regular multidisciplinary round, ICU physician staffing availability and low patient density. Although the NPR did not demonstrate any benefit in crude mortality, a lower NPR (higher number of nurse staff) was associated with lower ventilator days.*

Conclusion: *Thai ICUs showed differences in administration systems. The outcome indicators of crude mortality, ventilator days and ICU-LOS were impacted by the ICU characteristics, human resources and ICU workload (Thai Clinical Trial Registry: TCTR-201200005).*

Keywords: *Intensivist, Critical care physician, Nurse to patient ratio, Closed ICU, Crude mortality, ICU resources*

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The critical care subspecialties have grown for more than three decades in developed countries[1,2]. In Thailand, fully official critical care subspecialty training began in the year 2000 and slowly developed. Therefore, there are few intensivists or critical care physicians available in the majority of Thai hospitals. Although the benefit of a closed intensive care unit (ICU) management system in a Thai tertiary general surgical ICU has demonstrated a lower mortality and length of ICU stay especially in patients who stayed in ICU greater than 48 hours[3], the overall outcomes of ICU characteristics, human resources and burden have not been evaluated thoroughly. Therefore, the objectives of the present study were to describe the ICU characteristics, human resources and burden of Thai ICUs as well as to demonstrate the association of these parameters to ICU outcomes indicators of crude mortality, ventilator days and ICU length of stay (ICU-LOS).

Correspondence to:
Chittawatanarat K, Division of Surgical Critical Care and Trauma, Department of Surgery, Faculty of Medicine, Chiang Mai University, Chiang Mai 50200, Thailand.
Phone: 053-945-533, Fax: 053-946-139
E-mail: kchittaw@gmail.com

Material and Method

The present study design was retrospective.

The data were extracted from unit records or hospital databases in each participating ICU. Data collection variables of RESOURCE I study were developed by the Thai Society of Critical Care Medicine (TSCCM) research subcommittee from January to April 2012. The study protocol was registered with the Thai Clinical Trial Registry (www.clinicaltrials.in.th, (TCTR-201200005). Based on the available ICU hospital lists from TSCCM and the Critical Care Nursing course of Chiang Mai University alumni, the directors of ICU either physicians or nurses were invited to participate in the present study. The data collection forms were sent to a total of 350 ICU directors in 210 hospitals over the country. These forms were divided into four major parts including ICU characteristics and management system, human resources availability, monitoring equipment and ICU outcome indicators. ICU characteristic data included hospital types, bed sparing capacity, patient density, ICU specialties, and management system of the ICU. Both physician and nursing resources were recorded. The ICU outcome indicators were monthly crude mortality rate in ICU in the year 2011, the average ventilator days and ICU length of stay (ICU-LOS). Although the severity of illness evaluated by different systems was important for ICU outcomes comparison, these data were not routinely recorded in the Thai ICUs and therefore not available for analysis. Cluster analysis with hospital types divided by Thai health care system was used as an individual cluster during the analysis process for compensation of disease severity. The present study was approved by the Ethics Committee, Faculty of Medicine, Chiang Mai University.

Definition terms in the study

Thai hospitals are mainly categorized into two groups, government and private. The majority of the hospitals in Thailand are government hospitals which subdivide into public and academic hospitals. Public hospital levels are further classified by the number of beds according to the Thai heath ministry criteria into general public hospitals and regional public hospitals. Public general hospitals consist of 200 to 500 beds, while regional hospitals are equipped with over 500 beds. The academic hospital is defined as the hospital which has both undergraduate and postgraduate training programs. All of the academic hospitals in Thailand are supported by the government.

Bed sparing capacity means the adding ability of ICU beds which is greater than an official bed. Patient density is calculated from the total number of patients divided by the official bed number and was reported in percentages. ICU specialties were classified into four groups; medical, surgical, mixed and pediatric ICUs. The adult ICUs mainly provide care for the patient older than 18 years. General medical ICU, respiratory care unit and cardiac care unit were included in medical ICUs. Peri-operative care in all specialties of general surgical, cardiovascular and thoracic and neurosurgical care unit were categorized as surgical ICUs except pediatric surgical care which was included in pediatric ICUs. Mixed ICUs provided service to both surgical and medical patients.

There were various definitions of ICU physician staffing[4] and there is a very small number of intensivists who are certified by the Board of Critical Care in Thailand. Therefore, the present study defined the closed ICU or units with high physician staffing pattern based on physician staffing responsibility with three criteria: (1) the presence of attending staff who takes primary responsibility to all of the treatments of ICU patients, (2) bed managing system primary depends on ICU staff, and (3) primary decisions in critical care problems are mainly provided by the ICU staff. The ICU management system, which does not include all of the above criteria, elective critical care consultation (the intensivist is involved in the care of the patient only when the attending physician requests a consultation) and no critical care physician, are categorized as open or with a low physician staffing pattern. The definition of multidisciplinary round in the present study was different from the previous literature[5]. It was defined as either multi-specialties scheduling round in ICUs or well organized multidisciplinary daily team rounds which were in addition to routine rounds by the primary physician. Specialty consultations case by case without routine scheduling were not included. Regular rounds were defined as regularly scheduled rounds of all patients in ICUs. Occasionally rounds were considered to be without a routine schedule but ICUs rounds were organized during some special events.

Nurse to patient ratio (NPR) was calculated by the official number of nurses on each rotation divided by the number of patient beds[6]. The NPR was recorded separately at the nurse rotation time every 8 hours. The final NPR in the present study was calculated from the average of NPR in each shift.

Data acquisition and statistical analysis

All data were processed by the online medical research tools program (OMERET: Clinical research collaboration network, Medical Research Foundation, Bangkok, Thailand). Data verification was performed by two research assistants and final correction was re-examined by the clinical research collaboration network staff. ICU directors were directly contacted for unclear data during the verification processes. Data were analyzed by STATA software (version 11.0, STATA Inc., College Station, TX). All continuous variables were tested for normal distribution with visual inspection of histogram and reported as mean ± SD if it had normal distribution or median (25-75 inter-quartile range [IQR]) for non-parametric distribution. Group differences of several samples were calculated using ANOVA for normal distributed continuous variables, Kruskal-Wallis equality of populations rank test for non-parametric continuous variables and Pearson's Chi-square for categorical variables. Multilevel mixed effect linear regression was used as an exploratory model to demonstrate effects between predictive variables (ICU characters, human resources and burden) and ICU outcome indicators (monthly crude mortality, ventilator days and length of ICU stay). Two nested levels were used for hypothesis testing. Random effect models were determined in the level of hospital types and ICU types based on previous mentioned of background knowledge of different relationships in each cluster level. Covariance structure for each random effect equation was hypothesized as independent covariance matrix assumption. Differences were considered to be statistically significant when $p<0.05$.

Results

At the end of August 2012, data were completely derived from 155 ICUs (44.2% of 350 ICUs) in 87 hospitals (41.4% of 210 hospitals) in 42 provinces (55.2% of 76 provinces) across all regions of Thailand. Fig. 1 demonstrated distribution of recruited hospitals divided by regions and hospital types. More than 40 ICUs in each region participated in this study except on the south and west region. Nearly 90% of participating ICUs were from government-based, adult hospitals. The overall participating adult ICUs were nearly equal in proportion regarding ICU types including surgical, medical or mixed ICUs but most regional and academic hospitals demonstrated lower number of mixed ICU types and contrary direction in general and private hospitals (Table 1). The number of ICUs beds in Thai government hospitals was significantly lower than in private hospitals (Median/IQR: 8/2 vs. 12/9; p = 0.046) (Table 1). Of these, more than half of them have a capacity to add extra ICUs beds (spare bed availability) with median/IQR of 2/1 beds and a maximum of six beds in this survey. The average patient density in government ICUs were nearly 90% while private ICUs were only about 50% (Table 1). Most ICUs in Thailand were categorized as open management system while almost half of academic hospitals had closed management system (44%). There were significant statistical differences among groups of hospital types ($p<0.001$, Table 1). Regular multidisciplinary rounds were organized in one third of academics ICUs, nearly 10% in private hospitals and less than 5% in the others.

From January to December 2011, a total of 104,046 admissions were reported from participating ICUs. Of these the overall reported crude mortality of Thai ICUs was 13.92 (IQR 10.16). The crude mortality of general and regional ICUs were 15-20% in range and less than 10% in academic ICUs and lowest in private ICUs with less than 5% (Table 2). Monthly reported crude mortality were statistically different between the hospital type with p-value <0.001 (Table 2). The median (IQR) of ventilator days and ICU LOS were 5.30 (4.41) and 5.80 (3.0), respectively. Both the ventilator days and ICU LOS were significantly different among all types of hospital groups.

The association between ICU characteristics, human resources and burden and ICU outcome indicators were explored with two level mixed models of hospital types and ICU specialties (Table 3). For ICU characteristics and management system, we found that a closed ICU management, academic hospital based

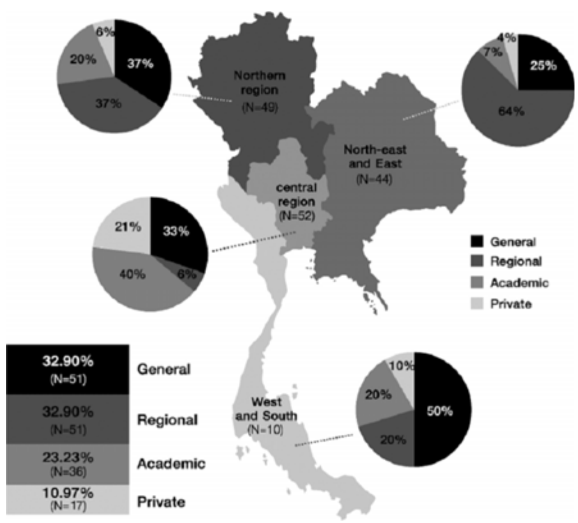

Fig. 1 Demonstrate the distribution of participated ICUs divided by regions and hospital types.

Table 1. ICU characters, human resources and management system divided by hospital types

ICU characters	All (n = 155)	General (n = 51)	Regional (n = 51)	Academic (n = 36)	Private (n = 17)	p-value
Bed, bed sparing and density						
Bed per unit [median (iqr)]	8 (2)	8 (2)	8 (2)	8 (2)	12 (9)	0.05
Bed sparing availability unit (%)	55 (35.48)	15 (29.41)	24 (47.06)	9 (25.00)	7 (41.19)	0.12
Number of sparing bed [median (iqr/min-max)]	2 (1/1-6)	1 (1/1-6)	2 (1/1-5)	1 (1/1-5)	2 (0/1-2)	0.37
Patient density [median (iqr)]	90.25 (13.97)	86.40 (29.98)	95.0 (8.54)	89.28 (9.66)	48 (38.42)	0.25
ICU specialty (%)						
Medical ICU	42 (27.10)	8 (15.69)	19 (37.25)	15 (41.67)	0 (0.00)	0.07
Surgical ICU	44 (28.39)	4 (7.84)	20 (39.22)	18 (50.00)	2 (11.76)	<0.01
Mixed ICU	55 (35.48)	36 (70.59)	3 (5.88)	1 (2.78)	15 (88.23)	<0.01
Pediatrics ICU	14 (9.03)	3 (5.88)	9 (17.65)	2 (5.56)	0 (0.00)	0.06
ICU management system (%)						
Opened ICU or low physician staffing	132 (85.16)	51 (100.00)	45 (88.24)	20 (55.56)	16 (94.12)	<0.01
Closed ICU or high physician staffing	23 (14.84)	0 (0.00)	6 (11.76)	16 (44.44)	1 (5.88)	<0.01
Multidisciplinary round (%)						
Regular	17 (11.97)	2 (3.92)	2 (3.92)	11 (30.56)	2 (12.50)	<0.01
Occasionally	70 (45.16)	18 (35.29)	34 (66.67)	12 (33.33)	6 (37.50)	<0.01
Never	68 (43.87)	31 (60.78)	15 (29.41)	13 (36.11)	9 (52.94)	<0.01
Frequency per week [median (iqr)]	1.00 (1.50)	0.50 (1.00)	1.00 (0.00)	1.00 (4.00)	1.75 (1.50)	0.57
ICU physician staffing						
Yes	118 (76.13)	32 (62.75)	37 (72.55)	35 (97.22)	14 (82.35)	<0.01
No	37 (23.87)	19 (37.25)	14 (27.45)	1 (2.78)	3 (17.65)	<0.01
Physician specialist						
Critical care	53 (34.19)	5 (9.80)	17 (33.33)	24 (66.67)	7 (41.18)	<0.01
Medicine	76 (49.03)	38 (74.51)	15 (29.41)	9 (25.00)	14 (82.35)	<0.01
Anesthesiologist	36 (23.22)	23 (45.10)	2 (3.92)	2 (5.55)	9 (52.94)	<0.01
Surgeons	60 (38.71)	29 (56.86)	11 (21.56)	9 (25.00)	11 (64.71)	<0.01
Pediatrics	37 (23.87)	20 (39.22)	9 (17.65)	3 (8.33)	5 (29.41)	<0.01
Nurse to patient ratio (median/iqr)						
Morning rotation (8.00 am-16.00 pm)	0.50 (0.17)	0.50 (0.00)	0.50 (0.00)	0.75 (0.50)	0.50 (0.33)	<0.01
Evening rotation (16.00 pm-24.00 pm)	0.50 (0.10)	0.50 (0.10)	0.50 (0.17)	0.67 (0.39)	0.50 (0.17)	<0.01
Night rotation (0.00 am-8.00 am)	0.50 (0.13)	0.50 (0.10)	0.50 (0.17)	0.67 (0.38)	0.38 (0.17)	<0.01
Average	0.50 (0.23)	0.50 (0.08)	0.50 (0.11)	0.69 (0.37)	0.46 (0.17)	<0.01

Table 2. ICU outcome indicators at the year 2011

	All	General	Regional	Academic	Private	p-value
Median ventilator days (iqr)	5.305 (4.415)	5.675 (3.985)	6.065 (4.02)	4.680 (4.43)	2.000 (1.71)	<0.01
Median ICU LOS (iqr)	5.8 (3)	6.0 (2)	6.0 (3)	6.0 (3)	2.0 (2)	<0.01
Crude mortality rate at 2011 [Median (iqr)]						
January	11.36 (17.82)	16.36 (13.94)	15.90 (16.37)	7.57 (7.78)	0.06 (5.56)	<0.01
February	12.32 (17.92)	15.83 (13.48)	15.83 (15.03)	5.21 (12.37)	0.22 (7.32)	<0.01
March	11.11 (17.92)	15.15 (20.44)	14.10 (16.39)	5.99 (10.53)	0.54 (7.14)	<0.01
April	13.40 (18.56)	20.05 (12.10)	18.58 (17.76)	6.88 (9.83)	1.48 (3.31)	<0.01
May	13.54 (15.49)	15.62 (15.35)	15.02 (15.96)	9.00 (16.22)	1.33 (6.37)	<0.01
June	13.95 (21.09)	19.76 (16.57)	16.95 (19.45)	5.98 (13.24)	0.96 (4.23)	<0.01
July	13.98 (17.66)	18.08 (15.48)	18.28 (18.80)	8.33 (9.81)	0.67 (5.62)	<0.01
August	12.00 (16.79)	19.38 (13.66)	13.62 (14.46)	6.60 (9.17)	0.14 (3.98)	<0.01
September	13.47 (18.21)	20.76 (17.09)	15.89 (14.12)	5.37 (14.86)	0.77 (6.57)	<0.01
October	15.15 (17.74)	18.35 (14.67)	16.50 (17.81)	7.18 (10.16)	0.04 (4.07)	<0.01
November	12.76 (17.56)	19.72 (16.50)	14.55 (15.84)	4.2 (10.77)	2.02 (6.55)	<0.01
December	11.61 (19.24)	17.65 (19.79)	15.15 (16.12)	5.07 (10.42)	2.85 (3.73)	<0.01
All	13.920 (10.16)	18.060 (8.53)	16.615 (10.68)	7.930 (8.91)	2.440 (5.37)	<0.01

Table 3. ICU characters associated with ICU outcomes

ICU characters	Coefficient (95% confidence interval)					
	Crude mortality	p-value	Ventilator day	p-value	ICU-LOS	p-value
Closed ICU or high physician staffing	-4.13 (-5.700 to -2.570)	<0.01	0.34 (-1.240 to 1.93)	0.67	0.47 (-0.95 to 1.900)	0.52
Academic ICU	-5.55 (-7.080 to -4.030)	<0.01	-0.91(-2.220 to 0.39)	0.17	0.28 (-0.98 to 1.540)	0.66
Regular multidisciplinary round	-2.05 (-3.757 to -0.332)	0.02	-0.38 (-2.110 to 1.35)	0.67	0.94 (-0.73 to 2.600)	0.27
ICU physician staffing	-1.74 (-3.070 to -0.420)	0.01	0.25 (-0.980 to 1.48)	0.69	0.21 (-0.97 to 1.380)	0.73
Nurse to patient ratio	0.26 (-2.400 to 2.920)	0.85	-2.08 (-5.380 to -0.17)	0.04	-0.64 (-3.17 to 1.880)	0.62
Patients density (%)	0.09 (0.070 to 0.110)	<0.01	0.024 (0.000 to 0.05)	0.03	0.03 (0.01 to 0.046)	<0.01

ICU and regular multidisciplinary rounds were the predictors of decreased crude mortality in Thai ICUs (Coefficient [95% confidence interval]: -4.132 [-5.699 to -2.566], p<0.001; -5.553 [-7.076 to -4.032], p<0.001 and -2.045 [-3.757 to -0.332], p = 0.019 respectively (Table 3 and Fig. 2). However; there were no statistical significant differences on ventilator days and ICU-LOS of all these predictors. For human resources, ICU physician staffing availability significantly decrease crude mortality (-1.742 [-3.067 to -0.417], p = 0.010; Table 3 and Fig. 2) but as a predictor was significantly unable to alter ventilator days and ICU-LOS. Although the increment of NPR did not significantly alter crude mortality and ICU-LOS (0.260 [-2.403 to 2.923]; p = 0.848 and -0.643 (-3.172 to 1.884); p = 0.618, respectively; Table 3 and Fig. 3) but the increased NPR significantly decreased the number of ventilator days (-2.08 [-5.377 to -0.166], p = 0.037; Table 3). For ICU burden, the increment of patient density significantly increased the crude mortality, ventilator days as well as ICU-LOS (0.088 [0.067 to 0.10], p<0.001; 0.024 [0.002 to 0.045], p = 0.031; 0.028 [0.009 to 0.0464], p = 0.003, respectively Table 3 and Fig. 3).

Discussion

Caring systems in ICUs are varied based on different definitions and the manpower involved[7]. The most important manpower needed in ICUs are suggested in the best practice model including full time intensivists, critical care nurses, clinical pharmacists and respiratory therapists[7]. However, the last two practitioners are rarely available or are not present in

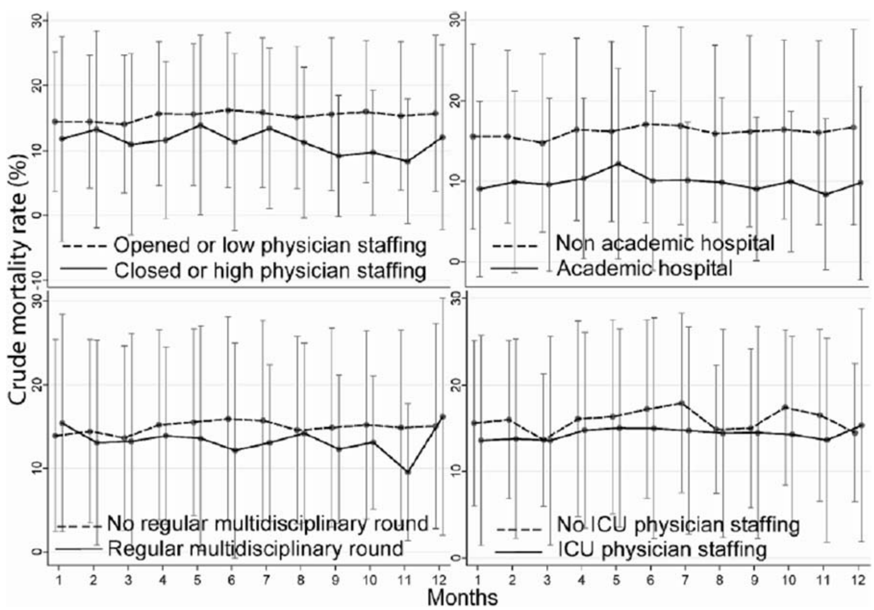

Fig. 2 Association between ICU types, management system and crude mortality rate.

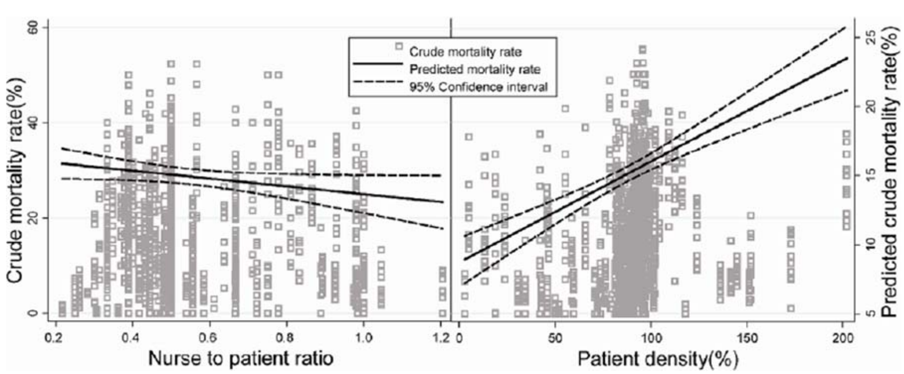

Fig. 3 Association between ICU burden and crude mortality rate.

most of Thai ICUs. Therefore, both physician and nurses play important roles for the ICU caring process as well as outcomes determination in Thailand.

For physician staffing, an intensivist was associated with reduced hospital mortality and specific postoperative medical complications on a large observation study[8]. In addition, ICU physician staffing could save hospital costs ranging from 0.51 to 3.3 million US dollars for 6 to 18 beds ICUs in the financial model of leapfrog standard[9]. However, the critical care physician or intensitivist is a new subspecialty training program in Thailand and less well recognized among hospital executives. Physician staff responsibilities in Thai ICUs depend on the specialty of ICU types. While most medical ICUs in an academic center are covered by an intensivist, pulmologist or cardiologist, the majority of surgical ICUs were directed by surgeons or anesthesiologists. In our survey, nearly half (48.98%) of the critical care physicians have been working in academic hospitals. Closed ICUs or high physician staffing had a better association with crude mortaity resuction (-4.132; 95% CI: -5.699 to -2.566; $p<0.001$) and these associations were also maintained in ICUs under the responsibility of ICU physician staffing (high or low intensity) compared to no staffing (-1.742; 95% CI: -3.067 to -0.417; $p = 0.01$). Our survey also demonstrated that academic centers had lower crude mortality comparing to non-academic centers. These findings might result from the higher number of critical care physicians in academic centers (Table 1) as well as higher medical specialists available in the hospitals. The average mortality of academic centers was highest in May. This might be associated with the transition between the old and the new groups of trainee in the training programs.

For the nurse staffing component, critical care nurses performed the majority of patient assessments, evaluations and bed side care in the ICUs. The best practice model suggested the ratio of bed side nurse to patient is typically 1:2[7]. Studies of higher NPR (>1:2) especially in night shift was associated with a lower risk of several postoperative pulmonary and infectious complications as well as the decrease in resource use in patients undergoing esophageal resection[6]. Furthermore, a cross-section analysis of surgical wards demonstrated that high patient to nurse ratios were associated with a higher risk of 7% both in the adjusted 30 day mortality and the odds of failure to rescue in each additional patient per nurse[10]. In addition, the workload (burden) of each additional patient was associated with a 23% increase in the odds of burnout and a 15% increase in job dissatisfaction[10]. The recent study of Asian hospitals in Taiwan also demonstrated similar results as indicated in the previous studies, the long direct nursing care hours of more than 2.52 hours had lower odds of death (OR 0.589; 95% CI: 0.245-0.617; $p<0.05$)[11]. Although the crude mortality probability of the increase of NPR in the present study was not statistically different with the crude mortality coefficient 0.260 (95% CI: -2.403 to 2.923; $p = 0.848$) there was a trend to decrease in crude mortality on increasing of NPR (Fig. 3). In addition a higher NPR was associated with lower ventilator days in this study.

A multidisciplinary care team is one of the key success factors in ICU caring system. By working toward team care, hospitals may achieve a successful intensivist model and patients may realize the benefits of spending less for healthcare and living longer[12]. In addition, daily rounds by a multidisciplinary team was associated with lower mortality[5]. This effect was also added to high intensity physician staffing and had better effects than low intensify physician staffing[5]. Our results confirmed this observation, regular multidisciplinary round ICUs had a lower crude mortality coefficient -2.045 (95% CI -3.757 to -0.332; $p = 0.019$).

ICU bed provision has large worldwide differences. Lack of ICUs beds can result in delayed admission of patients with either potentially or increasing mortality[13]. On the contrary, an abundance of ICU beds may bring a possibility of increasing harm in the forms of unnecessary costs, poor quality of deaths and iatrogenic complications[13]. The present study demonstrated more than half of ICUs in Thai hospitals could increase the bed availability with a range from one to six beds. However, the percentage of patient density was associated with an increase of crude mortality coefficient 0.088 (95% CI: 0.067-0.108; $p<0.001$). The fewer ventilator days and ICU LOS in this survey could be attributed to the higher mortality.

There were many inevitable limitations in this study. First, the present study was a retrospective survey that collected the end result of crude mortality rates rather than the individual patient outcomes. Therefore, the authors could not calculate the risk or odds ratio to compare with each predictive parameter. Second, distribution of ICUs might not represent all of the ICUs in our country. The unequal proportion of data return was lower in the southern and western part of Thailand. Third, severity of diseases was not recorded in the database and might confound causal relation. Finally, the collected data could not be completely extracted from all participating ICUs due to differences in data recording systems. However, this was the first survey in Thai ICUs and indicated the trend of ICU characteristics, resources and workloads which affected the outcome indicators in Thai ICUs. Additional well designed studies should be performed in the future.

Conclusion

Closed ICU or units with high intensity physician, academic ICUs, ICU physician staffing availability and regular multidisciplinary rounds demonstrated a lower probability of crude mortality rate. Although the increment in nurse to patient ratio was unable to show any significant difference in the ICU crude mortality rate probability, it demonstrated lower ventilator days. High workload or high density ICUs had worse outcomes. The impact of ICU outcomes indicators were modified by ICU characteristics, human resources and burden of ICU.

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Potential conflicts of interest

No author had any conflicts of interest from the present study. The abstract was presented as an oral presentation at 4th International Critical Care Conference in Thailand on 27th-29th June 2013.

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ผลของลักษณะของไอซียูทรัพยากรบุคคลและภาระงานต่อตัวชี้วัดผลการรักษาในไอซียูของไทย: ผลการศึกษาของ ICU-RESOURCE I

กวีศักดิ์ จิตตวัฒนรัตน์, ดุสิต สถาวร, ฉวีวรรณ ธงชัย, กลุ่มวิจัยสมาคมเวชบำบัดวิกฤตแห่งประเทศไทย

วัตถุประสงค์: *เนื่องจากมีหลักฐานเชิงประจักษ์จำกัดเกี่ยวกับลักษณะของไอซียู ทรัพยากรบุคคล ภาระงานของไอซียูและผลของตัวชี้วัดการรักษาในไอซียูในประเทศไทย ดังนั้นวัตถุประสงค์ของการศึกษานี้เพื่อบรรยายสถานการณ์ดังกล่าวของไอซียูในประเทศไทย รวมถึงวิเคราะห์ความสัมพันธ์ของสถานการณ์ดังกล่าวกับผลของตัวชี้วัดการรักษาของไอซียูในประเทศไทย*

วัสดุและวิธีการ: *เป็นการศึกษาโดยการเก็บข้อมูลย้อนหลังใน 155 ไอซียู ที่เข้าร่วมทั่วประเทศไทย บันทึกลักษณะการบริหารจัดการไอซียู แพทย์และพยาบาลของไอซียู รวมถึงจำนวนความหนาแน่นของผู้ป่วยและผลของการรักษา ในไอซียูในปี พ.ศ. 2554 การวิเคราะห์ทางสถิติใช้ multilevel mixed effect linear regression สำหรับการวิเคราะห์แบบกลุ่ม ค่าความแตกต่างอย่างมีนัยสำคัญทางสถิติเมื่อ* $p<0.05$

ผลการศึกษา: *ไอซียูจำนวน 132 แห่ง ได้ระบุว่าเป็นไอซียูที่มีระบบการจัดการแบบเปิดหรือไม่มีแพทย์ประจำไอซียูไอซียูที่มีแพทย์เวชบำบัดวิกฤตดูแลมีทั้งหมดจำนวน 53 ไอซียู และประมาณครึ่งหนึ่งอยู่ในสถาบันที่มีการฝึกอบรมทางการแพทย์ ค่ามัธยฐานของอัตราส่วนพยาบาลต่อผู้ป่วยคือ 0.5 (IQR 0.23) มัธยฐานของอัตราการเสียชีวิตอย่างหยาบคือ ร้อยละ 13.9 (IQR 10.16) จำนวนวันที่ใช้เครื่องช่วยหายใจและระยะเวลานอนในไอซียู คือ 5.31 (IQR 4.42) วัน และ 5.8 (IQR 3.0) วันตามลำดับ การวิเคราะห์แบบ multilevel mixed model พบว่าอัตราการเสียชีวิตอย่างหยาบลดลงในกลุ่มไอซียูที่มีระบบการบริหารแบบปิดหรือมีแพทย์ดูแลอย่างเป็นประจำไอซียู ในสถาบันฝึกอบรมไอซียูที่มีการราวด์แบบสหสาขา ไอซียูที่มีแพทย์รับผิดชอบและไอซียูที่มีอัตราการครองเตียงต่ำ และแม้ว่าการศึกษานี้ไม่พบความแตกต่างของอัตราส่วนของจำนวนพยาบาลต่อจำนวนผู้ป่วยต่ออัตราการตายอย่างหยาบ แต่พบว่าหากมีจำนวนพยาบาลที่เพิ่มมากขึ้น ผู้ป่วยจะมีระยะเวลาของจำนวนวันที่ใช้เครื่องช่วยหายใจลดลง*

สรุป: *ระบบการบริหารจัดการไอซียูในประเทศไทยยังมีความแตกต่างกัน ลักษณะการบริหารจัดการไอซียู ทรัพยากรบุคคลและภาระงานของไอซียูมีผลกระทบต่อตัวชี้วัดของไอซียูโดยวัดจากอัตราการเสียชีวิตอย่างหยาบ จำนวนวันที่ใช้เครื่องช่วยหายใจและจำนวนนอนในไอซียู*