Agreement of Variables Selection and Program Development for Data Collection in Thai Intensive Care Unit by Delphi Method

Kaweesak Chittawatanarat MD, PhD*[1],
Kannika Daungcharone MSc*[2], Onuma Chaiwat MD*[3],
Ratapum Champunot MD*[4], Chairat Permpikul MD*[5]

*[1] *Department of Surgery, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand*
*[2] *College of Arts, Media and Technology, Chiang Mai University, Chiang Mai, Thailand*
*[3] *Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand*
*[4] *Department of Internal Medicine, Buddhachinaraj Hospital, Phitsanulok, Thailand*
*[5] *Department of Internal Medicine, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand*

Objective: *The objective of this study was to determine the data collection variables and program for Thai intensive care units (ICU) as well as to obtain agreement using the modified Delphi method.*
Material and Method: *The variables for program development were modified from the THAI-SICU study case record form. The first open discussion on the prototype was performed in a program development workshop. After revision, the stakeholder agreement was performed by modified Delphi method on the final browser program. All the categorical variable details were scored by a rating scale at five levels. The agreement level was defined as the median score at of least four and the interquartile range (IQR) up to two.*
Results: *During June to September 2015, a total of 20 questionnaires from invited intensive care unit (ICU) expert stakeholders were returned (11 from physicians or surgeons, and 9 from critical care nurses). All of the seven parts of the variable groups, including: 1) patient characteristics, 2) diagnosis, 3) adverse events, 4) detail of operation in surgical cases, 5) ICU intervention, 6) discharge, and 7) summarized report, were agreed upon as the preset criteria (Median $\geq$4 and IQR $\leq$2).*
Conclusion: *The selected variables in seven parts of the variable group via browser system were widely agreed upon from stake holders in Thai ICUs.*

Keywords: *Agreement, ICU program, ICU collection data, Data collection, Delphi method*

J Med Assoc Thai 2016; 99 (Suppl. 6): S63-S68
Full text. e-Journal: *http://www.jmatonline.com*

There are widely routine data registries of intensive care unit (ICU) patients in Western countries. These registries are unavailable in Thai ICUs because there is no variables consensus on the registration form[1,2]. Despite highest consumption of health care resources in ICU, the ineffective administration of ICU resources leads to inevitable waste when compared with treatment outcomes[3]. The data in a registry result in awareness and directing health policies. The objectives of this study were to develop the data collection variables and program as well as to obtain the agreement in using Delphi method.

Correspondence to:
Chittawatanarat K, Department of Surgery, Faculty of Medicine, Chiang Mai University, Chiang Mai 50200, Thailand.
Phone: +66-53-935533, Fax: +66-53-936139
Email: kchittaw@gmail.com

Material and Method

Variable design for program development

The variables for program development were modified from the THAI-SICU study case record form which collected the data from surgical intensive care units during the year 2011-2012[4]. The prototype of variables set was developed by the research committee of the Thai Society of Critical Care Medicine (TSCCM). The prototype program was developed by a Microsoft Access program. The first open discussion on the prototype program was conducted at the program development workshop during the annual meeting of TSCCM during 18th-20th December 2014 (at Centrara Ladplao Hotel, Bangkok, Thailand). The opinions and discussion points from the stakeholders including critical care nurses, physicians, surgeons, and intensivists were obtained from this workshop and these were collected for revision of the program.

Regarding the final consensus, the variables were categorized into seven parts as follows: 1) patient characteristics, 2) diagnosis, 3) adverse events, 4) detail of operation in surgical cases, 5) ICU intervention, 6) discharge, and 7) summarized report (Table 1).

Program development

The collection database program was developed in co-operation with the College of arts, media and technology (CAMT), Chiang Mai University. Because of the limitations of the Microsoft Access program, the working group used an offline browser program for the final program. The browser program could further be developed for a future version. The relationship of variables in the program was demonstrated in Fig. 1. The severity of diseases was automatic calculations after raw data was input into the program. The severity score was comprised of the acute physiologic and chronic health evaluation II score (APACHE II), simplified acute physiology score (SAPS II), The Sequential Organ Failure Assessment Score (SOFA), admission Mortality Probability Models II (MPM II_0), and Search out Severity Score (SOS). The best support care of patients was classified by the Palliative Performance Scale (PPS). Medication errors were defined by the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP).

Agreement of variables and program

The stakeholder agreement was performed utilizing the modified Delphi method[5]. The program variables and detail questionnaires were sent to the stakeholders. All the categorical variable details were scored by a rating scale at five levels: (1 disagree; 2 slightly disagree; 3 neither agree nor disagree; 4 agree; 5 strongly agree). Regarding the power and precision aspect, the number of expert participants should be more than 17[5]. The agreement level was defined as the median score at least 4 and the interquartile range (IQR) up to 2[5]. This study was approved by EthicsCommittee, Faculty of Medicine, Chiang Mai University (Study code: SUR-2557-02408).

Results

A total of 26 questionnaires were sent to the invited stakeholder experts including critical care nurses, physician or surgeons involved in the care of critical patients. During June to September 2015, 20 questionnaires (77%) were returned (11 from physicians or surgeons, and 9 from critical care nurses). The agreement of some important collection and report variables were demonstrated in Table 2.

Regarding the agreement in Table 2, all of the variables were agreed upon as the preset definition. Although all of the variables had a very high level of agreement with a narrow IQR, the PPS, intra-abdominal hypertension (IAH) and reporting of MPM II <30 mortality number/rate were lesser precision than the other variables (IQR = 2 or Median = 4). The reasons for these results from comments in the questionnairesare are indicated below. Regarding the PPS score, some participants mentioned that this score might be appropriate for other types of patients. Most of critically ill patients had higher level of PPS score. The PPS score alone might be misinterpreted and should be integrated with the other clinical data. Regarding the IAH, there were no routine measurements in any admitted patients, so the reporting result might be in error. Regarding the report of MPM II_0 score, the MPM II_0 score was not

Table 1. Collection and report variables

Part	Categories	Details
1.	Patient characters	Identification data, co-morbidities, disease severity, priority model.
2.	Diagnosis	Diagnostic categories and codes
3.	Adverse events	Medication error, unplanned extubation, reintubation within 72 hours, pulmonary embolism, new stroke, intra-abdominal hypertension, cardiac arrest, delirium, iatrogenic pneumothorax, pulmonary aspiration, upper gastrointestinal hemorrhage, symptomatic deep vein thrombosis, acute kidney injury, myocardial infarction, pressure sore, infection
4.	Operation	Type of operation, wound classification, blood loss estimation
5.	Intervention	Endotracheal intubation or tracheostomy, renal replacement therapy (RRT), extracorporeal membrane oxygenation (ECMO), central venous catheterization, urinary catheterization
6.	Discharge	Transfer status, discharge result, simplified severity score
7.	Report	Mortality rate, adverse events rate, ventilator associated pneumonia rate, catheter associated urinary tract infection, length of stay, readmission rate

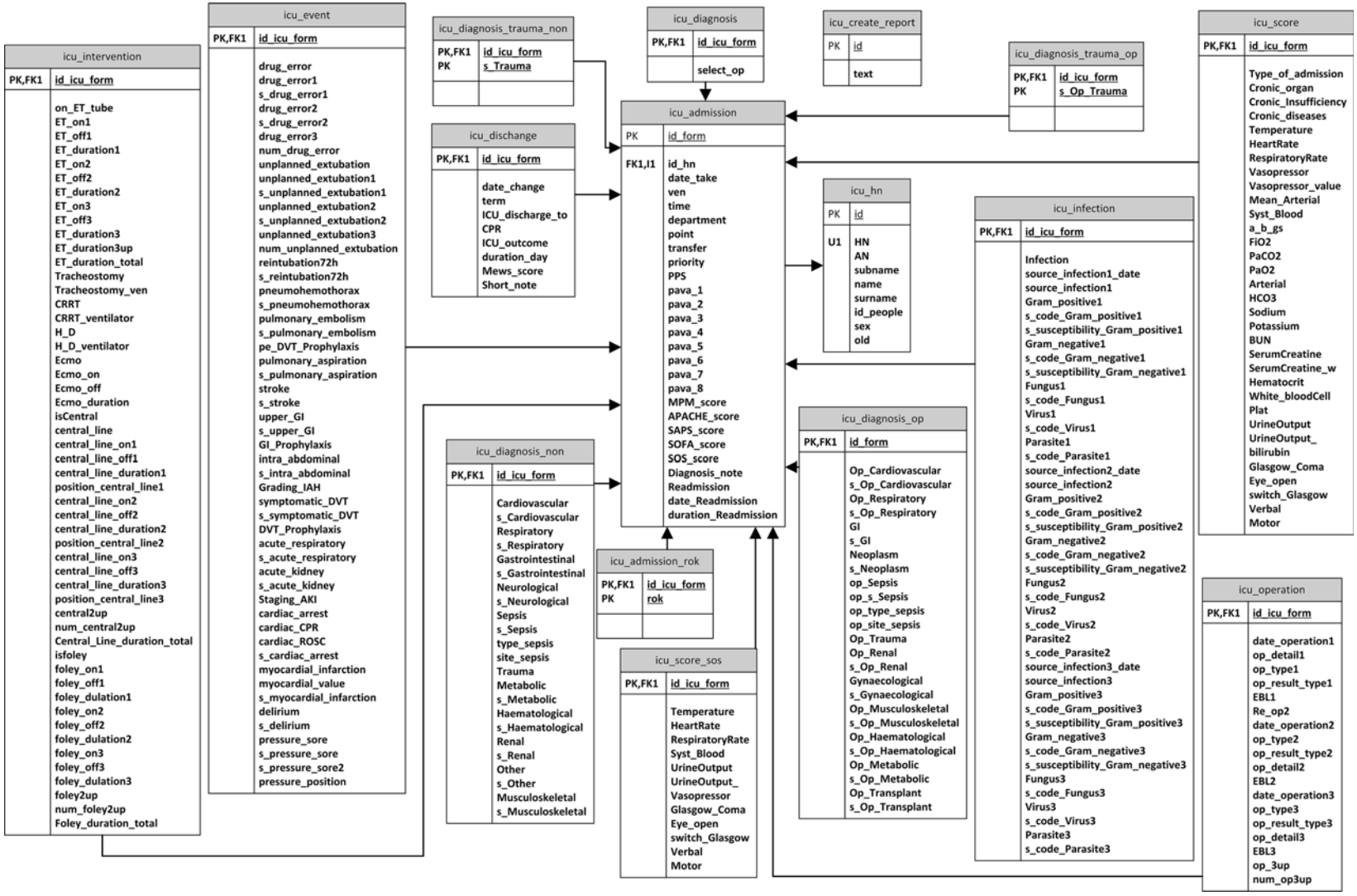

Fig. 1 The relationship of variables in the developed browser program.

Table 2. Agreement of collection and report variables

	Median	IQR
Patient characteristics		
Palliative performance scale (PPS)	4.0	2.0
Priority model	5.0	1.0
Auto-calculation of disease severity*	5.0	0.0
Adverse events		
Medication error	5.0	0.5
Unplanned extubation	5.0	0.0
Reintubation within 72 hours	5.0	0.0
Pulmonary embolism	5.0	0.5
New stroke	5.0	0.5
Intra-abdominal hypertension	5.0	2.0
Acute respiratory failure	5.0	0.5
Cardiac arrest	5.0	0.0
Delirium	5.0	1.0
Iatrogenic pneumothorax	5.0	1.0
Pulmonary aspiration	5.0	1.0
Upper gastrointestinal hemorrhage	5.0	1.0
Symptomatic deep vein thrombosis	5.0	1.5
Acute kidney injury	5.0	0.0
Myocardial infarction	5.0	0.0
Pressure sore	5.0	0.0
ICU acquired infection	5.0	0.0
Summarized outcome report		
MPM II <30 mortality number/rate	5.0	2.0
APACHE II <20 mortality number/rate	5.0	0.5
Overall mortality number/rate	5.0	0.0
Sudden cardiac arrest number/rate	5.0	0.0
Unplanned extubation number/rate	5.0	0.0
Reintubation rate within 72 hours number/rate	5.0	0.0
VAP rate per 1,000 ventilator day	5.0	0.0
CA-UTI rate per 1,000 catheter day	5.0	0.0
Medication error number/rate	5.0	0.5
Pressure sore >grade I number	5.0	0.0
Iatrogenic pneumothorax number	5.0	0.0
ICU readmission number/rate	5.0	1.0
Survival rate at interested interval	5.0	0.5

* Disease severity including APACHE II score, SOFA score, SAPS II, MPM II, and SOS score
VAP = ventilator associated pneumonia

familiar to the Thai ICU. Implementation of MPM II_0 score might create confusion.

Discussion

The present study demonstrated the method of variables selection for database collection program development. The prototype of the selected variables originated from the case record form of the THAI-SICU study[4]. However, the target population in that study was mainly critically illsurgical patients. The stakeholders involved in multi-disciplinary teams were invited. In addition, the TSCCM had an important role in providing a workshop with sharing and learning. After sharing, the variables especially the outcome indications were adjusted. The most prominent feature of this program was the disease severity scores calculation using the raw input data into the program. Even though there were many severity classifications and many versions of them, the selected severity scores in this program were APACHE II score, SAPS II score, SOFA score, MPM II_0 score, and SOS score[6-9]. The validity of their performance still differed depending on study sites and patient types[10-13]. Regarding SOS score, this severity score was adjusted from the modified, early warning score (MEWS)[14]. The SOS score is familiar and popular for patient triage in the Thai referral system. The score is widely used in the sepsis working groups in hospital networks.

Regarding the diagnosis, the diagnostic reference was followed the International Classification of Diseases, 10th revision (ICD-10). Although most of critically ill patients suffered from multiple abnormalities, the program could select only one principle diagnosis. In addition, the program separated the diagnosis depending on surgical or medical diseases. In other words, only one main disease could be selected for each patient.

Regarding the adverse outcomes, the working group proposed 16 adverse events in the program. Although these events might be of interest in the tertiary hospital, the primary or secondary hospital might tailor and collect some of them. Regarding the health care associated with infective complications, accurate results required the attending physician and diagnostic criteria which might differ among hospitals[15]. In addition, the program allowed only three occurrences of infection for one admission.

Regarding the intervention, the present study recorded only the frequent interventions in ICU and organ support. More specialized devices such as pacemakers, intra-aortic balloon pumps, and others were not included in this program.

Regarding the discharge parameter, the program was designed to collect only the simple severity of SOS score. Sophisticated severity scores such as APACHE II, SAPSII, SOFA score, MPM II score might create an increased unnecessary workload. In addition, these scores were developed for the prediction of mortality at the admission evaluation.

Although this program was the first program

provided for Thai ICUs, there were some limitations on this program. First, the program was developed for adult patients and did not include pediatric patients. Therefore, the pediatric severity grading such as the pediatric risk of mortality score (PRISM score) and the pediatric logistic organ dysfunction (PELOD score) was not included in the present study. Second, the parameters especially the interventions were designed for the general ICU. The intervention in some specialized units, such as neurological and cardiovascular ICU, might be missed. Third, although the authors attempted to edit the program before wide recommendations, mistakes or incompletion of the program might be found after implementation. Finally, the primary and secondary level hospitals might not have established surveillance of all of the accepted variables in this study. Future variables development might need classifications based on hospital types and unit specialties.

Conclusion

The selected variables in seven parts of variables groups included: 1) patient characteristics, 2) diagnosis, 3) adverse events, 4) detail of operation in surgical cases, 5) ICU intervention, 6) discharge, and 7) summarized report.These were widely agreed upon via a browser system from stakeholders in Thai ICUs.

What is already known on this topic?

The ICU database is important for quality improvement. However, the variables for admission, adverse events, severity scoring system, and summarized clinical indicators or tracer reports are not well establishment in Thailand.

What this study adds?

The variables for admission characteristics, adverse events, ICU interventions, and discharge as well as the program for data collection, automatic severity calculation, and summarized report via browser system were developed and widely agreed upon from stakeholders in Thai ICUs.

Acknowledgements

This study was supported by the Medical Association of Thailand (Prasert Prasartthong-osoth) Research Fund (Funding years 2014-2015). The authors gratefully thank Ms. Kanokkarn Jantaping and Mr. Thirawat Sutalungka for program development.

Potential conflicts of interest

None.

References

1. Hutchings A, Durand MA, Grieve R, Harrison D, Rowan K, Green J, et al. Evaluation of modernisation of adult critical care services in England: time series and cost effectiveness analysis. BMJ 2009; 339: b4353.
2. Jones DA, Cooper DJ, Finfer SR, Bellomo R, Myburgh JA, Higgins A, et al. Advancing intensive care research in Australia and New Zealand: development of the binational ANZIC Research Centre. Crit Care Resusc 2007; 9: 198-204.
3. Halpern NA, Pastores SM. Critical care medicine in the United States 2000-2005: an analysis of bed numbers, occupancy rates, payer mix, and costs. Crit Care Med 2010; 38: 65-71.
4. Chittawatanarat K, Chaiwat O, Morakul S, Pipanmekaporn T, Thawitsri T, Wacharasint P, et al. A multi-center Thai university-based surgical intensive care units study (THAI-SICU study): methodology and ICU characteristics. J Med Assoc Thai 2014; 97 (Suppl 1): S45-54.
5. Macmillan TT. The Delphi technique. In: The annual meeting of the California Junior Colleges Associations Committee on Research and Development. Monterey, CA; 1971: 3-5.
6. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. Crit Care Med 1985; 13: 818-29.
7. Le Gall JR, Lemeshow S, Saulnier F. A new Simplified Acute Physiology Score (SAPS II) based on a European/North American multicenter study. JAMA 1993; 270: 2957-63.
8. Lemeshow S, Teres D, Avrunin JS, Gage RW. Refining intensive care unit outcome prediction by using changing probabilities of mortality. Crit Care Med 1988; 16: 470-7.
9. Vincent JL, Moreno R, Takala J, Willatts S, De Mendonca A, Bruining H, et al. The SOFA (Sepsis-related Organ Failure Assessment) score to describe organ dysfunction/failure. On behalf of the Working Group on Sepsis-Related Problems of the European Society of Intensive Care Medicine. Intensive Care Med 1996; 22: 707-10.
10. Ilker I, Mehmet K, Mehmet A, Aysenur D, Fesih K, Aysenur S, et al. Study of effectiveness of the SAPS II-III, APACHE II-IV and MPM II scores in the determination of prognosis of the patients in reanimation intensive care unit. Acta Medica Mediterranea 2015; 31: 127-31.
11. Khwannimit B. Validation of the LOD score

compared with APACHE II score in prediction of the hospital outcome in critically ill patients. Southeast Asian J Trop Med Public Health 2008; 39: 138-45.
12. Khwannimit B, Bhurayanontachai R. The performance of customised APACHE II and SAPS II in predicting mortality of mixed critically ill patients in a Thai medical intensive care unit. Anaesth Intensive Care 2009; 37: 784-90.
13. Bouch DC, Thompson JP. Severity scoring systems in the critically ill. Contin Educ Anaesth Crit Care Pain 2008; 8: 181-5.
14. Subbe CP, Kruger M, Rutherford P, Gemmel L. Validation of a modified Early Warning Score in medical admissions. QJM 2001; 94: 521-6.
15. National Nosocomial Infections Surveillance (NNIS) System Report, data summary from January 1992 through June 2004, issued October 2004. Am J Infect Control 2004; 32: 470-85.

ความเห็นพ้องของการเลือกตัวแปรและการพัฒนาโปรแกรมสำหรับการเก็บข้อมูลในหออภิบาลผู้ป่วยหนักในประเทศไทยด้วยวิธีเดลฟาย

กวีศักดิ์ จิตตวัฒนรัตน์, กรรณิกาณ์ ด้วงเจริญ, อรอุมา ชัยวัฒน์, รัฐภูมิ ชามพูนท, ไชยรัตน์ เพิ่มพิกุล

วัตถุประสงค์: *เพื่อพัฒนาตัวแปรที่จะนำมาใช้ในการเก็บข้อมูลและนำมาพัฒนาเป็นโปรแกรมการเก็บข้อมูลในหออภิบาลผู้ป่วยหนักในประเทศไทย รวมถึงการนำมาหาข้อตกลงด้วยวิธี modified Delphi*

วัสดุและวิธีการ: *ตัวแปรสำหรับการพัฒนาโปรแกรมพัฒนาต่อยอดจากแบบบันทึกของการศึกษา THAI-SICU การพิจารณ์แก่สาธารณะได้จัดทำขึ้นในโปรแกรมต้นแบบ หลังจากที่ทำการปรับปรุง ผู้ที่มีส่วนได้เสียที่ได้ความเห็นพ้องโดยวิธีเดลฟายด้วยโปรแกรมบราวน์เซอร์ กลุ่มตัวแปรจะได้การวัดความเห็นพ้องเป็น 5 ระดับ ความเห็นพ้องอย่างเป็นเอกฉันท์เมื่อค่ามัธยฐานอย่างน้อย 4 และค่าส่วนเบี่ยงเบนควอร์ไทล์ไม่เกิน 2*

ผลการศึกษา: *ระหว่างเดือนมิถุนายนถึงกันยายน พ.ศ. 2558 แบบสอบถามจำนวน 20 ชุดจากผู้มีส่วนได้ส่วนเสียที่เป็นผู้เชี่ยวชาญในหออภิบาลผู้ป่วยหนัก (จากแพทย์ 11 ชุด และจากพยาบาล 9 ชุด) กลุ่มตัวแปรทั้ง 7 ส่วนได้แก่ 1) ลักษณะผู้ป่วย 2) การวินิจฉัย 3) ภาวะไม่พึงประสงค์ 4) การผ่าตัดกรณีเป็นผู้ป่วยศัลยกรรม 5) หัตถการในหออภิบาล 6) การจำหน่าย และ 7) แบบรายงานได้รับความเห็นพ้องตามข้อกำหนด (ค่ามัธยฐานอย่างน้อย 4 และค่าส่วนเบี่ยงเบนควอร์ไทล์ไม่เกิน 2)*

สรุป: *กลุ่มตัวแปรที่ได้รับคัดเลือกทั้ง 7 ส่วน ของกลุ่มตัวแปรผ่านระบบโปรแกรมบราวน์เซอร์เป็นที่เห็นพ้องอย่างกว้างขวาง จากผู้มีส่วนได้เสียที่ปฏิบัติงานในหออภิบาลผู้ป่วยหนักในประเทศไทย*