

## Medical education

# Development of a learning portfolio to assess the competency of anesthesia residents in Thailand

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**Background:** Recently, a competency-based educational system has been recommended for anesthesia residents in Thailand, instead of a structure-and-process-based medical system. Learning portfolios have become popular and reliable in health profession and education to assess competency and performance in clinical practice.

**Objectives:** Develop a portfolio for learning improvement in first year anesthesia residents in Thailand, and validate this portfolio as a competency evaluation and to identify strength and weakness of implementation.

**Methods:** A learning portfolio was developed from Thai Medical Council general competencies, academic activities, and performance assessment in several modalities. Twenty-four first year anesthesia residents and eight mentors were enrolled for this study. One staff mentored three residents and rated their competencies in portfolios, twice, four-months apart. Content validity was assessed by six content experts. Concurrent validity of portfolio was determined by agreement with faculty global rating and in-training examination. Inter-rater reliability of portfolio was evaluated by five faculties that rated 24 residents. Practicality was commented upon by all mentors and residents in the questionnaire and semi-structure, open-ended questions.

**Results:** All content experts accepted that this portfolio could assess general competencies of the first year anesthesia residents. Concurrent validity of portfolio was demonstrated by high overall agreement with faculty global rating and in-training examination. Inter-rater reliability was good. The majority of mentors and residents (>70%) agreed with the benefit of portfolio based on learning development and competency assessment. However, half of residents were not satisfied with the burden from portfolio.

**Conclusion:** The present learning portfolio provided benefit in learning improvement. It was a valid and reliable tool in competency assessment, but a burden, in the views of the residents.

**Keywords:** Anesthesia, competency, development, portfolio, resident

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The traditional medical educational system is based on “exposure to specific content for a prescribed period of time” [1]. Under faculties’ global rotation evaluation, residents may often be judged satisfactory in spite of substandard performance. In USA, a competency-based educational system has been recommended instead of the traditional structure-and-process based system [2]. Steps of curriculum development include 1) competency identification, 2) determination of core competency and performance level, 3) competency evaluation, and 4) overall assessment of the process.

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To assess competency and performance in clinical practice, learning portfolios have become popular and reliable in health profession and education [3, 4-8]. They can be used for summative and formative evaluation as a tool for learning improvement [9]. The components of self-reflection and learning development focus on areas that residents consider weak. These are key points related to adult learning and life-long learning. However, the weaknesses of portfolios include problems with validity and reliability, lack of guidelines for development, and being tedious for use to evaluate practicing physicians. Moreover, collection for multiple physician/trainees may be difficult to track and be time consuming [7].

Recently, an increasing demand of anesthetists has doubled or tripled the number of anesthesia

residents in Thailand. Since the Thai Medical Council requirements are dependent upon the traditional structure-and-process based educational system, achievements of its general competencies look questionable. In this study, we developed a portfolio of tools for learning improvement, providing a formative and summative evaluation of first year anesthesia residents' competency. The validity and reliability of learning portfolio as a competency-evaluation was determined. Students' and faculties' perception of their experiences were explored to identify strengths and weaknesses of the training program for further improvement.

## Methods

This prospective descriptive study was approved by the Ethical Review Board of Siriraj Hospital. The study was conducted between June 2008 and May 2009 at Siriraj Hospital with 70 faculties, 67 residents, 50 nurse anesthetists, 36 nurse anesthetist students, and 15 medical students who rotate for two-week period each.

This learning process for first year anesthesia residents included lectures of basic anesthesia, academic conferences, learning basic procedural skills (such as endotracheal intubation, undermask technique, spinal block) practicing clinical anesthetic care for simple cases in perioperative period and having skills in research methodology and presentation. The first year residents had six rotations in anesthesia for general surgery, orthopedic surgery, obstetric-gynecological surgery, neurosurgery, eye/ear nose throat surgery, and emergency surgery. Traditionally, there were only official summative evaluations at the end of academic years such as in-training examination (MCQ, Essay, MEQ, OSCE, and oral examination), faculty global rating, and research proposal evaluation. The steps of this study included 1) portfolio development, 2) content validity evaluation, 3) training residents and mentors in using portfolios, 4) concurrent validity evaluation, 5) inter-rater reliability evaluation, and 6) exploration of the perceptions of residents and faculties.

### Portfolio development

The items of the portfolio were derived from:

**I.** General competencies from anesthesia residency training documented by Thai Medical Council and Royal College of Anesthesiologists of Thailand. These competencies were found suitable

for first year level resident such as (i) patient care or clinical skills in perioperative period for uncomplicated patients undergoing simple procedures or operations, (ii) medical knowledge of basic anesthesia and uncomplicated clinical anesthesia, (iii) practice based learning and development, including basic procedural skills, skills in medical informatics, presentation, and conducting research, (iv) communication skill, and (v) professionalism.

**II.** Learning process involvement to acquire required competencies included records of attending academic activities, lectures, workshops, and conferences.

**III.** Competencies assessment that were modified from portfolio of anesthesia training in United Kingdom [10], and included: A) Case Based Discussion (CBD): a report discussed about anesthetic management of the patients. Residents sent six reports of CBD (one report for each rotation). Scoring was categorized into details of preoperative evaluation and preparation, intraoperative care and postoperative management; B) Anesthetic-Clinical Evaluation Exercise (Anes-CEX): an evaluation of clinical skills in anesthesia care for uncomplicated patients which involved all steps of preoperative, intraoperative and postoperative care, communication skill and professionalism. The rubric Likert scales with description were used to increase validity and reliability; C) Direct Observation of Procedural Skills (DOPS): an evaluation of procedural skill of first year residents. The evaluation also included patient consideration, whether informed consent was obtained, situation awareness, help seeking by residents when necessary and communication skill; D) Multisource Feedback: Team assessment (MSF): an evaluation of the operation, patient safety care, communication skills and professionalism from attending faculties and nurse anesthetists. We did not use patients' feedback because most of them were anesthetized. Therefore, this tool was not a 360 assessment; E) Log book: a file which residents recorded cases for which they provided anesthetic care or procedural skills (minimum cases for passing criteria of Log book in first year resident were 100 cases of endotracheal intubation, 50 cases of spinal block, 10 cases of epidural block, and 10 cases of undermask techniques); F) Literature search, presentation and critical appraisal skill assessment: evaluated by faculties and other residents in journal club presentation; G) Research development: As research manuscript was compulsory for third year residents in applying for

Board examination, the passing criterion for this final category in first year resident was a research proposal submitted to the Department at the end of the academic year.

**IV. Self assessment and development plan:** a reflective note in which residents assessed themselves and discussed the appropriate plan with their mentors.

All items except records of attendance of academic activities were rated in four levels: 1 = below expectation, 2 = borderline, 3 = meet expectation, 4 = above expectation. All scores were disclosed to residents. They were allowed to improve their competencies such as CBD, Anes-CEX and DOPS, etc. in order to yield better scores. The determination of evaluation techniques related to competency and passing criteria were shown in **Table 1**.

#### **Content validity evaluation**

The developed portfolio was assessed for content validity by two faculties with teaching experience of more than 20 years, two faculties with teaching experiences of 10-15 years and two faculties with teaching experiences of three to five years. Content and scaling of all items in each competency were rated as not applicable, partially applicable, and absolutely applicable. All opinions were discussed and strategies to improve the portfolio.

#### **Training residents and mentors in using portfolio**

The definitions, objectives, and benefits of portfolio were clarified to all residents and mentors. We also explained the flow of study, data collection, and criteria for passing. One staff mentored three residents. Most of paper works, documents, and evaluated scores were collected by two research assistants.

As all faculties were involved in the assessment of CBD, Anes-CEX, DOPS, and MSF. They were informed about and trained how to use these assessment tools in the faculty monthly meeting in October 2008.

Data collection started in November 2008. Then, the first resident-mentor meeting was arranged in January 2009. Mentors thoroughly assessed each portfolio, discussed with their residents about reflective notes, and supported resident efforts to improve themselves. The second meeting was arranged in May 2009.

#### **Evaluation of concurrent validity, inter-rater reliability, and resident and faculty perception**

Portfolio scores were compared with global rating score from 12 faculties who also trained first year residents (passing scores >3) and with an in-training examination (passing scores > mean - one SD)

**Table 1.** Instruments in portfolio and competency measurement, including passing criteria.

| Competencies                            | Instruments |      |     |                                               |     |                   |                             |                         |                      |
|-----------------------------------------|-------------|------|-----|-----------------------------------------------|-----|-------------------|-----------------------------|-------------------------|----------------------|
|                                         | Anes-CEX    | DOPS | MSF | Log book                                      | CBD | Academic activity | Research progress attention | Presentation assessment | Self assessment plan |
| Patient care                            | ✓           | ✓    | ✓   |                                               |     |                   |                             |                         |                      |
| Medical knowledge                       | ✓           |      |     |                                               | ✓   | ✓                 |                             | ✓                       |                      |
| Practice based learning and improvement | ✓           | ✓    |     | ✓                                             | ✓   |                   | ✓                           |                         | ✓                    |
| Professionalism                         | ✓           | ✓    | ✓   |                                               |     |                   |                             |                         |                      |
| Communication skill                     | ✓           | ✓    | ✓   |                                               |     |                   |                             | ✓                       |                      |
| Passing criteria                        | >3          | >3   | >3  | ET 100<br>Spinal 50<br>Epidural 10<br>Mask 10 | >3  | >70%              | Present proposal            | >3                      | +                    |

Anes-CEX = anesthetic-clinical evaluation exercise, DOPS = direct observation of procedural skills, MSF = multisource feedback: 360 team assessment, CBD = case based discussion, ET = endotracheal tube.

Five faculties independently rated contents in all competencies of 24 residents' portfolio without knowing the owner. They rated based on their opinion into four levels: 1 = below expectation, 2 = borderline, 3 = meet expectation, 4 = above expectation.

Questionnaires were used to survey satisfaction scores that were rated with four levels: 1 = absolutely disagree, 2 = disagree, 3 = agree, 4 = absolutely agree. We also explored residents and faculties' perception of portfolio and their experiences with portfolio affected their learning activities in semi-structure and open-ended questions. All return answers were anonymous.

### **Statistical analysis**

Data are expressed as means±standard deviation (SD). Demographic data, content validation, and satisfaction score were analyzed using descriptive statistics. Data Concurrent validity was analyzed using overall agreement between portfolio rating vs. faculty global rating and portfolio rating vs. in-training examination score [11]. The overall agreement was calculated as follows:

$$\text{Overall agreement (\%)} = \frac{\text{Number of cases with the same observed agreement by two tests (x100\%)}}{\text{Number of all residents}}$$

### **Results**

There were 24 first year residents and eight mentors enrolled in this study. Residents had a mean age of 27.8±0.9 years (range: 26-29 years) and a mean grade point average from medical school of 3.21±0.27 (range: 2.71-3.65)

### **Content validity**

There was no content expert opposed to any item (Table 2). All experts absolutely agreed with the content designed to measure competency of patient care. Most of them agreed with the content and scoring of items to assess practice based learning, professionalism, interpersonal and communication skills. Interestingly, the content item with least agreement was medical knowledge for which three experts admitted that they were uncertain about using this item for this competency measure without including in-training knowledge examination.

### **Concurrent validity**

Only one resident failed when using portfolio

evaluation, four residents failed when using in-training examination, and three residents failed when using faculty global rating.

Overall agreement between portfolio score and in-training examination was 79.17% (Table 3), which was lower than the overall agreement between portfolio rating and global faculty rating (91.67%)

### **Inter-rater reliability**

Agreement between five faculties who rated portfolio of same resident was quite good with an intra-class correlation of 0.814.

### **Exploration of resident and faculty perception**

According to questionnaires, most residents and mentors accepted that the portfolio project did aid in learning improvement and measuring the expected competencies (70.0%-87.5%). This project received good co-operation from a majority of residents and mentors (83.3%-91.7%). Even though residents could benefit from access to and close attention from mentors, nearly half of them (41.7%) resisted this project due to a sense of excess burden. However,

the majority of mentors (85.5%) preferred the portfolio to assess competency and for reflecting residents actual self-assessment and learning development as shown in Table 4.

Based on semi-structure open-ended questions, most residents and mentors recognized the strength of learning portfolio that it was able to systematically assess and improve residents' competency in various aspects such as knowledge, clinical skill, communication skill, presentation skill, research skill and professionalism. This system also provided continuous formative assessment with regular feedback that helped residents improve themselves and encourage active learning. Seventy percent of residents preferred using portfolio rather than traditional system. However, they also proposed the weakness of mentor-resident relationship, inefficient infrastructure, and inadequate understanding of new system among faculties and residents. They also recommended the improvement of several weak points.

**Table 2.** Content validity (n = 6)

| Item                                    | Mean±SD<br>(Min-Max) | Absolutely agreed<br>number (%) | Partially agreed<br>number (%) | Disagreed<br>number (%) |
|-----------------------------------------|----------------------|---------------------------------|--------------------------------|-------------------------|
| <b>Patient care</b>                     |                      |                                 |                                |                         |
| content                                 | 2.00±0.00 (2-2)      | 6 (100)                         | 0                              | 0                       |
| scoring                                 | 1.67±0.52 (1-2)      | 4 (66.7)                        | 2 (33.3)                       | 0                       |
| <b>Medical knowledge</b>                |                      |                                 |                                |                         |
| content                                 | 1.50±0.52 (1-2)      | 3 (50)                          | 3 (50)                         | 0                       |
| scoring                                 | 1.67±0.52 (1-2)      | 4 (66.7)                        | 2 (33.3)                       | 0                       |
| <b>Practice based learning</b>          |                      |                                 |                                |                         |
| content                                 | 1.83±0.41 (1-2)      | 5 (83.3)                        | 1 (16.7)                       | 0                       |
| scoring                                 | 1.67±0.52 (1-2)      | 4 (66.7)                        | 2 (33.3)                       | 0                       |
| <b>Professionalism</b>                  |                      |                                 |                                |                         |
| content                                 | 1.83±0.41 (1-2)      | 5 (83.3)                        | 1 (16.7)                       | 0                       |
| scoring                                 | 1.83±0.41 (1-2)      | 5 (83.3)                        | 1 (16.7)                       | 0                       |
| <b>InterpersonalCommunication skill</b> |                      |                                 |                                |                         |
| content                                 | 1.83±0.41 (1-2)      | 5 (83.3)                        | 1 (16.7)                       | 0                       |
| scoring                                 | 1.83±0.41 (1-2)      | 5 (83.3)                        | 1 (16.7)                       | 0                       |

**Table 3.** Agreement between portfolio assessment and in-training examination (ITE) or global faculty rating (GFR)

|            | Portfolio assessment |      | Total |
|------------|----------------------|------|-------|
|            | Fail                 | Pass |       |
| <b>ITE</b> |                      |      |       |
| Fail       | 0                    | 4    | 4     |
| Pass       | 1                    | 19   | 20    |
| <b>GFR</b> |                      |      |       |
| Fail       | 1                    | 2    | 3     |
| Pass       | 10                   | 21   | 21    |

ITE: Agreement = 0+19/24 = 79.2%, GFR: Agreement = 1+21/24 = 91.7%

**Table 4.** Practicality of portfolio for competency assessment and learning development

| Item                                                                           | Positive response, n (%) |                    |
|--------------------------------------------------------------------------------|--------------------------|--------------------|
|                                                                                | Mentor (n = 8)           | Residents (n = 24) |
| Encourage active learning                                                      | 7 (87.5%)                | 17 (70.8%)         |
| Able to assess competencies                                                    | 6 (75%)                  | 18 (75%)           |
| Increase burden                                                                | 3 (37.5%)                | 17 (70.8%)         |
| Co-operation from residents                                                    | 7 (87.5%)                | 20 (83.3%)         |
| Co-operation from mentors                                                      | 7 (87.5%)                | 22 (91.7%)         |
| Satisfaction with portfolio for competency assessment and learning improvement | 7 (87.5%)                | 14 (58.3%)         |

## Discussion

Our learning portfolio was designed as a collection of evidences over time intended to demonstrate a resident's education and performance achievement. We used this portfolio as a formative and summative assessment. The main purposes were to ensure a certain minimum level of competencies and to help restore competence for quality of practice at the level of first year anesthesia resident training. We absolutely agreed with Wilkinson and colleagues that a good assessment system should not reflect only a competent destination but also a journey to improve performance or excellence [12].

We had extensively reviewed several portfolios for resident competency assessment related to ACGME [3, 6, 8, 13] and the portfolio component in United Kingdom [11, 13]. Then, we allocated our learning activities, research activities, logbook, peri-operative performance assessment, case based discussion and multi-source feedback into five expected competencies. Finally, criteria for passing were also determined for formative and summative assessment. The majority of mentors were satisfied with both the easy scoring system from objective evidence, the structure based scoring system with clear description, and the precise criteria laid out for passing. In addition, their preference for portfolio scoring was attributable to competency coverage compared to scoring by global rating scale.

In content validation, all items were accepted for their meaning and scoring. However, only the item of medical knowledge yielded the least agreement from content experts. Based on their opinion, the coverage range of the portfolio to measure this competency might not be as complete as in-training examinations. In addition, the purpose of portfolio was not only for assessment but also for learning improvement. As a result, it was demonstrated that only one resident failed from portfolio assessment whereas four residents failed from in-training examination. Therefore, a combination of in-training examination and portfolio should be used for summative assessment to cover all expected competencies. This idea was similar to a study of Al Kadri et al. [14], which recommended to implementation of work based assessment to assess knowledge and competencies. This was based on Miller's pyramid such as mini clinical examination (mini CEX), direct observation of practical skills (DOPS), long and short cases, and others to test the students capabilities, and

competencies both in vitro and in vivo. Additionally, these should be accompanied by direct observation and feedback to allow improvement and to guarantee competency [14, 15].

According to concurrent validity criterion, agreement of scores between portfolio and in-training examination (79.2%) were less than the agreement of scores between portfolio and faculty global rating (91.7%). The reason might be related to the ability of portfolio to measure performance more effectively than the cognitive domain and were similar to faculty global ratings.

The good inter-rater reliability of our portfolio to measure competencies might be attributed to the objective assessment from all evidences assessed by trained faculties collected by residents and departmental personnel, including applying precise criteria for passing.

In practice, both residents and mentors realized the benefit of portfolio in learning development and competency assessment. Therefore, the strength of this portfolio development was the positive co-operation from all faculties and mentors including residents. Moreover, portfolio was a tool to strengthen residents-faculties relationship in our large department. This also aided in early detection of residents' stress and depression and led to proper management.

In conclusion, our learning portfolio was valid and reliable for competency assessment in our first year residents. Based on practicality, mentors appreciated this tool more than residents did. The reason was attributed to residents' sense of excess burden.

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