SETTING PASSING SCORE FOR METERED DOSE INHALER (MDI) OSCE STATION: EXPERIENCE AT CENTER FOR ELABORATION COMPETENCY & INNOVATION IN CLINICAL SIMULATION (CECICS) OF PHAM NGOC THACH UNIVERSIRTY OF MEDICINE (PNT-UOM)

Nguyen Ngoc Phuong Thu*

ABSTRACT

Introduction: OSCE has been used increasingly in assessing learners globally. Standard Setting for OSCE is necessary to distinguish between a competent and an incompetent learner. This study was conducted to enhance the quality of assessment of the MDI OSCE for MS-2 at CECICS. **Objective**: 1. To describe steps in implementing Standard Setting for MDI Station; 2. To determine the content validity of the MDI checklist. **Method**: This is a cross-sectional study. To calculate the pass mark, we followed five steps of the Angoff method. To determine the content validity of the checklist, we calculated S-CVI, I-CVI and CVR. **Result**: We recruited a group of 8 SMEs who are qualified to define the required level of knowledge and skills of MCC. During the online orientation organized by CECICS' Director, all items of checklist were clarified. To avoid the time-consuming process, each SME will only determine the percentage of MCC would answer the item correctly for the first 3 items. SMEs explained their decisions on each item and discussed to resolve the discrepancies when the difference between the lowest and highest scores are greater than 15%. All SMEs made their judgements for the remaining items after the meeting. One week later, the 2nd online meeting was organized to collect all the judgements and repeated all steps to collect MCC. Finally, we obtained the passing score of 81% for this station by averaging the total score of 8 SMEs. The calculated value of S-CVI/average, S-CVI/UA, and CVR were all equal to 1. The results provided good evidence of content validity. **Conclusion**: In this study, Angoff method has shown to be practical in providing defensible passing score for the MDI station. Besides that, MDI checklist has evidence to support the content validity. In the future, to achieve a higher standard in measuring performance assessment, the passing scores of all OSCE at CECICS should be determined by appropriate standard setting methods.

Keywords: OSCE, MDI, standard setting, Angoff method, S-CVI, I-CVI, CVR.

* *CECICS, Pham Ngoc Thach University of Medicine*
Responsible person: Nguyen Ngoc Phuong Thu
Email: nguyenngocphuongthu@pnt.edu.vn

I. INTRODUCTION

Valid performance assessment in medical education plays an important role for patient safety as well as gaining patients' trust. Over the past several years, many efforts have been made to improve the validity and reliability of assessment methods and tools in medical education. Introduced by Ronald Harden in 1970s, objective structure clinical examination (OSCE) is a reliable and valid method to assess clinical skills for learners at all levels (1).

In 2017 and 2021, PNT has signed 2 memorandums of understanding with Texas Tech University Health Sciences Center at El Paso to prepare CECICS for Society for Simulation in Healthcare accreditation. To prepare for SSH Accreditation, one of the main goals of CECICS is to establish standard setting for all educational activities

including OSCE. Standard setting determines the score associated with the minimal level of skill or knowledge required to reach the basic level of competency and is also a way to guide the students' learning.

Non-communicable chronic respiratory diseases are still leading causes of morbidity and mortality in Vietnam (2). The correct use of a metered-dose inhaler (MDI) can improve respiratory symptoms and lung function, decreases the need for systemic corticosteroids and emergency department visits. However, correct inhaler technique involves many steps and can be difficult to follow for many patients. Therefore, ensuring proper inhaler technique is an essential component of patient education and non-communicable chronic respiratory diseases management.

Objective: This study was conducted to enhance the quality of performance

assessment by 1). Implementing the validation process of the OSCE checklist with the calculation of the content validity of each item in the checklist and 2). Conducting the standard setting to determine the passing score of the MDI OSCE station.

II. METHOD

This is a cross-sectional study conducted in June 2022 at CECICS, to determine the pass score of the MDI station for the second-year medical student of the Vietnamese - German school of medicine. This is a low stakes examination to assess the students' skills in educating a standardized patient for using MDI correctly.

To determine the content validity of the MDI checklist (Table 1), we followed five steps of content validation as shown below.

Table 1: Content Validation Form with domain and items measure the domain
CONTENT VALIDATION FORM

Domain 1: Communication

Item	Content	Relevance			
		1	2	3	4
1	Cleans hands, introduces self, confirms patient identity				
2	Check patients understanding				

Domain 2: Skills

Item	Content	Relevance			
		1	2	3	4
1	Explains the 4 parts of the inhaler which including the Cap, Plastic holder, Mouthpiece, and Canister				
2	Demonstrate to patients to check the expiry date of the inhaler				
3	Demonstrate to patients how to prime the Metered Dose Inhaler				
4	Demonstrate to patients to hold the inhaler in their hand correctly				
5	Remove the cap from the MDI				
6	Shake the inhaler 5 - 10 times				
7	Breathe all the way out				

Item	Content	Relevance			
		1	2	3	4
8	Place the mouthpiece of the inhaler between their teeth and seal their lips tightly around it				
9	Breathe in deeply and simultaneously activate inhaler				
10	Continue to inhale until the lungs are full				
11	Hold their breath for 10 seconds				
12	Replace the cap on the MDI when finished				
13	Instruct patients rinse their mouth with water immediately after using Steroid				

1. Preparing content validation form

The first step of determining content validation is to set up the content validation form so that all SMEs know clearly about their task. A detailed instruction and rating scale is shown in Table 2. The rating scale of relevance has been used for scoring specific items. To facilitate for the SMEs judgement, we define domains of MDI checklist (Table 1).

2. Selecting a Review Panel of Experts

In setting the pass score for the MDI OSCE station, the SMEs reviewed and judged all items of the checklist.

3. Conducting content validation

The content validation was conducted through online approach. We sent content validation form to SMEs by Zalo group and clear instructions were offered (Table 1 and 2) to facilitate this process.

4. Providing score on each item

After completion of the third step, all SMEs are asked for giving score on each item independently based on the relevant scale (Table 2). They also were asked to send their decision to CECICS's Director one week later.

5. Calculating CVI and CVR

We have two forms of CVI, one is CVI for item (I-CVI) and another is CVI for scale (S-CVI). Two ways of S-CVI were calculated, in which the average of the I-CVI scores for all items on the scale (S-CVI/Ave) and the proportion of items on the scale that attained a relevance scale of 3 or 4 by all SMEs (S-CVI/UA) (3). The definition and formula of the CVI indices and CVR are summarized in Table 3.

Table 2: Instruction and Rating Scale in the content validation form to the Experts

Dear Experts,

This OSCE checklist contains 2 domains and 15 items related to communication with the SP, skills in demonstrating to SP using MDI correctly according to American Association for Respiratory Care guidelines 2017, and we need your expert judgement on the degree of relevance of each item to the measured domains.

Please use the following rating scale:

Degree of relevance:

1: The item is not relevant to the measured domain

2: The item is somewhat relevant to the measured domain

3: The item is quite relevant to the measured domain

4: The item is highly relevant to the measured domain

Table 3: The definition and formula of I-CVI, S-CVI/Ave and S-CVI/UA

The CVI indices	Expansion	Definition	Formula
I-CVI	Item Content Validity Index	The proportion of SMEs give item a relevance rating of 3 or 4	I-CVI = (agreed item)/ (number of SMEs)
The CVI indices	**Expansion**	**Definition**	**Formula**
S-CVI/Ave	Scale-Content Validity Index (by using the Average method)	The average of the I-CVI scores for all items on the scale by all SMEs.	S-CVI/Ave = (sum of I-CVI scores)/(number of items)
S-CVI/UA	Scale-Content Validity Index (by Universal Agreement method)	The proportion of items on the scale that attain a relevance scale of 3 or 4 by all SMEs. Universal agreement (UA) score is given as 1 when the item attained 100% SMEs in agreement, otherwise the UA score is given as 0.	S-CVI/UA = (sum of UA scores)/(number of items)
CVR	Content Validity Ratio	CVR is a numeric value indicating the instrument's degree of validity determined from expert's ratings of Content Validity	CVR = (ne - N/2)/(N/2) ne: total number of SMEs who agreed with "RELEVANCE" N: total number of SMEs

To implement standard setting for this OSCE station, we followed five steps of Angoff method 1). Selection and training of subject matter experts (SMEs); 2). Orientation of SMEs; 3). Define minimally competent candidate (MCC); 4). Make judgment on each item of the checklist and (5). Set the pass score for MDI OSCE station.

1. SMEs's selection and training

The first step of setting standard is SMEs's selection and training. SMEs are the persons who are qualified to define the minimal level of knowledge and skills required to meet the competence. SMEs also have responsibility and authority in selecting appropriate standard setting method. Qualified PNT faculty members participated in the Advanced Faculty Development Program are selected to serve as SMEs.

2. Orientation of SMEs

The director of CECICS informed the SMEs about the time of the first online meeting in Microsoft Teams (MS Teams) two weeks in advanced. During the online orientation, all items of checklist were clarified (Table 1).

3. Define MCC

To avoid the time-consuming process, each SME will only determine the percentage

of MCC would answer the item correctly for the first 3 checklist items. SMEs explained their decisions on each item and discussed to resolve the discrepancies of any item when the difference is either higher or lower than 15% of the other SMEs' MCC.

4. Make judgment on each item

All SMEs made their judgements for the remaining items after the meeting. One week later, the second online meeting by MS

Teams was organized to collect all the judgements and repeated all steps to collect the MCC data.

5. Set the Pass Score on MDI station

We calculated the passing score for the MDI OSCE station by averaging the MCC total score of 8 SMEs (multiply the average MCC % by 30, the total maximum score of 15 items).

III. RESULTS

We recruited a group of 8 SMEs who are qualified to define the required level of knowledge and skills of MCC and conducted the standard setting process to determine the MCC of each item in the checklist as described in the Method. Finally, we obtained the passing score of 81% for this MDI station by averaging the total score of 8 SMEs.

Table 4. Results of Setting Passing Score of MDI station

No	ITEM	SME 1 %	SME 2 %	SME 3 %	SME 4 %	SME 5 %	SME 6 %	SME 7 %	SME 8 %	Means (%)
1	Cleans hands, introduces self, confirms patient identity	90	95	90	90	90	85	99	90	**91.1**
2	Explains the 4 parts of the inhaler which including the Cap, Plastic holder, Mouthpiece, and Canister	90	80	80	90	90	85	95	90	**87.5**
3	Instructs patients to check the expiry date of the inhaler	80	95	80	80	90	80	90	80	**84.4**
4	Instructs patients how to prime the Metered Dose Inhaler	80	80	70	70	65	65	70	80	**72.5**
5	Instructs patients to hold the inhaler in their hand correctly	80	90	90	90	90	80	90	90	**87.5**
6	Remove the cap from the MDI	100	100	90	90	100	100	100	100	**97.5**
7	Shake the inhaler 5 - 10 times	95	90	80	90	80	80	90	80	**85.6**
8	Breathe all the way out	70	85	70	80	80	70	80	80	**76.9**
9	Place the mouthpiece of the inhaler between their teeth	80	85	70	80	80	70	80	80	**78.1**

	and seal their lips tightly around it								
10	Breathe in deeply and simultaneously activate inhaler	70	80	70	80	80	70	80	70	**75.0**
11	Continue to inhale until the lungs are full	65	70	70	80	70	65	80	70	**71.3**
12	Hold their breath for 10 seconds	75	80	70	85	70	70	85	70	**75.6**
13	Replace the cap on the MDI when finished	90	80	70	90	70	75	90	90	**81.9**
14	Instruct patients rinse their mouth with water immediately after using Steroid Inhalers	80	70	70	80	80	75	80	70	**75.6**
15	Check patients understanding	85	70	85	70	80	70	70	70	**75.0**
								Overall Average Rating		**81.0**

The Content Validity Indexes and Content Validity Ratio were calculated in the 2nd meeting. The relevance ratings on the item scale by 8 SMEs and the results of CVIs and CVR were shown in Table 5. The calculated value of S-CVI/average, S-CVI/UA, and CVR were all equal to 1. The results provided good evidence of content validity.

Table 5. The results of CVIs and CVR

No	ITEM	SME 1	SME 2	SME 3	SME 4	SME 5	SME 6	SME 7	SME 8		SME in agreement	I-CVI	UA
1	Cleans hands, introduces self, confirms patient identity	1	1	1	1	1	1	1	1		8	1	1
2	Check patients understanding	1	1	1	1	1	1	1	1		8	1	1
3	Explains the 4 parts of the inhaler which including the Cap, Plastic holder, Mouthpiece, and Canister	1	1	1	1	1	1	1	1		8	1	1
4	Demonstrate to patients to check the expiry date of the inhaler	1	1	1	1	1	1	1	1		8	1	1
5	Demonstrate to patients how to prime the Metered Dose Inhaler	1	1	1	1	1	1	1	1		8	1	1
6	Demonstrate to patients to hold the inhaler in their hand correctly	1	1	1	1	1	1	1	1		8	1	1
7	Remove the cap from the MDI	1	1	1	1	1	1	1	1		8	1	1
8	Shake the inhaler 5 - 10 times	1	1	1	1	1	1	1	1		8	1	1
9	Breathe all the way out	1	1	1	1	1	1	1	1		8	1	1

No	ITEM	SME 1	SME 2	SME 3	SME 4	SME 5	SME 6	SME 7	SME 8		SME in agreement	I-CVI	UA
10	Place the mouthpiece of the inhaler between their teeth and seal their lips tightly around it	1	1	1	1	1	1	1	1		8	1	1
11	Breathe in deeply and simultaneously activate inhaler	1	1	1	1	1	1	1	1		8	1	1
12	Continue to inhale until the lungs are full	1	1	1	1	1	1	1	1		8	1	1
13	Hold their breath for 10 seconds	1	1	1	1	1	1	1	1		8	1	1
14	Replace the cap on the MDI when finished	1	1	1	1	1	1	1	1		8	1	1
15	Instruct patients rinse their mouth with water immediately after using Steroid Inhalers	1	1	1	1	1	1	1	1		8	1	1
											S-CVI/Ave	1	
	Proportion relevance	1	1	1	1	1	1	1	1		S-CVI/UA		1
	Average proportion of items judged as relevance across the 8 experts									1			

IV. DISCUSSION

There are multiple standard setting methods for written tests and OSCE, which have been divided into three groups: 1). Norm-referenced or relative methods; 2). Criterion-referenced or absolute methods; and 3). Combination or compromise methods. Norm referenced or relative methods are useful when a predetermined number (or percentage) of examinees should pass the examination, e.g. admissions testing, employment testing (4). The relative method has low validity and reliability because the passing score may fluctuate due to examinee ability or test difficulty but the pass rate (number or percentage passing) is stable. An important element of standard setting is the performance level descriptor (PLD) that defines in details the knowledge, skills of the test takers according to their training level. It is recommended that the clinical competency committee (CCC) to develop the PLD in advance of the standard setting. The SMEs will elaborate and make judgements about

MCC based on the PLD. Criterion-referenced or absolute methods are useful when determining whether examinees meet requirements defined by the standard, and have high reliability and validity, if properly conducted (4). However, none method is agreed upon as the best method or gold standard for all settings.

Some important factors need to be considered in choosing standard setting are availability of SMEs, cost, time and response rate. For the offline approach, an SME meeting is arranged for a face-to-face meeting to happen. Despite having the highest response rate, the cost and time might be the challenging factor because of difficulty to get all experts be together at the same time (5), especially in the covid -19 epidemic. For the online approach, all forms are sent to SMEs by email or social network and all meetings were organized by MS Teams. Technical adequacy (reliability, validity), and practicability (ease of implementation and interpretation) are two

sets of criteria that may facilitate the selection of an appropriate standard setting method. Amongst other standard setting methods, the Angoff method appears to provide the best balance between technical adequacy and practicability (6). Based on our available resource, we chose the Angoff method as standard setting method for this station. MDI checklist and content validation form were sent to the SMEs by social network (Zalo Group) and clear instructions were given (Table 2) to facilitate the content validation process. The response rate and time might be the challenging factor for the online approach because of difficulty to get the answers on time and also at risk of not getting answer at all from the SMEs. The cost for taking SMEs away from their regular clinical services is the biggest economic issue that will require support from the Dean office and prior arrangement with clinical departments. With strong supports of Chairs of clinical departments for this study as well as the highly motivated SMEs, we are able to receive all requested reports on time. In our study, with the highly motivated SMEs, the online approach is doable and efficient.

Our study shows that the cut-off score of MDI station is 81%. This passing score is much higher than that of our traditional method in which we arbitrarily choose 50% as the passing score. As previously discussed, the relative method has low reliability and validity in differentiating the competent and non-competent test takers and should not be used in high stakes examinations.

OSCE checklist plays an important role in assessing the test takers' competence; therefore, checklist must be assessed for its content validity. According to the many authors (3) (7) (8), the acceptable cut off

score of CVIs depends on the number of SMEs. In our study, we have 8 SMEs, so the acceptable CVI value at least is 0.83. Similarly, the acceptable value of CVR also depends on the number of SMEs (9). With 8 SMEs, the cut off value of CVR is 0.75. Our calculated value of S-CVI/average, S-CVI/UA, and CVR were all equal to 1, a good evidence of content validity of MDI checklist.

V. CONCLUSION

In this study, the Angoff method has shown to be practical in providing defensible passing score for the MDI OSCE. Besides that, MDI checklist has strong evidence to support the content validity. In the future, to achieve a higher standard in measuring performance assessment, the passing scores of all OSCE at CECICS should be determined by appropriate standard setting methods.

VI. ACKNOWLEDGEMENT

REFERENCES
1. **Harden RM, Gleeson FA.** ASME Medical Educational Booklet no. 8 . Assessment of medical competence using an objective structured clinical examination (OSCE). MedEduc. 1979;13: 41-54.
2. **Hillary Ta, Bryant Lin, Latha Palaniappan.** Vietnamese and Vietnamese-American Health Statistics, 2003-2019. CARE Data Brief. 2020.
3. **Polit DF, Beck CT.** The content validity index: are you sure you know what's being reported? Critique and recommendations.

Research in Nursing & Health. 2006;29(5):489-97.

4. **Ben-David MF.** AMEE Guide No. 18: Standard setting in student assessment. Medical Teacher 2000.

5. **Muhamad Saiful Bahri Yuso.** ABC of Content Validation and Content Validity Index Calculation. Malaysian Association of Education in Medicine and Health Sciences 2019.

6. **Berk RA.** A consumer's guide to setting performance standards on criterion-referenced tests. Rev Educ Res. 1986;56:137-172.

7. **Davis LL.** Instrument review: getting the most from a panel of experts. Nursing Research. 1992;5(4):194-7.

8. **Lynn MR.** Determination and quantification of content validity. Nursing Research. 1986;35(6):381-5.

9. **Lawshe C.H.** A quantitative approach to content validity. Pers Psychol 1975;28, 563-575.