ORIGINAL ARTICLE

Objective Structured Clinical Examination as an instrument for evaluation of clinical competence in pediatrics. A pilot study

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ABSTRACT

Background. Assessment is an essential component of the teaching-learning process that stimulates and leads learners towards their goals and allows teachers to ascertain whether the students have acquired the necessary knowledge and clinical skills to be professionally competent. In medicine, the ideal assessment method does not exist; therefore, the use of several assessment instruments is advised; among them, the Objective Structured Clinical Examination (OSCE) has proven its advantage assessing clinical skills. The aim of this work is to describe the experience of teachers and students developing and applying an OSCE in a children's hospital.
Methods. Twenty OSCE stations were designed and applied in a pilot study. The assessment criteria for each station were defined. Individual marks were recorded and means for each station and year of residency were calculated (two first-year residents, seven second-year residents and 11 third-year residents).
Results. The OSCE lasted 2 h and 20 min. Overall, 12 stations were accredited. The overall mean was 6.53, standard deviation (SD) 0.62; the mean for first-year residents was 6.13 (SD 0.43), for second-year residents 6.26 (SD 0.60) and 6.76 for third-year residents (SD 0.59).
Conclusions. The OSCE is a valid and reliable method that permits an integral evaluation of clinical competence. The experience with this instrument has been limited to assessing postgraduate students. This study, however, shows that it is a useful tool that may be be valuable for resident pediatricians and their professors.
Key words: assessment, OSCE, graduate medical education, professional competence.

INTRODUCTION

The role of medicine in a changing society and patients' expectations of their physicians influence the evolution of contents and the implementation of study programs at healthcare training institutions.[1] Medical teaching-learning should agree with its operative context, with a trend nowadays to include less theoretical knowledge and to incorporate more skills and aptitudes to medical education programs.[2]

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Assessment is an essential part of the teaching-learning process that contributes to the continuous improvement of institutions and the professional development of all healthcare personnel.[3] The learning-assessment relationship should be considered as a cycle and not as a process separate from learning:[4] its main purpose is to optimize students' abilities, providing them with motivation and guidance for future learning and development.[5] Therefore, considering assessment as part of the training process, both should focus on competences.[6] According to Van der Vleuten and Schuwirt,[7] competence is integrated by cognitive, psychomotor and affective skills. All of these should be assessed using a range of procedures available to obtain information about students' learning and to develop value judgments on their progress.[8] Van der Vleuten[9] and Morrison[3] agree that usefulness of assessment methods is associated with their reliability, validity, required investment and acceptance from evaluators and students. Also, Van der Vleuten affirms that assessment is a useful criterion and has a significant impact on the teaching-learning process.[9] There is no ideal assessment method because all have different strengths and weaknesses;[5,7] therefore, we recommend using different instruments to obtain more precise results.[3,10,11]

The Objective Structured Clinical Examination (OSCE) was designed in 1975 by Harden et al. and is based on a series of assessment stations that can be static or dynamic, each focusing on a certain competence area.[12] This assessment method is applied with increasing frequency to healthcare areas.[13] OSCE is part of assessment protocols at healthcare institutions, faculties of medicine and scientific associations.[14]

We can highlight the following advantages offered by this method:

a) Can be used with different purposes: as a diagnostic exam,[15] as a training assessment[6] and to assign course grades. Examples of the above include the exam from the *Royal College of Physicians and Surgeons of Canada*, the U.S. evaluation of clinical skills by the Educational Commission for Foreign Medical Graduates,[6,16] the medical certification exam from the National Autonomous University of Mexico (UNAM, Faculty of Medicine) and the postgraduate exam for Family Medicine.[17]
b) Allows assessment of clinical competences without the characteristic bias of conventional assessment methods[6] because it is carried out within the patient's context, which increases objectiveness. Also, content variety allows the assessment of more areas over a shorter period of time.[18,19] Another advantage over conventional methods is the assessment of complex areas such as the physician-patient relationship, interrogation techniques, communication skills and cultural competences.[16,20]
c) Can be carried out at different sites simultaneously, which allows assessing a larger number of students at the same time.

Its main disadvantage is the implementation cost considering both time invested to design the tests as well as human and material resources required. Its use has been limited in pediatrics, possibly because it is difficult to standardize pediatric patients.[6,21]

At our institution, overall evaluation of pediatric residents is carried out through a monthly document that assesses their performance on different services, multiple-choice periodic exams and a final oral exam involving professors from different pediatrics areas. Also, residents must present a departmental exam of knowledge at the Faculty of Medicine, UNAM.

We created an OSCE at a tertiary-care pediatric hospital as a pilot study with 20 pediatric residents in order to develop a competence-assessment instrument that can be used to evaluate and reinforce knowledge and provide professors with tools to create future competence-assessment stations.

METHODS

We carried out an observational study with a qualitative and quantitative analysis of results. OSCE was carried out complying with the four stages as recommended by Harden and Gleeson:[16]

Planning: Design Instruments, Validate Contents, Elaborate Support Material

We obtained the workshop developed by the Postgraduate Studies Division from Faculty of Medicine (UNAM). This workshop was applied to 20 pediatricians in four sessions, each lasting 6 h. Of students, 18 were subspecialists with more than 10 years experience in their fields. A "brainstorming" session was carried out on the most relevant subjects for each pediatric subspecialty according to the Plan for Medical Specialization (PUEM) and 28 topics were selected by group consensus. These topics were used to build a competence matrix describing the type of station, main topics and components to be assessed. This matrix was used by the group of professors through two additional sessions. Then, drafts for each station were assigned to professors according to their subspecialty to fine-tune them and include assessment criteria in order to facilitate the recording and execution of activities to be carried out by student and include them in checklists. Then, checklists for each station were validated by knowledge from area professionals, special OSCE training, experts experience and institutional practice.

Afterwards, two of the authors met with each professor to fine-tune station contents. Once finished, 20 stations were selected for a pilot test. The following criteria were used in order to select topics: problem frequency, relevance in pediatrics, components to be assessed and feasibility to set up each station (Table 1). According to some reports and because duration of each station depended on what was being evaluated, it was agreed that all stations had a duration of 5 min and checklists were binary in order to reduce bias associated with the evaluator.[22]

The grading scale ranged from 0 to 10 and the cutoff point was established at 6.1 by consensus of experts. Final approval of study was done by the first three authors.

The experts selected the elements they considered relevant at each station: medical history, physical examination, paraclinical test interpretation, diagnosis, integral management and communication skills (Table 1).

A list of required materials was elaborated for each station and two professors were appointed to gather necessary resources for pilot test and to coordinate evaluators, observers and students. We invited professors who participated in the original workshops at UNAM as evaluators and we also invited professors and 5th year residents as observers in order for them to become familiar with this evaluation method.

The test was applied at the external consultation area of our hospital during off-work hours. We invited residents who had not been on the night shift the day before to participate in the test.

We identified dynamic stations as those including procedures that allow assessing the interaction with patients and their relatives while static stations were those where only clinical histories and complementary material were required (x-rays, laboratory tests, weight and height measurements, etc.)

Organization the Day Before the Exam: Prepare Support Material and Ultimate Details

Professors responsible for coordinating the test met to print required documents and organize material used during the test. Attendants were reminded about arriving on time for the test.

The Day of the Test: Instructions for Participants

Twenty eight professors met in a classroom where they received instructions to apply the exam. Of these profes-

Table 1. Twenty stations included on test pilot applied to pediatric residents at Hospital Infantil de México Federico Gómez

#	*Type*	*Area*	*CH*	*PE*	*LAB*	*DX*	*PLAN*	*Resources*
1	Dynamic	Radiology			X	X		Clinical summary and negatoscope
2	Dynamic	Pediatrics I		X		X		Office with lavatory, soap and towel, nurse, infantometer, medical mannequin, tape, scales and WHO graphs
3	Static	Endocrinology I				X	X	Clinical history
4	Dynamic	Dermatology I	X	X		X	X	Clinical history, photographs
5	Static	Endocrinology II				X	X	Clinical history, BMI tables
6	Dynamic	Pediatrics II		X		X		Standardized patient, office with lavatory, soap, towels, height rod, scales, graphs
7	Static	Neurology			X	X		Clinical history, negatoscope and cranial CT scan images
8	Dynamic	Allergy				X	X	Video of patient
9	Static	Pediatrics III					X	Board and markers
10	Dynamic	Cardiology	X			X	X	Standardized patient
11	Static	Oncology I			X	X		Clinical history, negatoscope and abdominal CT scan images
12	Dynamic	Neonatology		X		X	X	Neonatal resuscitation equipment, medical mannequin, gown, gloves, face mask, cap
13	Dynamic	Hematology			X	X		Clinical history, laboratory results
14	Static	Pediatrics IV			X	X	X	Clinical history
15	Dynamic	Dermatology II	X	X		X		Clinical history and photographs
16	Static	Emergencies				X	X*	Clinical history
17	Static	Genetics			X		X	Clinical history
18	Static	Gastroenterology				X	X	Clinical history
19	Dynamic	Infectology	X	X	X	X	X	Clinical history and photographs
20	Dynamic	Oncology II			X	X		Clinical history, laboratory results

#, station number; CH, clinical history; PE, physical examination; LAB, laboratory tests or clinical studies; DX, diagnosis.

sors, 20 were assigned as evaluators and eight as observers who were able to move between stations. They were asked not to provide feedback to students immediately because this was a pilot test and a brief meeting after the test was scheduled to provide feedback.

At the same time, 20 residents met in another classroom (two first-year residents, seven second-year residents, 11 third-year residents) where they received instructions for exam. We emphasized the importance of reading the instructions carefully and answering questions at each station. Because most residents were unfamiliar with this type of evaluation, they were informed that this was a pilot study.

The students were distributed in 20 offices with an evaluator who remained at the office during the process. Students shifted stations every 5 min; station change was notified through a loudspeaker.

After Exam: Reflection, Evaluation

Residents were asked to complete a survey at the end of exam. They were asked to attend a meeting immediately after the exam where they could express their opinions about this evaluation method, its applicability, feasibility and fairness. Observers returned their comments in writing. Professors were requested to rank each item on the checklists according to their relevance on evaluated skills. Each station had to complete 10 points.

Checklists were reviewed manually and a database was obtained from points obtained per student at each station. We obtained overall grades for each student, calculated averages per residence year at a given station and overall average per residence year. Statistical analysis was carried out using SPSS v.15.0 software.

Finally, according to the recommendations of Dolmans et al.,[23] we proceeded to analyze results not only by station but from the design experience and general application of the instrument.

RESULTS

Time required at each station was according to plan; at each station shift we allowed 1 min to reorder materials and allow student re-placement. There were no intermediate rest stations; however, some stations required <5 min to solve. Total duration of the exam was 2:20 h. Because pediatric patients are generally nonstandardized, we included only one healthy 9-year-old boy at a single station; at another station one physician played the role of a nurse and at another station a resident played the role of the mother of a pediatric patient. These participants were trained to provide the same information to all students.

Of stations, 12 were approved in general and eight were not approved. The average grade for all stations was 6.53 (SD 0.62). The station with the highest average was associated with cardiology (Num. 10) reaching 8.90 points (SD 1.6) and the station with the lowest average was gastroenterology (Num. 18) with 3.04 points (SD 0.98). Averages per year of residence were as follows: 6.13 (SD 0.43) R1, 6.26 (SD 0.60) R2 and 6.76 (SD 0.59) R3 (Table 2).

The survey applied to professors and students at the end of the exam reported 60% of participants consider this a fair evaluation, 65% regarded it as practical and 65% considered it useful for their professional career. Of students, 25% considered that the instructions were insufficient, whereas 45% considered this was an appropriate way to measure knowledge.

DISCUSSION

The concept of assessment as a driving force behind the learning process is being increasingly considered as good practice in the teaching-learning process. Therefore, the effect of evaluation over the learning process acquires increasing acceptance and relevance.[7]

OSCE is a tool that evaluates the third stage of Miller's pyramid (what a student is able to do) and has demonstrated to be a valid and reliable method that allows evaluation of multiple essential clinical skills in postgraduate programs that cannot be assessed using traditional methods. This instrument favors the integration of three dimensions of learning evaluation. It allows a more objective evaluation of multidimensional attributes involved in clinical competences without biases characteristic of competence-evaluation methods[6] because it is done within the patient context. In this method, all students go through the same stations and this complexity can be controlled in a standardized way.[16] It includes different evaluators and uses checklists to avoid biases associated with grades awarded by professors.[18] Also, diversity of contents allows the evaluation of more areas in less time and its dynamic environment encourages students to learn more because it has been demonstrated that learning is more significant when carried out interactively.[18,19]

Table 2. OSCE results according to station and year of residence

Area	*Group*	*Minimum*	*Maximum*	*Average*	*SD*
1) Radiology	R1	4.44	4.44	4.44	0
	R2	0	6.66	3.00	2.77
	R3	0	6.66	4.24	1.84
	Overall			3.83	2.10
2) Pediatrics I	R1	5.45	7.72	6.59	1.60
	R2	7.27	9.09	7.92	0.68
	R3	6.36	9.09	8.14	0.91
	Overall			7.90	0.97
3) Endocrinology I	R1	2.50	8.75	5.62	4.41
	R2	5.00	10.00	8.03	1.74
	R3	2.50	10.00	7.72	2.15
	Overall			7.62	2.21
4) Dermatology I	R1	5.00	10.00	7.50	3.53
	R2	3.57	7.85	6.73	1.42
	R3	1.42	10.00	6.36	2.62
	Overall			6.60	2.24
5) Endocrinology II	R1	7.27	10.00	8.63	1.92
	R2	5.45	10.00	8.82	1.79
	R3	7.27	10.00	9.09	0.90
	Overall			8.95	1.29
6) Pediatrics II	R1	3.50	6.00	4.75	1.76
	R2	4.00	8.00	5.78	1.38
	R3	2.00	7.50	4.81	1.56
	Overall			5.15	1.50
7) Neurology	R1	4.66	6.00	5.33	0.94
	R2	4.66	6.66	5.90	0.80
	R3	3.30	8.00	6.18	1.49
	Overall			6.00	1.20
8) Allergy	R1	3.12	8.12	5.62	3.53
	R2	5.00	8.12	6.78	0.98
	R3	3.75	8.12	6.19	1.23
	Overall			6.34	1.37
9) Pediatrics III	R1	2.50	3.75	3.12	0.88
	R2	2.50	5.00	2.85	0.94
	R3	2.50	7.50	3.97	2.15
	Overall			3.50	1.70
10) Cardiology	R1	6.36	8.18	7.27	1.28
	R2	6.36	10.00	9.22	1.43
	R3	4.54	10.00	9.00	1.69
	Overall			8.90	1.60
11) Oncology I	R1	6.25	7.50	6.87	0.88
	R2	8.75	10.00	9.28	0.66
	R3	7.50	10.00	8.18	1.09
	Overall			8.62	1.13
12) Neonatology	R1	3.52	7.64	5.58	2.91
	R2	7.64	9.41	8.15	0.62
	R3	5.29	10.00	8.18	1.52
	Overall			7.91	1.55

Table 2. (continued), OSCE results according to station and year of residence

Area	*Group*	*Minimum*	*Maximum*	*Average*	*SD*
13) Hematology	R1	7.77	8.88	8.33	0.78
	R2	4.44	10.00	6.82	2.35
	R3	4.44	10.00	7.87	1.44
	Overall			7.55	1.80
14) Pediatrics IV	R1	6.15	7.69	6.92	1.08
	R2	3.84	5.38	4.72	0.82
	R3	5.38	10.00	7.83	1.27
	Overall			6.65	1.82
15) Dermatology II	R1	5.45	5.45	5.45	0
	R2	2.72	5.45	4.15	1.27
	R3	3.63	6.36	5.20	0.91
	Overall			4.86	1.11
16) Emergencies	R1	3.63	5.45	4.54	1.28
	R2	2.72	7.27	4.80	1.45
	R3	2.72	10.00	6.77	2.45
	Overall			5.86	2.23
17) Genetics	R1	3.500	8.00	5.75	3.18
	R2	1.00	8.50	3.35	3.37
	R3	2.00	10.00	6.77	2.59
	Overall			5.47	3.20
18) Gastroenterology	R1	3.33	3.33	3.33	0
	R2	1.66	4.16	3.09	0.79
	R3	0.83	5.00	2.95	1.19
	Overall			3.04	0.98
19) Infectology	R1	9.16	10.00	9.58	0.58
	R2	6.66	9.16	8.21	1.21
	R3	4.16	9.16	7.80	1.75
	Overall			8.12	1.50
20) Oncology II	R1	5.71	9.04	7.38	2.35
	R2	3.80	10.00	7.68	2.58
	R3	5.71	10.00	7.70	1.47
	Overall			7.66	1.88

SD, standard deviation

There has been limited experience in the use of OSCE in postgraduate programs, even more if we consider pediatrics programs; however, there is evidence of validity involving concurrence, contents and construction as well as a high level of reliability provided by this type of exam.[24] Hilliard and Tallett demonstrated that homogeneity of tasks to be accomplished at stations influences positively on reliability.[25] Other factors that favor reliability are the use of checklists instead of ranges, training and standardization of actual and simulated patients, defining a maximum time to complete the exam (3-4 h), the use of active stations and contents variety.[26] Reliability is affected when patients have not been standardized correctly,[6] when students receive a subjective evaluation and, in general, when the organizing committee fails to design and apply the exam.[27]

Using this pilot study we accomplished the goal of having a competence-evaluation method for pediatric students that could be used for diagnostic, learning and cumulative evaluation because traditional methods lack the objectiveness required to these ends. OSCE was demonstrated to be a feasible method for a pediatric hospital. We

reached a good level of organization with some difficulties and a cooperative and team-working environment was perceived during the process. Both professors and students reported being fatigued at the end of the exam; however, we should consider that it was applied in the afternoon. It would be more suitable to apply the exam during the morning hours and to design two or more rest stations.

There is no purpose to discuss qualities of evaluators or whether their experience or training affects the exam reliability.[13] We strongly recommend having an adequate number of different stations to improve the internal validity of the instrument.[18] Feasibility of stations and student fatigue are factors to be analyzed when designing an exam to decide on the number of stations to be included in the evaluation.[13]

It is not possible to calculate the cost of the exam; however, it is important to highlight that it requires an additional effort from professors and time for its design and application. Other studies have mentioned as disadvantages the time personnel invest in evaluation, organization, cost and confidentiality of this type of exam.[12,13,18,28] It has even been reported that this type of exam increases stress among students, which may be perceived as an advantage because actual clinical practice is carried out under stress.[18,29]

In conclusion, implementation of this pilot study allowed the collaborative participation of professors and students and favored the identification of strengths and weaknesses associated with the instrument as well as obstacles that will have to be overcome for its future application. OSCE is a repeatable and valid method to evaluate the clinical competence of pediatric residents when used together with other evaluation methods because it provides an objective measure of the progress of physicians in training. Therefore, future investigations will be needed in order to demonstrate its usefulness as a diagnostic, training and cumulative evaluation tool for pediatric residents.

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