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Level of competencies in Comprehensive Health Care in medical students through the Mini-Clinical Evaluation Exercise (MINI-CEX)

Evaluación del nivel de competencias en cuidado integral en estudiantes de medicina con Mini-Clinical Evaluation Exercise (MINI-CEX)

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SUMMARY

Objective: To assess the level of competencies in Comprehensive Health Care in medical students before and after Family Medicine rotation through the Mini-Clinical Evaluation Exercise (MINI-CEX). ***Methods:*** A quantitative, quasi-experimental, pre-post study was conducted at primary care teaching facilities on 115 senior medical students. The Mini-CEX instrument was applied at the beginning and at the end of a month of a family medicine rotation. The evaluation was carried out by teachers trained in the use of Mini-CEX. The study collected the results and analyzed them with the statistical package STATA 17.0. ***Results:*** The average age was 23.4 ± 1.4 years, and 61.7% were women. At the beginning of the rotation, 15% of the students had a satisfactory global evaluation, while at the end of the rotation, 88% had a satisfactory evaluation. Clinical judgment was the competence which increased the most (68%). Cronbach's Alpha resulted in 0.9383. ***Conclusions:*** The training of medical students in a family medicine rotation contributes to the achievement of competencies in a comprehensive approach.

KEYWORDS: Family practice, Integrality in Health, Medical education, Primary Health care.

RESUMEN

***Objetivo*:** Evaluar el nivel de competencias en cuidado integral a través del Mini-Clinical Evaluation Exercise (MINI-CEX). ***Material y métodos*:** Se realizó un estudio cuantitativo, cuasi experimental, tipo pre-post, en establecimientos docentes de atención primaria, en 115 estudiantes del último año de medicina. Se aplicó el instrumento Mini-CEX al inicio y al final de un mes de rotación en medicina familiar. La evaluación fue realizada por profesores entrenados en el uso del Mini-CEX. El análisis se realizó con el paquete estadístico STATA 17.0. ***Resultados*:** La edad media fue de 23,4 ± 1,4 años, y el 61,7% eran mujeres. Al inicio de la rotación, el 15% de los estudiantes tenía una evaluación global satisfactoria, mientras que al final de la rotación, el 88% tenía una evaluación satisfactoria. El juicio clínico fue la competencia con mayor mejora (68%). El alfa de Cronbach del instrumento fue de 0,9383. ***Conclusiones*:** La formación de los estudiantes de medicina en una rotación de medicina familiar contribuye al logro de competencias con un enfoque integral.

PALABRAS CLAVE: Medicina familiar y comunitaria, integralidad en salud, educación médica, atención primaria de salud.

INTRODUCTION

The Comprehensive Model of Care was established as the model of healthcare in Peru in 2020 by the Ministry of Health. It is defined as "person, family and community centered health actions and interventions aimed to promote healthy habits and behaviors, to preserve health, recover from disease, rehabilitate, alleviate physical or mental suffering, strengthen family and social protection, considering the biopsychosocial dimensions of individuals and applying the approaches of human rights, gender, interculturalism and equity in health". [1]

The Peruvian profile of essential competencies, which guides the training of health professionals, was approved in 2020 to ensure that the healthcare workforce addresses the needs of health services and society in general [2]. It is based on the achievement of an outcome-based competencies framework, resembling the competencies of the CANMEDS framework (developed by the Royal College of Physicians and Surgeons of Canada, a widely accepted and applied medical competency framework) [3]. The teaching and learning scenarios that occur in primary care expose the student to the most frequent health problems and increase the possibility of understanding the need for a system based on Primary Health Care [4]. This model facilitates learning in Primary Care centers, encouraging collaborative and self-directed learning, the provision of teacher development, as well as strengthening of evaluation and feedback procedures. [5]

In Peru, the medical student education lasts seven years. From the 4th to the 7th year, educational activities are scheduled more frequently in clinical settings with greater exposure to hospital training. The sixth year of medicine, in some universities, has been called a medical externship and classically included hospital rotations in Internal Medicine, Pediatrics, Obstetrics & Gynecology, and Surgery, which are then repeated in the final year of training called medical internship. [6]

In 2022, Universidad Peruana Cayetano Heredia, one of the oldest in the country, started a family medicine rotation in the 6th year of training. In this rotation, students follow the outpatient consultation under supervision and participate in health promotion activities carried out in the health centers with the multidisciplinary health team. The family medicine rotation aims to expose the students to common and diverse problems in primary care facilities and to accomplish comprehensive care competencies during an individual's life course. [7]

In these learning scenarios, the students value having an adequate number and variety of patients while being supervised by preceptors who provide feedback and are willing to discuss their reasoning processes and delegate responsibilities [8]. In this sense, students are evaluated with tools of direct observation that link the objectives and goals of the study plans [9]. Mini-CEX is an instrument that has good, solid validity for the evaluation of clinical competencies with the direct

observation of doctors in training [10]. Moreover, it is an appropriate instrument for immediate feedback, is based on real clinical cases with different typologies and complexity, and different evaluators [11], and can be used without modifications in Latin American countries.

In the previous context, the objective of the study was to determine the level of competencies in comprehensive health care in medical students before and after the family medicine rotation through Mini-CEX.

METHODS

Study Design: Quantitative, quasi-experimental, pre–post study. The study was conducted from June to December 2022. Data was collected from the database of monthly evaluations carried out by each faculty member during the first and last week of rotation. Overall, 125 students did the clinical rotation during the study period, of which 115 (92%) agreed to participate in the study. The sampling was non-random, based on convenience. Regarding the selection criteria, we have:

Inclusion criteria: medical students enrolled in the sixth year of the undergraduate program at UPCH, who completed the family medicine rotation between June and December 2022, and who voluntarily agreed to participate by providing written informed consent. *Exclusion criteria:* students who did not complete both the initial and final Mini-CEX evaluations, or who withdrew from the rotation before its completion.

To administer this research, we trained nine faculty family doctors in the theory and practical course of Mini-CEX. The course lasted two weeks and a total of 15 hours of dedication. The Mini-CEX was previously validated in Spanish and adapted for use with Peruvian medical students, ensuring cultural and linguistic appropriateness [12]

The Mini-CEX instrument evaluates clinical interview skills, physical examination skills, professionalism, clinical judgment, communication skills, organization, and efficiency. For the scoring of each of the seven dimensions, the evaluator uses a Likert scale from 1 to 9, which is grouped into three categories: from 1 to 3 unsatisfactory, from 4 to 6 satisfactory, and from 7 to 9 superior. [13].

At the beginning of the family medicine rotation, each faculty member explained the objectives of the rotation and the evaluation to students through the Mini-CEX instrument. We explained the study to the students and informed them individually that participation was voluntary and would not influence their grades. We then obtained consent from the students to participate in the study and use deidentified evaluation data collected at the beginning and end of the rotation. As per the policy of the university, patients were informed of the role of the student, including the provision of direct supervision of the student by a family physician.

The results were stored in a protected database. The statistical analysis was run with the statistical package STATA 17.0 (Stata Corp. 2021. Stata Statistical Software: Release 17. College Station, TX: Stata Corp LLC), using the Excel database. Pre and post-intervention scores were compared using a paired t-test or Wilcoxon test, and internal consistency was assessed with Cronbach's alpha.

Ethical considerations

Participation in the study was voluntary. Informed consents were obtained from participants who agreed to participate. The research project was approved by the Comité Institucional de Ética en Investigación of the Universidad Peruana Cayetano Heredia with Certificate No. 128-01-22.

RESULTS

Of the 115 students in the study, 71(61.7%) were female. The average age of participants was 23.4±1.4 years, with a range of 20 to 28 years. The 23-25 age group is the largest (67%), followed by the 20-22 age group (24.4%) and finally the 26-28 age group with only 8.6%.

In the evaluation at the beginning of every rotation, the scenarios were of medium complexity, and only 14.8% of the evaluations were graded satisfactory, with 'organization' being the worst graded competency (Table 1).

At the end of the rotation, the global grading was satisfactory in 87.8% of evaluations, with 'professionalism' the best-marked competency. Most of the scenarios were of medium complexity (Table 2).

None of the students obtained a superior score, either at the beginning or at the end of the rotation. In all competencies, as well as in global scores, there was a substantial improvement in the final scores compared to the initial evaluation (Graphic 1).

Table 1. Results of the evaluation with Mini-CEX in medical students at the beginning family medicine rotation (n = 115).

Competency	Result	
	Unsatisfactory	Satisfactory
Global scoring	98 (85.2)	17 (14.8)
-Anamnesis	82 (71.3)	33 (28.7)
-Physical exploration	86 (74.8)	29 (25.2)
-Professionalism	65 (56.5)	50 (43.5)
-Clinical judgement	93 (80.9)	22 (19.1)
-Communication	86 (74.8)	29 (25.2)
-Organization	100 (87.0)	15 (13.0)
Scenario complexity	Low: 6 (5.2%)	
	Medium: 108 (93.9%)	
	High: 1 (0.8%)	

None of the students achieved higher scores across all assessed competencies.

Moreover, a significant improvement in Mini-CEX scores was observed throughout the clinical rotation (Table 3). Overall, there was a substantial increase in global scoring from the beginning to the end of the study period ($p < 0.001$). Specific improvements were noted in anamnesis, physical exploration, professionalism, clinical judgement, communication, and organization skills.

Cronbach's Alpha, measuring internal consistency of the instrument, was 0.9383.

Table 2. Results of the evaluation with Mini-CEX in medical students at the end of the family Medicine rotation (n = 115).

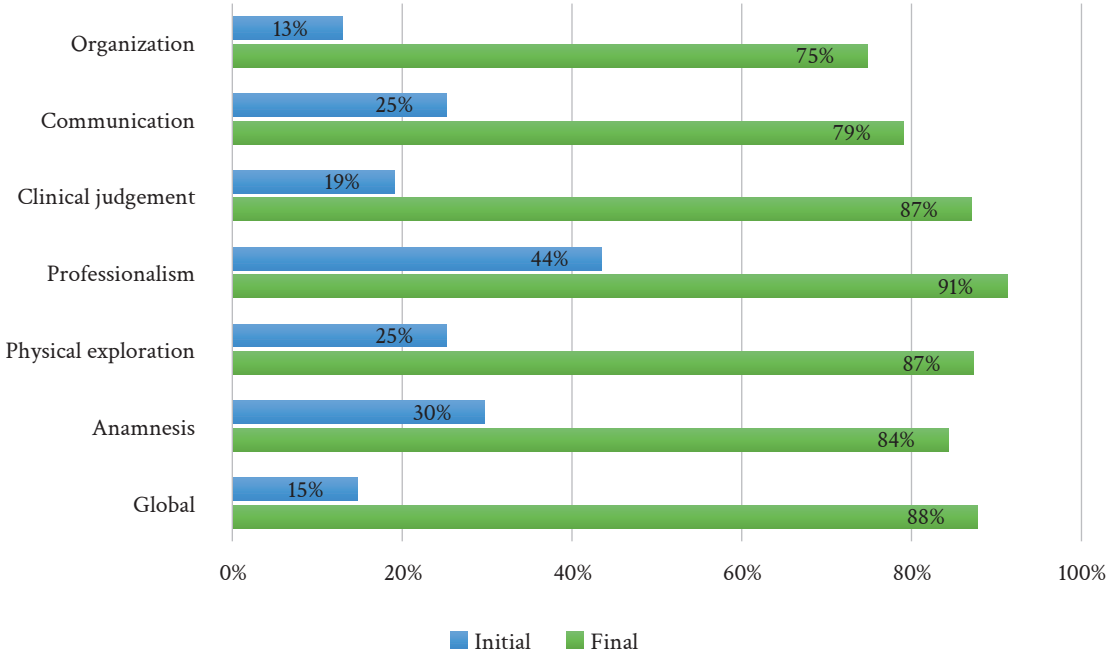
Competency	Result	
	Unsatisfactory	Satisfactory
Global scoring	14 (12.2)	101 (87.8)
- Anamnesis	18 (15.7)	97 (84.3)
- Physical exploration	26 (22.6)	89 (77.4)
- Professionalism	10 (8.7)	105 (91.3)
- Clinical judgement	15 (13.0)	100 (87.0)
- Communication	24 (20.9)	91 (79.1)
- Organization	29 (25.2)	86 (74.8)
Scenario complexity	Low:	6 (5.2%)
	Medium:	101 (87.8%)
	High:	8 (7.0%)

None of the students achieved higher scores across all assessed competencies.

Table 3. Results of the MiniCEX evaluation of externship students at the beginning and end of the family medicine rotation.

Variables	MiniCEX Scoring		p
	Initial (n=115)	Final (n=115)	
Global scoring*	3.0 (2.87 - 3.10)	4.1 (4.02 - 4.24)	<0.001[&]
Anamnesis*	3.1 (2.93 - 3.21)	4.1 (3.96 - 4.19)	<0.001[&]
Physical exploration*	3.0 (2.86 - 3.15)	4.0 (3.85 - 4.09)	<0.001[&]
Professionalism**	3.0 (3 - 4)	4.0 (4 - 5)	<0.001†
Clinical judgement**	3.0 (3 - 3)	4.0 (4 - 4)	<0.001†
Communication*	3.0 (2.88 - 3.16)	4.0 (3.89 - 4.16)	<0.001[&]
Organization*	2.8 (2.68 - 2.94)	3.9 (3.79 - 4.07)	<0.001[&]

* *Mean and 95% confidence interval are reported*
**, *median and interquartile range*
† *Wilcoxom test*
[&] Student t test



Graphic 1. Level of competence reached at the beginning and end of the family medicine rotation.

DISCUSSION

In our study, it was found that a four-week rotation in family medicine improved the comprehensive health care competencies of senior medical students. To our knowledge, this is the first time that the implementation of a new teaching-learning scenario has been evaluated regionally at the primary care level, through the observation of the acquisition of clinical competencies for comprehensive health care.

The training of medical students in the primary care field allows the future doctor to understand the importance of comprehensive care [14], as well as the role of the family doctor. The development of practices in this area would help strengthen the patient's skills and knowledge about comprehensive health care, since the first level of care is characterized by a comprehensive approach.

Mini-CEX instrument allowed us to observe the competencies presented by students before and after their exposure to the rotation, observing that said exposure achieves the desired objectives of the rotation. In this sense, this instrument enables the provision of feedback in a timely and practical way to students and the teaching team, as well as to observe the fulfillment of the rotation objectives.

While the Mini-CEX has been used as an instrument to evaluate the training of medical residents [12], its use has also been extended to undergraduate students of human medicine [15-17]. Our study identified Mini-CEX as a useful tool for clinical training in undergraduate medicine students. While the Cronbach's alpha in our study was high (>0.90), suggesting a high internal consistency of the instrument, we used only two measurements. Generally, 6 to 10 measurements are suggested to ensure reliability. [18]

The students in our study spent four weeks in the family medicine service, less time than the seven weeks in general medicine in the study carried out by Martinsen et al. [19]. However, the improvement in comprehensive care competencies was significant. Training by competencies in medical students is necessary [18], and even more so, the development of research that demonstrates the results of training in non-hospital settings, which are increasingly frequent spaces in medical training.

The tutors received training for 15 hours, distributed in several sessions of three hours each, before the application of the instrument, longer than in the case of the study by Martinsen [19], where the tutors were trained for 45 minutes before the study. This fact led to a broader knowledge of the tool by the tutors and to consistency in scoring patterns by evaluators. This training led to the evaluation being more objective and less dispersed among evaluators, emphasizing the need to adequately train tutors in the use of Mini-

CEX for objective assessment and improvement of students' competencies. Therefore, we emphasize the importance of optimal training of the training results evaluator, since this practice improves the results of a study. [20]

The notable change in the skills between the initial and final evaluation suggests that the feedback provided by the tutors was adequate and had an impact on the result. Nishan et al. [21], carried out a study with students of medicine, where the satisfaction of the evaluator was related to a better performance of their feedback. Although we did not collect data on the satisfaction of the tutors, after the training on the Mini-CEX, the tutors expressed satisfaction with the tool and its usefulness.

Our study had a few limitations, including the interval between measurements of one month, that the evaluators were the tutors themselves, and that the evaluations were performed twice, unlike other studies, including the Mini-CEX validation study [22,23]. Although the instrument was consistent and proved sufficient to detect significant change, this study employed a single-group pre-post design without a control group, which limits the ability to attribute the observed improvements solely to the intervention. Future studies should consider including a control group to strengthen causal inferences.

Mini-CEX is an assessment tool used to evaluate the performance of students or residents in clinical settings, specifically by observing their interactions with patients. It is not an evaluation of the program itself, but rather a tool for assessing individual clinical skills. Although results may lead to changes in teaching practices, evaluating programs and modifying assessment tools requires a different approach [24]. This will allow educators to reflect on the limitations in learning [25] and on the performance of the students. Furthermore, it will help educators determine if they have been exposed to representative situations of daily, real practice, a strong point of this study, given that it was carried out in the rotation of outpatient medicine for students and with family medicine professionals.

Our results give us evidence that it is necessary to expose medical students at our university to primary care settings and train them to develop competencies in comprehensive health care. Future studies should develop experimental methodology to determine the long-term effects of this type of training in medical students.

In our study, we observed that timely feedback from students directly affects their subsequent performance, improving skills in all areas of the Mini-CEX instrument during an outpatient rotation. This experience in learning tracking can be replicated in other medical learning scenarios.

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