International Journal of Gerontology 17 (2023) 124–129
https://doi.org/10.6890/IJGE.202304_17(2).0009

International Journal of Gerontology

journal homepage: http://www.sgecm.org.tw/ijge/

Original Article

Analysis of Intensive Care and ACGME Core Competencies between PGY2 and R1 Residents of Internal Medicine

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ARTICLE INFO

Accepted 23 June 2022

Keywords:
blended learning,
core competencies,
critical care,
internship and residency,
simulation-based education

SUMMARY

Background: In Taiwan, all trainees (first-year residents (R1) and postgraduate year two (PGY2)) can apply for second-year residents (R2) physician level since 2021. However, there is no data to assess whether PGY2 will be equal in ability to R1 when dealing with intensive care situations. Therefore, we aimed to evaluate trainees' Accreditation Council for Graduate Medical Education (ACGME) core competencies in the PGY period and intensive care core competencies before achieving R2 status. We also examined the correlation between the two.

Methods: We retrospectively collected PGYs' examination scores on a small-scale objective structured clinical examination and evaluated the old PGY1 or PGY2 scores from the intensive care simulation-based education (SBE) workshop for PGY2 and R1 trainees about three months before the R2 classification. The study period was 2018 to 2020.

Results: A total of 71 trainees (58 R1 and 13 PGY2) attended the intensive care SBE workshop. There was no significant differences in average simulation total scores among 2018 to 2020 ($p = 0.172$). A comparison of the test scores of R1 in internal medicine ($n = 23$) with PGY2 ($n = 13$) in 2020 revealed no significant difference ($n = 0.884$). Furthermore, the total scores for PGY's ACGME core competencies were positively correlated with the total scores for R1 or PGY2 simulation performance in intensive care ($r = 0.580$, $p < 0.001$).

Conclusion: Our findings revealed no significant difference between PGY2's and R1's average simulation total scores. Thus, these trainees have the competencies required to move on to R2. The PGY's ACGME core competencies are also positively correlated with intensive care simulation performance score in the future.

1. Introduction

The general and internal medicine training is organized based on the six core competences defined by the Accreditation Council for Graduate Medical Education (ACGME), which include: 1) patient care; 2) medical knowledge; 3) practice-based learning and improvement; 4) systems-based practice; 5) interpersonal and communication skills; and 6) professionalism. The residents of general and internal medicine are expected to acquire ACGME general competencies, which is why core competency-based learning is the current trend in medical education. As such, a reliable method to assess residents' core competency is very crucial. Gordon et al.[1] emphasized the importance of the assessment of educational outcomes in the accreditation of ACGME residency programs. Several methods including the small-scale objective structured clinical examination (OSCE)[2] and simulation-based education (SBE) with flipped classrooms have been used to assess and train postgraduate year's (PGY) ACGME core competencies and residents' intensive care performance.[3,4]

Nowadays, the OSCE is widely used to assess the clinical competence of medical students or residents. Sloan et al.[5] reported that the 15-station OSCE is a highly reliable and valid clinical examination that provides unique information about the performance of individual surgery residents and quality of postgraduate training programs. Yang et al.[6] developed a core competency-based OSCE to evaluate the clinical performance of PGY one (PGY1) residents and concluded that the six-core-competency-based OSCE was reliable, with a Cronbach's alpha ranging from 0.69 to 0.87 in three years. Wallenstein et al.[7] stated that an early-residency OSCE has the ability to predict future postgraduate performance on a global level and in specific core competencies. Lin et al.[2] demonstrated that the ACGME core competency-based small-scale OSCE allows a global, patient-centered assessment of PGY residents' learning outcomes and may provide a reference for future improvements in PGY internal medicine training.

SBE, a method to develop health professionals' knowledge, skills, and attitudes, while protecting patients from unnecessary risks, is also widely applied in various fields. In previous studies, SBE

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has been proven to be more effective than traditional training. Kory et al.[8] demonstrated that traditional training was not sufficient for residents to achieve proficiency in initial airway management due to inadequate equipment usage. This suggested that scenario-based training with a computerized patient simulator is more effective in training medical residents compared to the traditional experiential method. Singer et al.[9] reported that the first-year residents (R1) who completed a simulation-based educational intervention demonstrated higher clinical competency than the third-year residents (R3) who did not undergo simulation training. In recent years, SBE has been extensively used for resident intensive care unit training. Concerning critical care, Saavedra et al.[10] verified that simulation programs have significantly improved the comfort of the residents in caring for critically-ill pediatric patients. Alinier and Platt also reported that within the critical care field, simulation has generated considerable interest and there is a growing consensus that it should be used as a learning and teaching strategy within this environment.

In Taiwan, a Postgraduate General Medical Training Program was constructed and executed by the Department of Health starting July 2003. The PGY1 general medical training program is a 12-month course which includes four months of internal medicine training. An internal medicine training curriculum includes first- to sixth-year medical students, internship, PGY1, R1, the second-year residents (R2), R3 courses, and then fellowship. In 2019, the postgraduate internal medicine training curriculum was changed from three years (intern, old PGY1, and R1) into two years (PGY1 and PGY two (PGY2)) (Table 1). By 2021, all trainees (R1 and PGY2) could apply for the R2 physician level. However, there is insufficient data to support the fact that PGY2 residents will be equal in ability to R1 trainees when dealing with intensive care situations in the future. For this reason, we included the results from two studies[2,3] conducted in the MacKay Memorial Hospital over the past few years to evaluate trainees' ACGME core competencies in the PGY period and intensive care core competencies before achieving R2 status. One study[2] trained and assessed the PGY residents' six core competencies defined by the ACGME using the five-station small-scale OSCE of simulated scenarios; the other study[3] evaluated the core competencies of internal medicine R1s for the intensive care using the flipped classroom method and the five-station simulation-based education. Further, we examined the correlations between trainees' ACGME core competencies in the PGY period and intensive care core competencies.

2. Materials and methods

2.1. Subjects

We retrospetively recruited a total of 106 PGY1 residents who were evaluated by a small-scale OSCE before finishing the three-month old PGY or PGY2 internal medicine training course at MacKay Memorial Hospital in the years 2018 (n = 38), 2019 (n = 39), and 2020 (n = 29). The study also invited internal medicine residents, including a total of 58 R1s in the years 2018 (n = 19), 2019 (n = 16), and 2020 (n = 23), and 13 PGY2 residents in 2020, who were evaluated by intensive care SBE workshop three months before the R2 classification. This study was conducted and approved by the Institutional Review Board of MacKay Memorial Hospital, Taipei, Taiwan.

2.2. Design of small-scale OSCE for PGY ACGME core competence examination

The small-scale OSCE included five stations with different scenarios, including: 1) a visit to an inpatient with sudden stroke; 2) explanation of end-of-life medical decisions and the appropriate care to be provided; 3) the use of medical evidence to explain the pros and cons of medical treatment to the patient; 4) explanation of the consultation results (positive for infection) to a patient with fever of unknown origin and suspected human immunodeficiency virus (HIV) infection accompanied by his wife; and 5) communication with a patient with emergent hemodialysis. Each OSCE station consisted of a 15-minute feedback type evaluation in which experienced standardized patients provided a simulated scenario typical of what the PGY1 residents may encounter in their clinical practice. The five ACGME core competencies tested in the small-scale OSCE included patient care, interpersonal and communication skills, professionalism, systems-based practice, and practice-based learning and improvement. The correspondence of the OSCE scenarios to the ACGME core competencies is provided by study by Lin et al.[2]

2.3. Design of SBE workshop for residents' intensive care examination

The intensive care SBE workshop included a 240-minute training course comprising a pre-curriculum test, interactive class, SBE (six scenarios), discussions, and a post-curriculum feedback questionnaire.

Each teacher was responsible for a specific scenario and a set of six multiple-choice questions about the simulated operation. The pre-curriculum test encompassed 30 questions. The results were compared with the residents' SBE performance. In addition, the teachers also provided the teaching materials for each scenario, namely 50 PowerPoint slides that included an outline and the core ideas. Additionally, each teacher recorded a 60-minute lecture that introduced the residents to the six major topics. Residents were asked to read the handouts carefully before participating in the subsequent

Table 1
The old and new postgraduate training curriculum of internal medicine in Taiwan.

Duration exam	6 years	1 year	1 year **PGY OSCE**	1 year **SBE**	1 year	1 year
Old curriculum	M1–M6 Program (2 years in hospital)	Intern	**Old PGY1** **2018** **2019**	**R1** **2018** **2019** **2020**	R2	R3
Duration exam	6 years	1 year	1 year **PGY OSCE**	**SBE**	1 year	1 year
New curriculum	M1–M6 Program (2 years in hospital)	PGY1	**PGY2** **2020**	**2020**	R2	R3

M1: first-year medical students; M6: sixth-year medical students; OSCE: objective structured clinical examination; PGY: postgraduate year; PGY1: postgraduate year one; PGY2: postgraduate year two; SBE: simulation-based education; R1: first-year residents; R2: second-year residents; R3: third-year residents.

training and interactive learning in the workshop.

The SBE included six stations with different scenarios. The six SBE scenarios included: 1) first aid teamwork in the intensive care unit (ICU); 2) implantation of a pulmonary artery catheter and a pulse contour cardiac output associated with reading reports; 3) mechanical ventilator setting and intubation in difficult airways; 4) a sepsis bundle; 5) medical error and physician-patient communications; 6) acute renal failure with the timing of hemodialysis. Each SBE station consisted of a 16-minute practice session and 5-minute real-time feedback and reflection. The six-station SBE was designed to enhance residents' ability to meet the six ACGME core competencies.

Following the six-station SBE, the residents took a short break before proceeding to a 30-minute panel discussion and feedback session. Finally, a post-curriculum questionnaire was conducted to assess their satisfaction with the workshop and post-training self-evaluation.[3]

2.4. Assessments

A checklist based on the small-scale OSCE and intensive care SBE workshop was used to assess the students. The scores were recorded according to their responses. Ratings were entered using Likert scales (range 1–5), ranging from: 1 = unsatisfactory, 3 = satisfactory, and 5 = superior.

We evaluated the difference of scores on small-scale OSCE for ACGME core competencies among PGY1 residents during 2018 to 2020. We also compared the R1's SBE scores on intensive care with PGY2 residents' SBE scores on intensive care to confirm whether PGY2 residents are equal in ability to R1s when dealing with intensive care situations in the future. We also evaluated the correlations between residents' ACGME core competencies in the PGY period and intensive care core competencies before achieving R2 status.

2.5. Statistical analysis

Analysis of all collected data was performed using the SPSS 23.0 statistical package (SPSS Inc., Chicago, IL). The data from the small-scale OSCE and intensive care SBE were shown as mean ± standard deviation or medians (interquartile ranges). Each analyte was tested for normality using the Kolmogorov-Smirnov test. One-way analysis of variance or Kruskal-Wallis H-test was conducted to evaluate differences among three groups. Two independent sample t-tests or the Mann-Whitney U-test was used to evaluate differences between two groups. We also used Pearson's correlation coefficient to determine the association between PGY trainees' ACGME core competencies and intensive care simulation performance scores in the future. All statistical analyses were based on two-sided hypothesis tests with a significance level of $p < 0.05$.

3. Results

A total of 106 PGY1 residents participated in the small-scale OSCE training and test in the years 2018 (n = 38), 2019 (n = 39), and 2020 (n = 29). The results showed no significant differences in their test total scores (p = 0.917, Table 2). In terms of ACGME competencies, the result showed significant differences in their test scores in three core competencies: medical knowledge (p = 0.007), professionalism (p = 0.004), and practice-based learning and improvement (p = 0.047). There were no significant differences in their test scores in other core competencies: patient care (p = 0.410), interpersonal and communication skills (p = 0.123), and systems-based practice (p = 0.119).

A total of 71 trainees, including 58 R1 in 2018 (n = 19), 2019 (n = 16), 2020 (n = 23), and 13 PGY2 residents in 2020 attended the intensive care SBE workshop. The results showed no significant differences in their average simulation total scores (p = 0.172, Table 3). In simulation scenario 3 (mechanical ventilator setting and intubation in difficult airways), there was significant difference in their test scores (p = 0.014).

A comparison of the test average simulation total scores of R1 in internal medicine (n = 23) with PGY2 residents (n = 13) in 2020 revealed no significant differences (n = 0.884, Table 4). However, PGY2

Table 2
The scores of PGY1 residents' ACGME core competencies in 2018, 2019 and 2020 (Mean ± standard deviation; medians (interquartile ranges)).

ACGME core competence	2018 (n = 38)	2019 (n = 39)	2020 (n = 29)	p
1. Medical knowledge	76.8 ± 7.8	72.4 ± 9.5	79.7 ± 11.3	0.007
2. Patient care	78.0 ± 6.9	75.8 ± 7.7	75.8 ± 9.7	0.410
3. Interpersonal and communication skills	82.0 (12.3)	81.0 (10.0)	90.0 (25.0)	0.123
4. Professionalism	70.9 ± 7.2	66.6 ± 8.0	65.0 ± 7.1	0.004
5. Systems based practice	71.7 ± 12.6	74.9 ± 9.2	68.9 ± 13.9	0.119
6. Practice based learning and improvement	80.0 (7.0)	80.0 (14.0)	80.0 (20.0)	0.047
Total score	453.8 ± 25.2	451.6 ± 28.4	450.2 ± 50.7	0.917

ACGME: Accreditation Council for Graduate Medical Education; PGY1: postgraduate year one.

Table 3
The scores of PGY2 residents' and R1's ICU simulation core competencies in 2018, 2019 and 2020 (Mean ± standard deviation; medians (interquartile ranges)).

ICU simulation base education topics	2018 (n = 19) R1	2019 (n = 16) R1	2020 (n = 36) R1, PGY2	p
Pre-simulation written test	85.0 (12.0)	83.0 (13.0)	87.0 (7.0)	0.216
1. First aid teamwork in the ICU	81.0 (8.0)	81.0 (10.3)	88.0 (26.0)	0.122
2. Implantation of a pulmonary artery catheter and a pulse contour cardiac output associated with reading reports	69.6 ± 14.6	64.1 ± 13.3	67.6 ± 12.9	0.486
3. Mechanical ventilator setting and intubation in difficult airways	71.7 ± 14.4	59.4 ± 12.7	64.8 ± 10.5	0.014
4. Sepsis bundle	60.0 (10.0)	68.5 (12.3)	57.0 (13.0)	0.071
5. Medical error and physician-patient communications	75.0 (13.0)	68.0 (7.0)	71.0 (10.8)	0.166
6. Acute renal failure with the timing of hemodialysis	83.0 (17.0)	77.0 (24.0)	79.0 (12.0)	0.091
Average simulation total scores	437.6 ± 40.9	416.9 ± 31.5	422.0 ± 33.0	0.172

ICU: intensive care unit; PGY2: postgraduate year two; R1: first-year residents.

residents had higher scores than R1 residents in simulation scenario 5 (medical error and physician-patient communications) (p = 0.012) and lower scores than R1 residents in simulation scenario 2 (implantation of a pulmonary artery catheter and a pulse contour cardiac output associated with reading reports) (p = 0.036). In the pre-simulation written test, simulation scenario 1 (first aid teamwork in the ICU), 3 (mechanical ventilator setting and intubation in difficult airways), 4 (sepsis bundle) and 6 (acute renal failure with the timing of hemodialysis), there was no significant difference in the test scores between R1 and PGY2 residents.

Furthermore, the Pearson correlation coefficient between total scores for PGY's ACGME core competencies and the total scores for R1 or PGY2 simulation performance in intensive care was statistically significant (r = 0.580, p < 0.001, Table 5). The performance in scenario of sepsis bundle is positive correlated with two ACGME core competencies, including professionalism (r = 0.36, p = 0.036) and systems-base practice (r = 0.356, p = 0.039). We also found positive correlation between practice-based learning and improvement and the performance in intensive care simulation, including the scenario of implantation of a pulmonary artery catheter and a pulse contour cardiac output associated with reading reports (r = 0.388, p = 0.023), scenario of mechanical ventilator setting and intubation in difficult

Table 4
The individual simulation performance scores between PGY2 and R1 in 2020 (Mean ± standard deviation; medians (interquartile ranges)).

ICU simulation base education topics	2020 R1 (n = 23)	2020 PGY2 (n = 13)	p
Pre-simulation written test	87.2 ± 7.5	87.2 ± 3.6	0.977
1. First aid teamwork in the ICU	88.0 (27.0)	88.0 (15.0)	0.820
2. Implantation of a pulmonary artery catheter and a pulse contour cardiac output associated with reading reports	71.0 ± 12.0	61.7 ± 12.5	0.036
3. Mechanical ventilator setting and intubation in difficult airways	64.3 ± 10.3	65.8 ± 11.2	0.685
4. Sepsis bundle	59.1 ± 8.8	59.8 ± 11.1	0.832
5. Medical error and physician-patient communications	68.0 (10.0)	77.0 (10.5)	0.012
6. Acute renal failure with the timing of hemodialysis	79.0 (12.0)	79.0 (14.0)	1.000
Average simulation total scores	422.7 ± 32.9	420.9 ± 34.3	0.884

ICU: intensive care unit; PGY2: postgraduate year two; R1: first-year residents.

Table 5
The PGY trainees' ACGME core competencies is correlated with intensive care simulation performance score in the future.

PGY ACGME core competencies	R1 intensive care simulation performance	r	p
1. Patient care	First aid teamwork in the ICU.	-0.82	0.644
	Implantation of a pulmonary artery catheter and a pulse contour cardiac output associated with reading reports.	0.118	0.508
	Mechanical ventilator setting and intubation in difficult airways.	0.163	0.356
	Sepsis bundle.	0.199	0.259
	Medical error and physician-patient communications.	0.239	0.173
	Acute renal failure with the timing of hemodialysis.	0.013	0.942
2. Interpersonal and communication skills	First aid teamwork in the ICU.	-0.146	0.411
	Implantation of a pulmonary artery catheter and a pulse contour cardiac output associated with reading reports.	0.227	0.196
	Mechanical ventilator setting and intubation in difficult airways.	-0.263	0.133
	Sepsis bundle.	0.205	0.245
	Medical error and physician-patient communications.	0.127	0.475
	Acute renal failure with the timing of hemodialysis.	0.132	0.457
3. Professionalism	First aid teamwork in the ICU.	0.260	0.138
	Implantation of a pulmonary artery catheter and a pulse contour cardiac output associated with reading reports.	0.16	0.366
	Mechanical ventilator setting and intubation in difficult airways.	0.235	0.180
	Sepsis bundle.	0.360	0.036
	Medical error and physician-patient communications.	0.441	0.009
	Acute renal failure with the timing of hemodialysis.	0.061	0.732
4. Systems-based practice	First aid teamwork in the ICU.	0.063	0.723
	Implantation of a pulmonary artery catheter and a pulse contour cardiac output associated with reading reports.	0.059	0.741
	Mechanical ventilator setting and intubation in difficult airways.	0.005	0.979
	Sepsis bundle.	0.356	0.039
	Medical error and physician-patient communications.	0.222	0.208
	Acute renal failure with the timing of hemodialysis.	0.207	0.241
5. Practice-based learning and improvement	First aid teamwork in the ICU.	0.059	0.739
	Implantation of a pulmonary artery catheter and a pulse contour cardiac output associated with reading reports.	0.388	0.023
	Mechanical ventilator setting and intubation in difficult airways.	0.415	0.015
	Sepsis bundle.	0.181	0.307
	Medical error and physician-patient communications.	0.181	0.306
	Acute renal failure with the timing of hemodialysis.	0.359	0.037
The total score of PGY ACGME OSCE	The total score of R1 simulation performance.	0.580	< 0.001

Correlation was assessed using Pearson's test. Statistically significant results (p < 0.05).
ACGME: Accreditation Council for Graduate Medical Education; ICU: intensive care unit; PGY: postgraduate year; R1: first-year residents.

airways (r = 0.415, p = 0.015), and scenario of acute renal failure with the timing of hemodialysis (r = 0.359, p = 0.037).

4. Discussion

The study's results indicated that there was no significant difference between PGY2 and R1 residents' test scores in the intensive care SBE workshop. This confirms that PGY2 residents are equivalent to R1s in terms of intensive care performance. Yamamoto et al.[12] stated that the combination of simulation-based learning and peer-assisted learning led by PGY2 residents is potentially more effective in improving the postgraduate education of PGY1 residents than the combination of lecture and peer-assisted learning. A combination of traditional lectures, clinical practice, and SBE has become the new strategy of internal medicine training, which has improved intensive care learning in recent years. The new strategy of pre-intensive care training has empowered PGY2 residents to be equal to R1s when dealing with intensive care situations in the future even though PGY2 residents have had a lesser amount of resident training compared to R1 residents.

R1s performed better in the implantation of a pulmonary artery catheter and a pulse contour cardiac output associated with reading reports than PGY2 residents. The best way for learning invasive ICU skills, including central catheter insertion, arterial line insertion, Swan-Ganz catheterization, double lumen insertion, endotracheal intubation, and chest tube insertion, is skill repetition. Zante et al.[13] stated that the ICU residents' expectations of teaching style and perceived learning behavior was associated with the number of skill repetitions and internal medicine base specialty and skill type. R1s have had more opportunities to practice invasive procedures than PGY2s because they have one extra year of internal medicine training compared to PGY2s. Consequently, a greater number of skill repetitions may explain the better performance in implantation of a pulmonary artery catheter and a pulse contour cardiac output based on R1s' reading reports.

In our study, the PGY trainees' ACGME core competencies was positively correlated with intensive care simulation performance score in the future. Practice-based learning and improvement is positively associated with performance in intensive care simulation, including the scenario of implantation of a pulmonary artery catheter and a pulse contour cardiac output associated with reading reports, scenario of mechanical ventilator setting and intubation in difficult airways, and scenario of acute renal failure with the timing of hemodialysis. Zante et al.[14] demonstrated that developing competence in practice-based learning and improvement is a skill-based activity with important theoretical and methodologic foundations. According to the results of our study, trainees with a higher score in practice-based learning and improvement performed better in difficult skills, including the insertion of the Swan-Ganz catheterization, double lumen, and difficult intubation. Professionalism includes compassion, integrity, and respect for others; responsiveness to patient needs that supersedes self-interest; respect for patient privacy and autonomy; accountability to patients, society and the profession; sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation. Professionalism is also the foundation of communication. In the small-scale OSCE for PGY ACGME core competence examination, we tested the trainees' professionalism, including respect, non-discrimination, privacy, informed consent in the scenario of explanation of suspected HIV infection and compassion, encouragement, positive attitude during patient's treatment, and communication and explanation skills when treating patients on an emergent hemodialysis. Our study demonstrated that the trainees with higher score in professionalism had better performance in the scenarios of a sepsis bundle and physician-patient communications of medical errors in the intensive care SBE workshop. We concluded that professionalism including communication ability, compassion, and honesty in the scenario of a medical error or a sepsis bundle during physician-patient communications is important. Systems-based practice include working effectively to coordinate patient care in various health care delivery settings and systems, working in interprofessional teams to enhance patient safety and improve patient care quality, as well as participating in identifying system errors and in implementing potential systems solutions. Our study demonstrated that the trainees with a higher score in systems-based practice performed better in the scenario of a sepsis bundle in the intensive care SBE workshop. We assume that systems-based practice involves a wide range of clinical conditions, which requires a comprehensive understanding of medical information, including history, physical examination, lab data interpretation, image study, treatment plan, and drug choice in caring for patients with infectious diseases.

We believe that the curriculum scores during resident training, including ACGME core competency-based small-scale OSCE, can guide medical training and predict further clinical performance. This is supported by Webb et al.[15] who reported that surgery residency curriculum examination scores in a PGY1 and PGY2 is predictive of performance in the respective American Board of Surgery in-training examination performance. Swing et al.[16] also supports this by claiming that ACGME general competencies assessment can provide evidence of residency program educational effectiveness and information to guide improvement. Our program thus concludes that examination scores for individuals' previous PGY ACGME core competencies can predict future residents' intensive care simulation performance.

There are certain limitations to this study. First, it was a pilot test because the sample size of this study is relatively small. Second, only five and six simulated scenarios were adopted in the small-scale OSCE for PGY ACGME core competence examination and SBE workshop for residents' intensive care examination, respectively. This is certainly not representative of all the clinical scenarios they may encounter in the general and internal medicine practice and critical care. Future assessments of core competency should include more subjects with more simulated scenarios. In conclusion, our study demonstrated that there was no significant difference between PGY2 and R1 residents' intensive care performance. Therefore, these trainees have the care performance and competencies required for upgrading to R2. Furthermore, the PGY trainees' ACGME core competencies were positively correlated with intensive care simulation performance score in the future. The PGY ACGME abilities of practice-based learning and improvement was correlated with the future skills necessary for performing the insertion of Swan-Ganz catheterization, difficult intubations, and hemodialysis. Finally, professionalism correlates with future sepsis bundle and medical error communication abilities. Thus, we reiterate that previous PGY's ACGME core competencies can predict future residents' intensive care simulation performance.

Declaration of any potential financial and non-financial conflicts of interest

None of the authors have any financial or other interests in the manufacture or distribution of any device or drug mentioned in a manuscript.

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