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Incoming Interns Perceived Preparedness for Core Entrustable Professional Activities

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Abstract

Introduction The AAMC described 13 core entrustable professional activities (EPAs) for which every graduating medical student should perform proficiently on day 1 of residency. We studied how prepared starting interns felt in the core EPAs.

Methods Interns from a diverse health system were surveyed on how well medical school prepared them in the 13 core EPAs. Data were collected on type of medical school, participation in an acting/sub-internship (AI/SI), knowledge of EPAs, and participation in an EPA experience.

Results We collected 224 surveys out of 384 (58%) interns. 61.2% attended allopathic, 14.6% attended osteopathic, and 24.2% attended international schools. 67% had not heard of EPAs. 29% had an EPA experience of which 82% were required. 80% or more felt prepared in all EPAs except orders (60.7%) and handovers (73%). Allopathic interns were significantly more likely to have heard of EPAs and participated in an EPA experience than international. Allopathic interns felt more prepared than international in oral presentations and evidence-based medicine. Interns who participated in an EPA experience felt more prepared for oral presentation and evidence-based medicine. There were small but significant differences in feeling prepared in certain EPAs and types of AI/SI taken.

Conclusion The majority of interns entering residency have not heard of EPAs with fewer than 1/3 of interns participating in an EPA experience. International graduates were less likely to be aware or have experience with EPAs and report being less prepared in oral presentation and evidence-based medicine compared to allopathic graduates.

Keywords Preparation for residency · Core entrustable professional activities

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The American Association of Medical Colleges described 13 core entrustable professional activities (EPAs) for which every graduating medical student should perform proficiently on day 1 of residency. We sought out to determine how prepared are new interns in the EPAs and discovered that the majority of interns entering residency have not heard of EPAs and there are certain EPAs that incoming interns feel less prepared in. This knowledge can help medical schools tailor their curriculum to maximize their graduate's preparedness at the onset of residency and can also alert residency programs on areas interns feel weak and address these issues during orientation.

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Introduction

In 2014, the Association of American Medical Colleges (AAMC) described 13 core entrustable professional activities (EPAs) every graduating medical student should be expected to perform proficiently, without direct supervision, on day 1 of residency, regardless of chosen specialty (Table 1) [1]. The core EPAs evolved from the entry level residency milestones of pediatrics, surgery, emergency medicine, internal medicine, and psychiatry as defined by the Accreditation Council for Graduate Medical Education (ACGME) [2,3]. As well described, EPAs are discrete units of work representative of physicians' routine activities [4,5]. They stand in contrast to competencies that measure an individual's abilities in a particular domain. As multiple competencies are inherent in each EPA, a learner's mastery of any one EPA can be seen as representing proficiency in several competencies [6].

Medical schools have been surveying directors of the residency programs in which their students matched to evaluate their graduates' level of core EPA proficiency at the start of residency. In 2015, Lindeman et al. [7] surveyed surgery program directors regarding their confidence in new residents' abilities to perform the core EPAs and compared their findings with data on resident confidence collected via the AAMC Graduation Questionnaire. This showed a sizable gap between graduating medical student and program director confidence in residents' performance of the 13 core EPAs, with program directors reporting less confidence compared to the residents themselves. More surprising was the finding of wide variability of program director confidence in interns' abilities to

perform core EPAs, which ranged from 78.7% for EPA 1 (history and physical) to 13.5% for EPA 13 (patient safety) [7].

We recently published a study of program directors' perception of residents' proficiency in the core EPAs 6 months into training [8]. Program directors felt that a significant percentage of residents were not adequately prepared to write orders, form a clinical question, handoff patients, obtain informed consent, and promote a culture of patient safety.

In this study, we sought to determine interns' self-assessment of preparation by medical school in the 13 core EPAs. We also looked to see if perceived preparation varied by type of school attended (US allopathic, US osteopathic, or international), participation in an Acting (or Sub) Internship, or participation in voluntary or mandatory EPA experiences (capstone, simulation, etc.) during medical school.

Methods

Northwell Health is a large integrated health care organization with 384 interns from 72 US, 10 osteopathic, and 59 international medical schools. During the 2017 Northwell Health new house-staff orientation, just prior to beginning internship, we asked interns from all ACGME-accredited residency programs to self-assess on how well they were prepared by their medical schools in the 13 core EPAs. In addition, we collected data on the type of medical school attended, participation in an acting/sub-internship (AI/SI), knowledge of the EPAs, and participation in a voluntary or mandatory EPA experience in medical school. Participation in the survey was voluntary. Northwell Health's Institutional Review Board deemed this study exempt from ethical review.

Chi-square analysis for each EPA and pairwise comparisons with Bonferroni correction were used to compare preparedness according to type of school and participation in EPA experiences in medical school. Binary logistic regression was performed to assess the impact of participation in various AI/SI's on the perceived preparedness of each EPA. Regression models for each EPA were tested separately, resulting in a total of 13 separate analyses. Predictors for each model included whether or not the student participated in a SI/AI in emergency medicine, medicine, pediatrics, surgery, and family medicine, entered as binary variables (0 = did not participate, 1 = did participate). A backward selection approach was used (probability for entry, $p \leq 0.05$; probability for removal, $p \geq 0.06$). The data analysis for this paper was generated using SAS software, Version 9 of the SAS System for Windows. Copyright © 2012 SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA.

Table 1 Core entrustable professional activities (EPAs) for entering residency

EPA 1: Gather a history and perform a physical examination
EPA 2: Prioritize a differential diagnosis following a clinical encounter
EPA 3: Recommend and interpret common diagnostic and screening tests
EPA 4: Enter and discuss orders and prescriptions
EPA 5: Document a clinical encounter in the patient record
EPA 6: Provide an oral presentation of a clinical encounter
EPA 7: Form clinical questions and retrieve evidence to advance patient care
EPA 8: Give or receive a patient handover to transaction care responsibility
EPA 9: Collaborate as a member of an interprofessional team
EPA 10: Recognize a patient requiring urgent or emergent care and initiate evaluation and management
EPA 11: Obtain informed consent for tests and/or procedures
EPA 12: Perform general procedures of a physician
EPA 13: Identify system failures and contribute to a culture of safety and improvement

Table 2 Number of respondents by residency

Specialty	N	%
Internal medicine	93	42.3
Pediatrics	32	14.5
Surgery	24	10.9
Family medicine	23	10.5
OB/GYN	15	6.8
Emergency medicine	12	5.5
Psychiatry	12	5.5
Internal medicine prelim	5	2.3
Combined EM/IM	1	0.5
Plastic surgery integrated	1	0.5
Thoracic surgery integrated	1	0.5
Vascular surgery integrated	1	0.5

Results

After eliminating those in advanced specialties, dental medicine, and podiatry, we collected 227 surveys out of 384 (59%) ACGME residents. Table 2 lists the number of respondents by residency. Of the types of schools attended, 137 (60%) of the residents attended US allopathic, 32 (14%) attended US osteopathic, and 55 (24%) attended international. Three residents (1%) did not respond. Two hundred and thirteen (94%) of the residents reported having participated in at least 1 AI, the most popular of which was medicine (141 residents, 62%). Seventy-three residents (32%) had heard of EPAs and 65 (29%) were provided with an EPA experience during medical school. Of the residents that attended schools providing an EPA experience, 57 out of 65 (88%) residents reported that those activities were required.

Residents’ knowledge and participation in EPAs is demonstrated in Table 3. US allopathic graduates were significantly more likely to have heard of EPAs than international graduates ($\chi^2(1) = 10.64, p = 0.001$) and were also more likely to have participated in an EPA experience during medical school

($\chi^2(1) = 11.36, p = 0.0007$). US allopathic and osteopathic graduates did not differ on their reported awareness of EPAs or having participated in an EPA experience. US osteopathic graduates also did not differ on their awareness of or participation in EPA activities compared to international students.

Residents’ self-assessment of their preparation in the core EPAs, broken down by type of school attended, is demonstrated in Table 4. US allopathic graduates reported being significantly more prepared than international graduates in EPA 6—oral presentation ($\chi^2(1) = 6.79, p = 0.009$)—and EPA 7—evidence-based medicine ($\chi^2(1) = 7.49, p = 0.006$). US allopathic graduates also reported being significantly more prepared than osteopathic graduates in EPA 1—history and physical ($\chi^2(1) = 9.04, p = 0.003$). There were no significant differences between osteopathic and international graduates in these EPAs.

Graduates who participated in an EPA experience in medical school felt significantly more prepared for EPA 6—oral presentation ($\chi^2(1) = 6.04, p = 0.014$)—and EPA 7—evidence-based medicine ($\chi^2(1) = 4.12, p = 0.043$).

Although the number of AI/SIs taken had no significant impact on perceived preparedness, logistic regression models indicated that participation in specific AI/SI’s had a small but significant effect on perceived preparedness (Table 5). Graduates who participated in an emergency medicine AI/SI were significantly more likely to report feeling prepared in EPA 4—order writing than those who did not ($\chi^2(1) = 4.08, p = 0.03$). Conversely, graduates who participated in a pediatrics AI/SI were significantly less likely to report feeling prepared in EPA 7—evidence-based medicine ($\chi^2(1) = 5.97, p = 0.015$)—and EPA 13—patient safety ($\chi^2(1) = 3.94, p = 0.047$). Similarly, graduates who participated in a family medicine AI/SI were significantly less likely to report feeling prepared in EPA 3—recommend and interpret tests ($\chi^2(1) = 5.02, p = 0.025$)—and EPA 10—recognize a patient requiring urgent/emergent care ($\chi^2(1) = 7.20, p = 0.007$). Participating in an internal medicine or surgery AI/SI did not have an effect on perceived preparedness in any EPA.

Table 3 Number (and percent) of PGY1 residents who responded “yes.” Data are presented for the entire sample, as well as by type of medical school attended (US allopathic, US osteopathic, and

international medical school). Chi-square analyses were used to compare the three groups. A model in bold signifies significance

	All school types N = 220	Grouped by school			Statistical analysis		
		US allopathic N = 137	US osteopathic N = 30	International N = 55	US allopathic vs. US osteopathic	US allopathic vs. international	US osteopathic vs. international
Have you heard of the AAMC core entrustable professional activities (EPAs)?	73 (33%)	57 (42%)	7 (22%)	9 (17%)	$\chi^2(1) = 4.53$ $p = 0.033$	$\chi^2(1) = 10.64$ $p = 0.0011$	$\chi^2(1) = 0.31$ $p = 0.576$
Did your medical school provide you with experience in the AAMC core EPAs?	65 (30%)	51 (38%)	7 (22%)	7 (13%)	$\chi^2(1) = 2.98$ $p = 0.085$	$\chi^2(1) = 11.36$ $p = 0.0007$	$\chi^2(1) = 1.17$ $p = 0.279$

Table 4 Number (and percent) of PGY1 residents who agreed with the statement “I was adequately prepared and I can perform without direct supervision.” Data are presented for the entire sample, as well as by type of medical school attended (US allopathic, US osteopathic, and international medical school). Chi-square analyses were used to compare the three groups. A model in bold signifies significance

EPA	All school types N = 222	Grouped by school			Statistical analysis		
		US allopathic N = 137	US osteopathic N = 30	International N = 55	US allopathic vs. US osteopathic	US allopathic vs. international	US osteopathic vs. international
EPA 1: gather history and perform physical	219 (98.6%)	137 (100.0%)	28 (93.3%)	54 (98.2%)	$\chi^2(1) = 9.04$ $p = 0.003$	$\chi^2(1) = 2.45$ $p = 0.118$	$\chi^2(1) = 1.34$ $p = 0.247$
EPA 2: prioritize a differential diagnosis	210 (95.5%)	132 (97.1%)	28 (93.3%)	50 (92.6%)	$\chi^2(1) = 0.92$ $p = 0.336$	$\chi^2(1) = 1.82$ $p = 0.178$	$\chi^2(1) = 0.02$ $p = 0.899$
EPA 3: recommend and interpret tests	202 (91.0%)	129 (94.2%)	27 (90.0%)	46 (83.6%)	$\chi^2(1) = 0.64$ $p = 0.425$	$\chi^2(1) = 5.15$ $p = 0.023$	$\chi^2(1) = 0.65$ $p = 0.421$
EPA 4: enter and discuss orders/prescriptions	133 (60.7%)	85 (63.0%)	17 (56.7%)	31 (57.4%)	$\chi^2(1) = 0.51$ $p = 0.477$	$\chi^2(1) = 0.63$ $p = 0.427$	$\chi^2(1) = 0.01$ $p = 0.9476$
EPA 5: document an encounter	199 (89.6%)	126 (92.0%)	28 (93.3%)	45 (81.8%)	$\chi^2(1) = 0.08$ $p = 0.777$	$\chi^2(1) = 3.93$ $p = 0.048$	$\chi^2(1) = 2.12$ $p = 0.145$
EPA 6: provide an oral presentation	206 (94.1%)	131 (97.0%)	28 (93.3%)	47 (87.0%)	$\chi^2(1) = 0.91$ $p = 0.341$	$\chi^2(1) = 6.79$ $p = 0.009$	$\chi^2(1) = 0.79$ $p = 0.371$
EPA 7: EBM: form clinical questions and retrieve evidence	204 (92.7%)	131 (96.3%)	28 (90.3%)	45 (84.9%)	$\chi^2(1) = 1.90$ $p = 0.168$	$\chi^2(1) = 7.49$ $p = 0.006$	$\chi^2(1) = 0.50$ $p = 0.478$
EPA 8: give or receive a patient handover	162 (73.0%)	102 (75.0%)	25 (80.6%)	35 (63.6%)	$\chi^2(1) = 0.53$ $p = 0.469$	$\chi^2(1) = 2.22$ $p = 0.137$	$\chi^2(1) = 2.72$ $p = 0.099$
EPA 9: collaborate as an interprofessional team member	213 (96.8%)	130 (97.0%)	29 (93.5%)	54 (98.2%)	$\chi^2(1) = 0.81$ $p = 0.368$	$\chi^2(1) = 0.23$ $p = 0.635$	$\chi^2(1) = 1.26$ $p = 0.261$
EPA 10: recognize a patient requiring urgent/emergent care	193 (87.3%)	120 (87.6%)	27 (93.1%)	46 (83.6%)	$\chi^2(1) = 0.78$ $p = 0.378$	$\chi^2(1) = 0.44$ $p = 0.505$	$\chi^2(1) = 1.49$ $p = 0.221$
EPA 11: obtain informed consent	180 (81.8%)	113 (83.7%)	25 (80.6%)	42 (77.8%)	$\chi^2(1) = 0.13$ $p = 0.721$	$\chi^2(1) = 0.79$ $p = 0.373$	$\chi^2(1) = 0.09$ $p = 0.756$
EPA 12: perform general procedures	176 (80.0%)	106 (79.1%)	27 (87.1%)	43 (78.2%)	$\chi^2(1) = 1.13$ $p = 0.287$	$\chi^2(1) = 0.01$ $p = 0.946$	$\chi^2(1) = 1.04$ $p = 0.308$
EPA 13: identify errors and contribute to culture of safety	186 (84.5%)	115 (85.8%)	26 (83.9%)	45 (81.8%)	$\chi^2(1) = 0.05$ $p = 0.819$	$\chi^2(1) = 0.39$ $p = 0.528$	$\chi^2(1) = 0.58$ $p = 0.809$

Table 5 Logistic Regression of AI/SI participation and impact on preparedness on core EPAs. Only significant predictors are reported

Model Predictor variable	<i>B</i> (SE)	Wald	OR (95% CI)	df	<i>p</i> value	Nagelkerke <i>R</i> ²
Regression model 1: EPA 3 Family medicine SI/AI	−0.644 (0.282)	5.018	0.276 (0.09–0.85)	1	0.025	0.04
Regression model 2: EPA 4 Emergency medicine SI/AI	0.385 (0.191)	4.080	2.16 (1.02–4.561)	1	0.043	0.03
Regression model 3: EPA 7 Pediatrics SI/AI	−0.645 (0.264)	5.974	0.28 (0.09–0.74)	1	0.015	0.06
Regression model 4: EPA 10 Family medicine SI/AI	−0.688 (0.256)	7.198	0.25 (0.09–0.69)	1	0.007	0.05
Regression model 5: EPA 13 Pediatrics SI/AI	−0.392 (0.197)	3.940	0.46 (0.21–0.99)	1	0.047	0.03

Discussion

In spite of the increased attention to the core EPAs in the literature, the majority of entering interns report no awareness, and only a third report participating in an EPA-related experience during medical school. When EPA experiences are offered by medical schools, they tend to be required. Perhaps not surprisingly, international students were less likely to have heard of EPAs and to have participated in an EPA experience than their US counterparts. The reason for this is likely multifactorial. The EPAs are a relatively new concept created by the AAMC and are just being adopted by US schools. Some international graduates complete their entire training in the host country and the core EPAs may not be a focus in those schools yet. Other international graduates complete their “clinical years” in the USA but the hospitals through which they rotate may not be medical school-campus based and have been slower in adopting the concept of the EPAs. EPA experiences do appear to have a role as those students that did participate in an EPA experience felt more prepared in EPA 6—oral presentation—and EPA 7—evidence-based medicine, than those that did not.

Pereira et al. [9] surveyed more than 20,000 internal medicine residents and reported that sub-internships were the most valuable fourth-year medical school courses to prepare them for internship. In our study, 95% of new interns participated in at least one AI/sub-internship in medical school and yet only 60.7% and 73.0% felt adequately prepared for EPA 4—order writing—and EPA 8—handovers, respectively.

Lindeman [7] also reported graduating medical students’ confidence in performance of EPA 4—order writing and EPA 8—handovers, as only 54.9% and 77.3%, respectively. That study compared program director perception with graduating medical student perception of preparedness in the EPAs and found that there was a large gap in perceptions with students overestimating their preparedness.

It is not surprising that new interns felt unprepared for order writing. Since the implementation of the electronic health record, many students do not have the opportunity to write orders [10]. Before the electronic health record, some medical centers allowed medical students to hand write orders that would be countersigned by the supervising physician. In the era of electronic health records, many schools do not grant electronic prescription privileges to medical students. In the medical centers that do allow students to place orders, the orders need to be verified electronically and this added step can lead to inefficient patient care and extra work for the supervising physician. Thus, many supervising physicians may find it easier and more efficient to place orders in themselves. In this study, a small but significant number of students reported being more prepared in EPA 4—order writing—if they had participated in an emergency medicine AI/SI. This finding may be a consequence of the supervising physician being present all of the time in an emergency medicine AI/SI all of the time and students may either witness supervisors enter orders or have the opportunity to enter orders in the presence of a supervising physician.

Similarly, a small but significant number of interns reported being significantly less prepared for EPA 7—evidence-based medicine—and EPA 13—patient safety if they had participated in a pediatrics AI/SI. This finding, while interesting, has no obvious explanation. Those students who participated in a family medicine AI/SI felt less prepared for EPA 3—recommend and interpret tests—and EPA 10—recognize a patient requiring urgent/emergent care. A possible reason for this is that many of the family medicine AI/Sis are outpatient based and perhaps during their family medicine AI/SI students cared for patients with routine well care or preventive care not requiring advanced testing. Along the same lines students who participated in family medicine AI/Sis also felt less prepared in EPA-10 recognizing a patient requiring urgent/emergent care. This EPA is more commonly experienced in the Emergency Department or inpatient wards so it is not

surprising. Only 2 participants participated in both an emergency medicine and family medicine AI/SI and both felt adequately prepared in EPA 3 and 10. We believe those students participating in family medicine AI/SI had less of an opportunity to see EPA 10 (recognize a patient requiring urgent/emergent care) and EPA 3 (recommend and interpret tests).

No significant differences in EPA preparedness were found if students had taken an internal medicine or surgery AI/SI.

New interns also felt unprepared in handovers. Both order writing and handovers are tasks prone to error that pose threats to patient safety [11–15]. The fact that interns feel they are not adequately prepared for these tasks is concerning. If the AAMC EPAs are considered a requirement for entering residency, medical schools should provide the opportunity for medical students to perform and practice them under supervision.

Overall, EPAs where less than 90% of new interns felt prepared in were EPA 10 (recognize a patient requiring urgent/emergent care), EPA 11 (informed consent), EPA 12 (procedures), and EPA 13 (patient safety), 87.3%, 81.8%, 80%, and 84.5% respectively. There was no statistically significant differences between type of school attended and these EPAs.

Two out of 30 osteopathic interns reported not feeling prepared in EPA-1 (gather a history and perform a physical). Although this finding was statistically significant, we do not feel it is relevant as the total number of osteopathic interns is low relative to allopathic and international.

Limitations of this study include that it took place in a single health care organization, reducing generalizability. We did not identify the names of the individual schools and so we cannot comment on whether graduates of certain schools feel more prepared than those from other schools. In addition, although the logistic regression analyses for participation in specific AI/SI's resulted in significant models, they only accounted for a small amount of the variance in EPA preparedness. The sample size of the osteopathic graduates is small compared to allopathic and international graduates.

Based on our findings, we suggest that medical schools should add EPA experiences and assessments to their curriculum. We also think that residency programs may be well served by having fourth-year medical students engage in a capstone EPA assessment prior to graduation. This assessment could be followed by a supplementary, post-match, medical student performance evaluation (MSPE) addendum with EPA assessment data. These data can then be used by residency programs to tailor orientations to adequately prepare the new graduates for residency. Such an assessment would also allow medical schools to evaluate their curricula to ensure students obtain the necessary training and practice of the core EPAs to ensure adequate preparation for residency. For schools that may not have the resources to accomplish this labor and faculty intensive

endeavor, they may consider changing their current assessments to reflect the core EPAs in the clerkships and AI/SIs.

Conclusions

A study in a large and diverse health care organization demonstrated that the majority of interns entering residency are not aware of EPAs with a little less than a third of interns having an experience in the EPAs. International students are less likely to be aware of EPAs, to have experience with them, and report being less prepared in oral presentations and evidence-based medicine skills than their allopathic counterparts. Consistent with other studies, incoming interns feel least prepared in order writing and handoffs.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

Informed Consent Informed consent was obtained and participation was voluntary. This study has not been published in print or online and is not under consideration for publication in another journal.

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