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RESEARCH ARTICLE

Descriptive survey of pharmacy students' self-evaluation of Advanced Pharmacy Practice Experiences (APPE) and practice readiness using entrustable professional activities

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Abstract

Objective: To evaluate pharmacy students' self-identified levels of entrustability before and after their advanced pharmacy practice experiences (APPE). **Methods:** Third and fourth-year pharmacy students completed a Qualtrics survey where they were asked to self-identify their entrustability level (scale of I–V) on each of the fifteen core entrustable professional activities (EPAs) for pharmacy graduates. **Results:** A total of 249 third-year students completed the APPE-readiness survey in the Fall of 2017–2019, and 106 fourth-year students completed the practice-readiness survey in the Spring of 2018. The highest entrustability level in both surveys was "create a written plan for continuous professional development". The lowest reported entrustability levels in both surveys were: "Oversee the pharmacy operations…", "Maximise the appropriate use of medications…," and "Establish patient-centred goals and create a plan…". The largest area of change from pre-APPE to post-APPE was overseeing pharmacy operations, with an increase of 26%. The average pre-APPE entrustment level was 3.72, increasing to 4.2 in the practice readiness portion. The percentage of students self-reporting below an entrustment level of 3 in the practice-readiness survey ranged from 0–0.99%. **Conclusion:** Pharmacy students increased their self-reported level of entrustability over all 15 EPA domains from pre-APPE to post-APPE year.

Introduction

Entrustable professional activities (EPAs) are a concept introduced and operationalised in medical education to support a framework for competency-based medical education. EPAs have been built to communicate the professional work units that medical students should be able to perform upon entering residency (Chen, van den Broek & ten Cate, 2015; Obesso *et al.,* 2017). In 2016, the American Association of Colleges of Pharmacy (AACP) Academic Affairs Committee adopted this concept for pharmacy education (Association of American Medical Colleges, 2017). This workgroup developed fifteen core EPAs separated into six core domains to assist in defining the work tasks of an entry-level licensed pharmacist (Haines *et al.,* 2017; Lomis *et al.,* 2017; Pittenger *et al.,* 2017). Performance evaluation for the EPAs is categorised by five levels of entrustability, illustrating an increasing level of independence from limited knowledge or skill requiring observation only (Level I) to the ability to practice a skill unsupervised with trust they can also supervise others (Level V) (Pittenger *et al.,* 2016; Obesso *et al.,* 2017; Pittenger *et al.,* 2017).

Since its introduction to pharmacy education, several studies have illustrated general agreement with the validity of the fifteen core EPAs as appropriate work tasks (Haines *et al.,* 2018; Moon *et al.,* 2018; Pittenger *et al.,* 2019; VanLangen *et al.,* 2019). In addition to creating these pharmacy-focused EPAs, the AACP

workgroup also made recommendations regarding the expected level of entrustability before graduation. In addition to other expert recommendations, the AACP workgroup recommended graduates could be expected to reach an entrustability level of 3 –reactive supervision needed, with postgraduate training and practice assisting pharmacists in reaching levels 4 and 5 of entrustability (Pittenger *et al.,* 2017; Jarrett *et al.,* 2018). Despite agreement on the validity of these tasks, there is little information to validate the AACP workgroup's suggestion that a minimum entrustabilty level of 3 should be achieved by all pharmacy graduates in each EPA. Additionally, there is limited guidance on how to use EPAs to determine the appropriate level of entrustability before and after APPE rotations to assist in evaluating both APPE and practice readiness (Pittenger *et al.,* 2016; Pittenger *et al.,* 2017). Given the limited and conflicting recommendations, the goal of this study is to evaluate students' self-assessment of their level of entrustability before (APPE readiness) and after the completion of their APPE year (practice readiness) and the degree of change in entrustability levels over this time.

Methods

This study is a descriptive survey of pharmacy students' self-perceptions of their pre- and post-APPE confidence levels in the 15 core EPAs for pharmacy graduates. Two nearly identical web-based electronic Qualtrics surveys were developed for students to conduct a self-evaluation based directly on AACP's 15 core EPAs. To decrease the risk of response bias, students were provided with the EPA statement and examples of tasks and then asked to select their level of entrustability from five options: (1) I do not possess the knowledge and/or skills to complete this task (Observation only), (2) I need direct supervision and frequent, proactive correction (Preceptor present and assisting in completion of the task), (3) I need supervision or reactive observation (Preceptor readily available to assist if needed), (4) I can practice this skill unsupervised with the preceptor distantly available for questions/clarification, and (5) I can consistently practice this skill unsupervised and could also be trusted to supervise others in completion of this task.

The first survey, APPE Readiness, was distributed to third-year pharmacy students at Texas A&M University Rangel School of Pharmacy (RSOP) as a completion assignment in their required Pharmaceutical Care course at the end of the Spring 2017, 2018, and 2019 terms. The second survey, Practice Readiness, was distributed to fourth-year pharmacy students at RSOP during a required component of exit interviews the week of graduation in the Spring of 2018. Each survey was open for one week. All completed survey responses were included in the analysis, regardless of the survey completion status.

Statistical analysis

Descriptive statistics were used for data analysis, with survey results aggregated into frequencies and reported as weighted percentages or means with applicable ranges. Weighted means were calculated for each reported EPA level by taking the average of the reported levels using the number of completed surveys. The study also calculated the percentage change from the APPE-readiness entrustment level to the practice-readiness entrustment level. A convenience sample was used to describe the frequencies of each EPA level in both surveys, as only descriptive statistics were used.

Ethical considerations

This study was determined to be exempt by Texas A&M University's Institutional Review Board.

Results

A total of 249 third-year students completed the APPE-readiness survey over three academic years (Fall 2017 to 2019), and 106 fourth-year students completed the practice-readiness survey at the end of one academic year (Spring 2018).

APPE readiness survey results

Before APPE rotations, students reported the lowest level of entrustability in EPA 13, "oversee the pharmacy operation of an assigned shift", in the Practice Management domain. The highest reported entrustability level was "create a written plan for continuous professional development," followed closely by "ensure patients have been immunised against vaccine-preventable diseases." The average self-rated entrustablity level for all EPAs was above 3 (3.09–4.06). Tables I and II outline the remaining self-reported entrustability levels for the APPE readiness survey.

Practice readiness survey results

The EPAs that received the lowest and highest self-rated entrustability levels remained nearly identical in the pre-APPE and post-APPE surveys. Students self-ranked "oversee the pharmacy operation of an

assigned shift" as the lowest level and "create a written plan for continuous professional development" as the highest. The weighted mean for most EPAs in the practice readiness survey results was at least a 4 (3.88–4.34), except for EPA 13: overseeing pharmacy operations. Tables I and II outline the remaining self-reported entrustability levels for the practice readiness survey.

Table I: Student self-evaluation of levels of entrustablity for EPAs 1–6, 15 (APPE and Practice Readiness)

	Level 1	Level 2	Level 3	Level 4	Level 5
Patient care provider domain					
EPA 1: Collect information to identify a patient's medication-related problems and health-related needs					
APPE Readiness	0.85%	2.13%	16.6%	71.49%	8.94%
Practice Readiness	0%	0.99%	8.91%	52.48%	37.62%
EPA 2: Analyse information to determine the effects of medication therapy, identify medication-related problems, and prioritise health-related needs					
APPE Readiness	1.28%	4.68%	29.79%	59.57%	4.68%
Practice Readiness	0%	0.99%	8.91%	65.35%	24.75%
EPA 3: Establish patient-centered goals and create a care plan for a patient in collaboration with the patient, caregiver(s), and other health professionals that is evidence-based and cost-effective					
APPE Readiness	0.86%	8.15%	38.2%	49.36%	3.43%
Practice Readiness	0%	0.99%	15.84%	58.42%	24.75%
EPA 4: Implement a care plan in collaboration with the patient, caregivers, and other health professionals.					
APPE Readiness	0.85%	5.13%	29.06%	54.27%	10.68%
Practice Readiness	0.99%	0%	12.87%	53.47%	32.67%
EPA 5: Follow-up and monitor a care plan					
APPE Readiness	1.28%	6.38%	33.62%	50.64%	8.09%
Practice Readiness	0%	0%	7.92%	59.41%	32.67%
Interprofessional team member domain					
EPA 6: Collaborate as a member of an interprofessional team.					
APPE Readiness	1.28%	3.83%	24.26%	51.91%	18.72%
Practice Readiness	0%	1%	11%	50%	38%
Self-developer domain					
EPA 15: Create a written plan for continuous professional development					
APPE Readiness	1.28%	4.26%	16.60%	42.55%	35.32%
Practice Readiness	0%	0%	11.88%	46.53%	41.58%

Table II: Student self-evaluation of levels of entrustablity for EPAs 7–14 (APPE and Practice Readiness)

	Level 1	Level 2	Level 3	Level 4	Level 5
Population health promoter domain					
EPA 7: Identify patients at risk for prevalent diseases in a population					
APPE Readiness	0.85%	3.85%	19.66%	52.99%	22.65%
Practice Readiness	0.99%	0%	10.89%	49.5%	38.61%
EPA 8: Minimise adverse drug events and medication errors					
APPE Readiness	1.28%	4.26%	27.66%	55.32%	11.49%
Practice Readiness	0%	0.99%	8.91%	63.37%	26.73%
EPA 9: Maximise the appropriate use of medications in a population					
APPE Readiness	4.70%	14.10%	38.46%	35.9%	6.84%
Practice Readiness	0%	0.99%	16.83%	60.4%	21.78%
EPA 10: Ensure that patients have been immunised against vaccine-preventable diseases					
APPE Readiness	0.43%	3.83%	15.32%	51.06%	29.36%
Practice Readiness	0%	0.99%	5.94%	53.47%	39.6%
Information master domain					
EPA 11: Educate patients and professional colleagues regarding the appropriate use of medications					
APPE Readiness	0.43%	2.99%	21.79%	54.7%	20.09%
Practice Readiness	0%	0%	7.92%	50.5%	41.55%
EPA 12: Use evidence-based information to advance patient care					
APPE Readiness	1.70%	5.11%	25.96%	54.89%	12.34%
Practice Readiness	0%	0%	11.88%	51.49%	36.65%
Practice manager domain					
EPA 13: Oversee the pharmacy operations for an assigned work shift					
APPE Readiness	11.54%	14.53%	35.04%	30.77%	8.12%
Practice Readiness	3%	1%	25%	47%	24%
EPA 14: Fulfill a medication order					
APPE Readiness	2.98%	2.55%	19.57%	43.40%	31.49%
Practice Readiness	1.98%	0%	10.89%	44.55%	42.57%

Comparison of change from beginning of APPE year to end of APPE year

All 15 EPA subdomains showed a positive change in entrustability level between the APPE readiness and practice readiness surveys (see Table III). Although "oversee the pharmacy operations of an assigned shift" was ranked the lowest in both surveys, it was the area of the highest gain, with a 26% increase in entrustability level, followed closely by "maximise the appropriate use of medications in a population", with a 24% change. The smallest change of 6% was found in the Self-Developer domain with the task "create a written plan for continuous professional development," where students reported their highest level of entrustability in both surveys. Overall, the largest changes in entrustability levels for subdomains were found in the Patient Care Domain, while the smallest change was found in the Self-Developer Domain. The average pre-APPE entrustment level was 3.72, which increased to an average of 4.2 in the practice readiness portion. The percentage of students scoring themselves below an entrustment level of 3 in the practice readiness survey was small, ranging from 0–0.99% when considering all the subdomains. The students scoring below a 4 varied largely by each subdomain, ranging from 6.93–28.71%. Table III outlines a summary of these changes.

Table III: Percentage change from APPE-Readiness to Practice Readiness

	APPE (weighted mean)	Practice (weighted mean)	% Change APPE to Practice
Patient care provider domain			
Collect information to identify a patient's medication-related problems and health-related needs	3.86	4.27	11%
Analyse information to determine the effects of medication therapy, identify medication-related problems and prioritise health-related needs	3.62	4.14	14%
Establish patient-centered goals and create a care plan for a patient in collaboration with the patient, caregiver(s), and other health professionals that are evidence-based and cost-effective	3.46	4.07	18%
Implement a care plan in collaboration with the patient, caregivers, and other health professionals.	3.69	4.17	13%
Follow-up and monitor a care plan	3.58	4.25	19%
Interprofessional team member domain			
Collaborate as a member of an interprofessional team.	3.83	4.25	11%
Population health promoter domain			
Identify patients at risk for prevalent diseases in a population	3.93	4.25	8%
Minimise adverse drug events and medication errors	3.71	4.16	12%
Maximise the appropriate use of medications in a population	3.26	4.03	24%
Ensure that patients have been immunised against vaccine-preventable diseases	4.05	4.32	7%
Information master domain			
Educate patients and professional colleagues regarding the appropriate use of medications	3.91	4.34	11%
Use evidence-based information to advance patient care	3.71	4.25	15%
Practice manager domain			
Oversee the pharmacy operations for an assigned work shift	3.09	3.88	26%
Fulfill a medication order	3.98	4.26	7%
Self-developer domain			
Create a written plan for continuous professional development	4.06	4.3	6%
Average across all domains	3.72	4.2	13%

Discussion

This study highlights results addressing three major areas: (1) effectiveness of APPE rotations to increase confidence in the 15 EPA domains, (2) insight into which specific subdomains students feel the least and most confident in, and (3) insight into target entrustability levels for both pre and post-APPE rotations.

The results of this study illustrate that APPE rotations positively impacted students' self-rated entrustability levels with all EPAs. Looking at the confidence levels in the various subdomains before and after APPE rotations provides preliminary information regarding

the didactic and experiential curricula's effectiveness in preparing students to execute these work tasks independently. The following EPA subdomains were consistently the areas of least confidence in both surveys: "Oversee the pharmacy operations…", "maximise the appropriate use of medications in a population", and "establish patient-centred goals and create a plan…". Overseeing pharmacy operations may be ranked lower due to limited exposure student learners likely get to a management-level position both before and during rotations, compared to clinical duties, which are more likely to be modelled across a larger spectrum of rotations. Additionally, given that creating a plan is one of the later steps in the Pharmacists Patient Care Process, students may be getting more practice with the collection and analysis components, supported by higher confidence levels seen in some studies. Additionally, limited data show that students may not believe creating a plan is an expected or relevant pharmacist work attribute across multiple settings (Pittenger *et al.,* 2019).

There was more variability between pre- and post-surveys with "create a written plan for continuous professional development [CPD]" and "ensure patients have been immunised against vaccine-preventable diseases" within the top three each time. Given students' ability to develop a plan for CPD is not robustly assessed at our institution, this finding may reflect overconfidence due to limited external feedback provided in this area compared to more clinically focused domains. Additionally, students may feel like they innately have this skill, so they do not need intentional development. Although they used different EPAs and rating systems, Lounsbery and colleagues (2019) also saw the smallest change in professionalism. In another study, the self-developer EPA was an area where students had the least agreement about its place in pharmacy professional practice (Pittenger *et al.,* 2019). These results highlight the need to gather more qualitative data to evaluate students' relationships with and perspectives on continuous professional development. Another area of high confidence was in students' ability to ensure appropriate immunisations, likely secondary to a significant emphasis on didactic training and practice experiences in their early experiential opportunities.

Recently, the AACP Academic Affairs Standing Committee was tasked with reviewing and updating both the Center for the Advancement of Pharmacy Education (CAPE) educational outcomes and the EPAs (Medina *et al.,* 2023). In their report, they propose a reduction of the current fifteen subdomains to thirteen. Relevant changes to these EPA subdomains to this study include a rephrasing of the area of least confidence from "Oversee the pharmacy operations for an assigned work shift" to "Perform the technical, administrative, and supporting operations of a pharmacy practice site" (Medina *et al.,* 2023). While this recommended change in phrasing may add slightly more specificity on what overseeing pharmacy operations entails, the authors expect little change in pharmacy students' self-reported confidence levels, given the similarity in concept. Looking at the area of highest confidence level, the Committee recommends the removal of the EPA self-developer domain focused on developing a written plan for CPD (Medina *et al.,* 2023). The results of this study illustrate a high level of confidence and little change through the APPE curriculum, so the removal may be warranted to consider the development and assessment of this domain through other curricular means. Additionally, the other area of highest reported confidence in this study, ensuring patients have been immunised (related to EPA 10), is recommended to be removed and is consolidated in more general phrasing related to the EPAs focused on the Pharmacist Patient Care Process.

Finally, this study provides data regarding considerations for entrustability levels before and after APPE rotations. Before starting their APPEs, average students believed they were at least at a level 3 of entrustability for all subdomains, where they understood the task but needed on-demand or reactive supervision. For the EPAs related to immunisations and CPD, average students were prepared at an entrustability level of 4, indicating confidence to perform these work tasks unsupervised. For the practice readiness results, students were able to increase their confidence level to at least a 4 in all subdomains except for overseeing pharmacy operations. Despite the recommendation from both AACP workgroups that students should meet a minimum of Level 3 (reactive supervision) before graduation, establishing agreement or appropriateness with this setpoint across all EPAs has been limited (VanLangen *et al.,* 2019). Although student self-assessment values can often be inflated when compared to preceptor data, other studies and stakeholders have questioned the validity of reactive supervision (Level 3) as the level of minimum competency, especially considering that employers often have expectations of independence when pharmacy graduates step into many entry-level positions (Pittenger *et al.,* 2017; VanLangen *et al.,* 2019). Despite the concern of restrictions placed by pharmacy law upon a student's ability to complete tasks independently, it is still possible to observe the independent execution of a work task and evaluate the need for supervision, as indicated by the levels of entrustment. Although an entrustablity level of 4 (defined as intermittent supervision in the most recent

Committee report) may not be reasonable for all EPAs, further discussion should address whether each EPA should have a different setpoint depending on the typical expectations of employers. These results may assist in increasing these setpoints from 3 to 4 upon graduation, at least for specific subdomains.

Limitations

Several limitations exist when interpreting these findings coming from a single school, which may limit the generalisability. However, given multiple years of data, some durability in results related to APPE readiness is expected. Given the variability in the exit interview process, these results cannot reflect the change in the same class from pre-APPE to pre-practice, so small changes in the didactic curriculum or experiential learning opportunities may impact the results. Fewer students completed the practice readiness survey compared to the APPE readiness, leaving less reliability with those results. These data were collected before the COVID-19 pandemic, leading to significant alterations in curricula and experiential rotations post-COVID-19. Self-reported levels in various EPAs may differ for current graduates, particularly those involving direct patient care. Student self-assessment data may not accurately reflect the evaluated performance levels by faculty or preceptor on experiential as students' scores tend to be higher than those of preceptors (Rhodes *et al.,* 2019; Marshall *et al.,* 2020). Using self-assessment data compared to preceptor evaluations may inflate the results seen. Finally, despite efforts to create some level of similarity through requirements of specific work products, APPE rotation experiences can be highly variable. The impact on student self-evaluation of entrustability levels for EPAs may change over time and location.

Future studies of similar design would be helpful to assist in validating the recommended level of entrustability at the pre-APPE and post-APPE checkpoints. Additionally, schools using EPAs as part of their student evaluation could help compare these data to preceptor evaluations to determine student self-assessment accuracy in these areas.

Conclusion

This study examined students' self-reported levels of entrustment on each of the 15 core subdomains for pharmacy EPAs before and after their APPE year. Over the year, APPEs improved self-reported entrustability scores on all EPA domains to varying degrees. The majority of students were able to meet the checkpoint of entrustability level of 3 for all EPAs in their practice readiness evaluations, with many meeting this level in the pre-APPE evaluation. Further studies are needed to confirm these findings and help create a clearer picture of realistic setpoints of entrustability for pharmacy graduates when evaluating APPE and practice readiness.

Conflict of interest

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