Use of the Electrodiagnostic Entrustable Professional Activity for Competency Assessment in Physical Medicine and Rehabilitation Training Programs

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Abstract: Entrustable professional activities have emerged as a means for the evaluation of resident competency that is expressed in terms of the assessed need for supervision. Recently, 19 physical medicine and rehabilitation–specific entrustable professional activities were published (Am J Phys Med Rehabil. 2017;96:762–764). The electrodiagnostic entrustable professional activity and six new electrodiagnostic entrustable professional activities subcategories (observable practice activities) were piloted as an entrustable professional activities/observable practice activities set within five residency programs. Survey-based (quantitative) and open-ended (qualitative) feedback was collected from participants. Participating attendings found this method feasible and generally reported satisfaction with the entrustable professional activities/observable practice activities as a means of providing feedback to residents. Residents were less clear on the added value of this approach. Qualitative data supported the need for adjustments to the entrustment scale to allow for more gradations within supervisory levels, a standardized orientation of residents to the use of observable practice activities and an increased quantity of assessments for each observable practice activities category to allow for demonstration of resident progress toward independence. Use of the electrodiagnostic entrustable professional activity/observable practice activities set shows promise as a means for observational competency assessment in the outpatient setting. However, feedback acquired through this pilot study suggests changes that could be made to improve future implementation.

Key Words: Clinical Competence, Feedback, Education, Medical, Internship and Residency

for the EPAs or “nested” EPAs. For example, the EPA for electrodiagnosis (EMG) covers the preparation for, performance of, troubleshooting for and interpretation of all forms of electrodiagnostic studies. By itself, the EMG EPA was felt to be too broad for making real-time observational entrustment decisions. To assist in the implementation of the EMG EPA, six nested EPAs were created (i.e., mononeuropathy, radiculopathy, peripheral polyneuropathy, motor neuron disease, myopathy, and neuromuscular junction disorders). To decrease confusion regarding the terminology, and following the work of Warm et al. (2014), these more granular EMG activities were labeled observable practice activities (OPAs). The following report describes a pilot study involving the use of the PM&R EMG EPA/OPA set in five PM&R residency programs across the United States.

The specific goals of this study were as follows:

- To acquire input from PM&R attendings regarding the feasibility of using the EMG EPA/OPA set in their clinics, as well as their satisfaction with using the EPA/OPA set as a means for providing residents with formative and summative feedback.
- To obtain information from PM&R residents regarding the clarity of expectations and usefulness of formative and summative feedback that they received using the EMG EPA/OPA set.

**METHODS**

This study took place over a 4-mo period in early 2018. The study was conducted at five PM&R residency programs distributed across the United States. Intitutional review board approval was sought and obtained in each location in accordance with the declaration of the World Medical Association. Written informed consent was obtained from all participating PM&R attending physicians and PM&R residents. All participating attending physicians had expertise in the performance and teaching of electrodiagnostic studies. The principal investigator (PI) and site-specific co-PIs performed a semistandardized orientation for the PM&R EMG attendings. The overall aim of the pilot was explained in writing to the participating residents during the consent process. Residents were informed that the completed OPAs would be used for formative feedback but would not take the place of the routine assessment strategies currently being used for assessing the residents on rotations. Each OPA was completed and reviewed with the resident within 3 hrs of the assessment.

Preparticipation and postparticipation surveys were sent electronically to all participating attending and residents (see Supplemental Materials, Supplemental Digital Content 1, http://links.lww.com/PHM/A870). Only the PI (HB) had access to information linking the surveys to the identity of the participants. Attending preparticipation surveys contained questions that elicited information regarding competency assessment methods used before the implementation of OPAs. The postparticipation attending survey inquired as to:

- how many residents performed EMGs with them
- how many OPAs they completed in an average week
- how well the EMG EPA/OPA set corresponded to the content of the rotation
- how useful the set was for setting expectations for learning and skill development
- how useful the set was for evaluating resident clinical competence
- how useful the set was for providing formative and summative feedback
- how easy it was to use the EPA/OPA set
- what barriers they may have encountered when trying to use the EPA/OPA set
- how the OPAs could be improved
- whether they felt that the EPA/OPA set added value to competency assessment

The preparticipation surveys for residents asked about the clarity of learning expectations and the perceived usefulness of the feedback that they received on their clinical rotations. The postparticipation resident survey elicited responses about the following:

- how well the OPAs served to clarify learning expectations
- whether the OPAs were used by the attendings to provide feedback
- how useful the OPAs were as a structure for receiving feedback
- whether the OPAs helped the resident to understand how much supervision they needed
- whether the resident thought OPAs would be useful on other rotations
- what was most helpful and least helpful about the OPAs
- what would make OPAs more useful

**Data Analysis**

This study followed the recommendation for pilot studies set out by Areán and Kraemer (2013), which suggested 20–30 participants for a “dress rehearsal” of a clinical trial. As such, the goal was for 36 total participants to be enrolled (28 residents and 8 attendings). The presurvey and postsurvey used a five-point Likert scale and were coded 1–5 (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). Presurvey and postsurvey responses were summarized both as means and standard deviations (SDs) within attendings and residents as well as proportion answering each question as either agree or strongly agree. In addition, for the attending surveys, the mean difference (post minus pre), SD, and 95% confidence interval for each question was calculated. The mean (SD) and median (range) of number of residents...
Performing EMGs with the attending and number of OPAs completed in an average week by attendings were recorded. For residents, the mean difference (post minus pre), SD, and 95% confidence interval were calculated. Because surveys were completely anonymous, it was not possible to match postsurvey responses to presurvey responses. As such, no formal statistical comparisons were made.

**RESULTS**

**Participants**

Eight PMR attending physicians and 24 PMR residents consented to take part in this study. One resident declined. Residents from all levels of training (i.e., PGY2–4) participated in this study.

**Attending Preparticipation Surveys**

All EMG attendings responded. Attendings listed the assessment measures that they were using before the pilot. These included direct verbal feedback during or after the procedure (25%), prerotation versus postrotation quizzes (12.5%), PM&R Milestones (37.5%), Resident Evaluation & Competency Assessments (37.5%), “standardized” mid rotation (12.5%) and end of rotation (37.5%) evaluations, and “non-EMG specific” OPAs (12.5%). Additional attending responses are summarized in Table 1.

**Attending Postparticipation Surveys**

Six of the attendings responded. Attendings reported that they worked with 2–9 residents per rotation. Attendings estimated that they completed 0–12 OPAs per week. Barriers to implementation included difficulty relating the wording of the ES to the clinical environment (16.5%), low patient volume (33%), and insufficient opportunity to complete the selected OPAs due to the distribution of diagnoses (33%). None of the attendings chose to use the OPAs for myopathy or neuromuscular junction disorders. Attending opinions regarding the relevance, usefulness, and ease of use of the OPAs are summarized in Table 1.

**Resident Preparticipation Surveys**

Twenty-four residents completed the preparticipation survey, although they did not all answer each question. Residents were asked to indicate the degree to which they agreed or disagreed with three statements as shown in Table 2.

**Resident Postparticipation Survey**

Fifteen residents completed this survey. Open-ended comments from responding participants reflected the opinion that OPAs were used by their attendings to describe expectations, were quick, and allowed for dynamic feedback. Some residents indicated that the OPAs were too broadly worded or vague and were inconsistently used and subjective. Residents suggested that OPAs could be improved by more specific orientation before use, inclusion of more categories within the ES, being

<table>
<thead>
<tr>
<th>Question Content</th>
<th>Attending Preparticipation Responses Questions Regarding Utility of Current Measures (n = 8)</th>
<th>Attending Postparticipation Responses Questions Regarding Utility of OPAs (n = 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1. Correspond with rotation content</td>
<td>Mean (SD) Median (Range) Agree or Strongly Agree Disagree or Strongly Disagree</td>
<td>Mean (SD) Median (Range) Agree or Strongly Agree Disagree or Strongly Disagree</td>
</tr>
<tr>
<td>3.6 (0.52) 4 (3–4) 5 (63%) 0 (0%)</td>
<td></td>
<td>4.2 (0.41) 4 (4–5) 6 (100%) 0 (0%)</td>
</tr>
<tr>
<td>Q2. Helpful for explaining learning expectations</td>
<td>3.1 (0.83) 3 (2–4) 3 (38%) 2 (25%)</td>
<td>4.2 (0.41) 4 (4–5) 6 (100%) 0 (0%)</td>
</tr>
<tr>
<td>Q3. Helpful for explaining skill development expectations</td>
<td>3.1 (0.64) 3 (2–4) 2 (25%) 1 (13%)</td>
<td>4.2 (0.41) 4 (4–5) 6 (100%) 0 (0%)</td>
</tr>
<tr>
<td>Q4. Helpful for evaluating level of competence</td>
<td>3.4 (0.74) 3.5 (2–4) 4 (50%) 1 (13%)</td>
<td>3.8 (0.41) 4 (3–4) 5 (83%) 0 (0%)</td>
</tr>
<tr>
<td>Q5. Helpful for formative feedback</td>
<td>3.5 (0.76) 4 (2–4) 5 (63%) 1 (13%)</td>
<td>4.3 (0.52) 4 (4–5) 6 (100%) 0 (0%)</td>
</tr>
<tr>
<td>Q6. Helpful for summative feedback</td>
<td>3.8 (0.46) 4 (3–4) 6 (75%) 0 (0%)</td>
<td>4.3 (0.52) 4 (4–5) 6 (100%) 0 (0%)</td>
</tr>
<tr>
<td>Q7. Easy to use</td>
<td>3.1 (0.99) 3.5 (2–4) 4 (50%) 3 (38%)</td>
<td>3.7 (1.0) 4 (2–5) 4 (67%) 1 (17%)</td>
</tr>
</tbody>
</table>

| Table 1. Attending preparticipation and postparticipation surveys |

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean (SD) Median (Range)</th>
<th>No. (%) Answering Either Agree or Strongly Agree</th>
<th>No. (%) Answering Either Disagree or Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1. Clear learning expectations</td>
<td>4.1 (0.50) 4 (3–5)</td>
<td>22 (92%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Q2. Receive useful feedback</td>
<td>4.1 (0.61) 4 (2–5)</td>
<td>23 (96%)</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>Q3. Clear amount of supervision</td>
<td>4.0 (0.86) 4 (2–5)</td>
<td>20 (83%)</td>
<td>2 (8%)</td>
</tr>
</tbody>
</table>
applied multiple times for a specific diagnosis, and being used more frequently during the rotation. The remainder of the resident’s responses are summarized in Table 3.

**DISCUSSION**

Although the use of entrustment-based formative and summative assessments has been increasing across different levels of medical education, we do not know how well this method will work in PM&R residency programs. The current study was designed to elicit some of this information to inform future application of EPAs and OPAs within PM&R clinical settings. The survey-based responses from attending physicians (Table 1) indicate that the EMG/OPA set corresponded well to the subject matter of the rotation, was helpful in setting out learning and skill development expectations for the trainees, was useful for assessing competence, and was helpful for providing feedback to the residents. In contrast, when asked about the assessment methods that they were using before introduction of the OPAs, the attendings had mixed responses regarding how well their assessment measures helped with setting expectations, assessing competence or providing feedback.

Open-ended feedback (see Supplemental Materials, Supplemental Digital Content 1, http://links.lww.com/PHM/A870) from participating PM&R attendings suggest that use of the EMG EPA/OPA set was feasible, although there were some barriers to implementation that reflected the specifics of the rotations at the different sites. These barriers included limitations on the number of EMGs performed on the rotation, the number of opportunities to evaluate the OPAs due to the distribution of possible diagnoses, and the number of sessions that the attending worked with the residents.

The wording of the chosen ES also seemed to create some difficulty. Although attendings were not specific regarding how the wording of the scale affected decision-making, it did become apparent that there was a desire to have finer gradations within the categories of supervision. It also seems that the descriptors for the levels needed to be clearer. The EMG attendings expressed enthusiasm for use of the OPAs as a means for outlining learning expectations for the residents as well as for providing formative and summative feedback. Attendings also indicated that the OPAs corresponded well with the day-to-day activities of their rotations.

Physical medicine and rehabilitation residents seemed to have mixed feelings about the value of the OPAs. Although they indicated that the attendings used the OPAs during the rotations to set expectations and anchor feedback, it seems that they were less clear about how useful that feedback was for them (Table 3). Open-ended responses from the residents (see Supplemental Materials, Supplemental Digital Content 1, http://links.lww.com/PHM/A870) did suggest that the value of the OPAs might be enhanced by a more detailed orientation to their use and meaning before the rotation, more frequent use of the OPAs, and an increased number of categories of supervision within the OPAs (presumably to allow the resident the opportunity to show more progress toward independence within the course of the rotation).

**Limitations**

There was a limited amount of standardization for the orientation of the participating attendings to the use of ES and the expectations of the protocol. This may have led to variability in the implementation of the EMG EPA/OPA set between participating attendings and across institutions. Although the intention of the OPAs was explained to residents in the consenting process, there was no standardization in how the EMG attendings explained the purpose or content of the OPAs to the residents nor is it clear whether the residents knew what the criteria were for assigning levels of supervision. Residents did not see the detailed descriptions included within each of the OPAs (e.g., planning the study, appropriately setting up the equipment, or troubleshooting). Perhaps if this had been shared with the residents at the start of the rotation, they would have better understood learning expectations and the basis for the feedback that they were receiving.

Rotation lengths varied between institutions (ranging from 4 to 8 wks) and some attendings had a much higher volume of EMGs than others. For this reason, it was not possible to be able to analyze the completed OPAs for evidence of progression in skills or independence. It also placed limits on the opportunity for residents in low-volume clinics to demonstrate improvements.

We did not control for year of training or previous EMG experience within the pool of residents. Each of the five participating institutions has residents rotating into the electrodiagnostic clinics at different points of their training. Therefore, we cannot know whether previous experience with EMGs would alter resident perceptions regarding the relevance or value of the OPAs.

Procedurally based clinical activities may be more amenable to this method than those involving complex medical management. That is because procedures generally require relatively easily defined steps that can be both repeated and

| Q1. OPAs used to set expectations | 3.6 (0.99) | 4 (1–5) | 11 (73%) | 2 (13%) |
| Q2. OPAs helped to understand expectations | 3.3 (0.96) | 4 (1–4) | 8 (53%) | 3 (20%) |
| Q3. OPAs used to provide feedback | 4.3 (0.59) | 4 (3–5) | 14 (93%) | 0 (0%) |
| Q4. OPAs source of useful feedback | 3.5 (0.99) | 4 (2–5) | 8 (53%) | 3 (20%) |
| Q5. OPAs helped me understand how much supervision I need | 3.7 (1.0) | 4 (1–5) | 12 (80%) | 2 (13%) |
| Q6. OPAs method would be useful in other settings/rotations | 3.5 (1.1) | 4 (1–5) | 9 (60%) | 3 (20%) |

**TABLE 3.** Postparticipation resident survey (n = 15)
observed. It is also the case that attending physicians are required to provide a significant amount of supervision for procedural interventions, thus increasing the number of potential opportunities for observational assessments. Clinical activities taking place in other settings may be performed with less consistent direct supervision and thus may be more challenging to capture with repeated observational assessments.

The preparticipation and postparticipation surveys were created for this study and not previously validated for educational research. Further work should be done to determine the best method for assessing the benefits and drawbacks to using entrustment-based assessments in PM&R programs.

Finally, the relatively low number of attendings and residents in the study and the lack full participation in the post study feedback surveys are of some concern. The response rate to the preparticipation surveys was 100%, but this may be because these surveys were linked to the digital consent forms. That is, if the resident or attending gave consent for the study, they were immediately taken to the survey. Multiple reminders were sent for completion of the postparticipation surveys. We do not know why some of the participants did not respond. However, low response rates to e-mail-based surveys are commonly reported in the literature.\(^{10-12}\) In addition, it is possible that our study participants are generally not routinely responsive to e-mail missives, preferring texting and/or social media. Perhaps we would have had a better response if we had sent the surveys through another method. Of course, we cannot rule out that lack of acceptance of the instrument played a part in reducing the response rates from both attendings and residents. Given the specifications of the protocol, we could not send more than two reminders to the participants.

**CONCLUSIONS**

Entrustment-based decision-making has become generally accepted as method for performing work-based competency assessments in medical education. Before widespread implementation of this approach in PM&R, we felt that it would be helpful to gather information regarding attending and resident satisfaction, feasibility, and barriers to this method of observational assessment. The EMG EPA/OPA set was chosen for this purpose as it was felt that the observation and assessment of supervision needs related to a procedurally based activity would be the most straightforward and thus a logical first step.

Use of the PM&R EMG EPA/OPA set shows promise as a means for observational competency assessment of the outpatient setting. However, feedback acquired through this pilot study suggests changes that should be made in attempts at future implementation. Chiefly, it is apparent that the ES that was used in this study was not well suited to the observational assessment of electrodiagnostic studies. A more tailored ES may be more sensitive to changes in skill/ability in performance of these procedures.

Incorporation of OPAs into orientation materials for residents at the start of an electrodiagnostic rotation may help with establishing learning expectations and lead to better resident satisfaction with the applicability of the feedback that they receive. In addition, breaking down OPAs into even more discrete entities (such as carpal tunnel evaluation) may be helpful for improving the specificity of the evaluations.

Finally, entrustment-based competency assessments are not expected to cover the totality of knowledge, skills, and attitudes that PM&R trainees will need to master to enter independent practice. As has happened in the training programs of other medical specialties, we anticipate that EPAs and OPAs would be part of a broad-based competency assessment strategy. Feedback gained from PM&R residents and attendings suggests that use of the EMG EPA/OPA set shows promise as a means for observational competency assessment of the outpatient setting. However, it is clear that changes that should be considered before attempts at future implementation. The findings from this pilot study may be useful for informing further efforts to use EPAs and OPAs as part of the competency assessment strategy in PM&R residency programs.

**ACKNOWLEDGMENTS**

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**REFERENCES**