Simulation of Neurological Emergencies for Milestones-Based Learning and Assessment  
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**OBJECTIVES**

To determine whether simulations:  
1. Enhances resident comfort in management of neurological emergencies  
2. Accurately assesses residents’ competence and entitlement

**BACKGROUND**

Simulation has been used to improve clinical and procedural skills, most extensively in fields like emergency medicine and anesthesiology. The role of simulation in neurology training and assessment has been the subject of recent discussion and debate. In neurology, simulation has shown to improve performance of lumbar puncture and may enhance confidence in the management of neurological emergencies and in brain death determination. Simulation may also be used for assessment, especially for activities that are not commonly directly observed by faculty members in the real-world setting.

Assessment of performance in simulations is often done using checklist or global rating scales. However, simulation could be used to assess residents on the basis of the ACGME Neurology Milestones. For some Milestone sub-competences, the rubric of an Observable Practice Activity (OPA) is a component of an Entrustable Professional Activity (EPA) – could be used to assess “entrustment.”

**METHODS**

The research protocol received a waiver from full review by the Yale University Human Subjects Committee (HSC #1509016507)

**Simulations**

- Two simulations of neurological emergencies were developed by the study authors: Acute Ischemic Stroke (AIS) and Status Epilepticus (SE).
- Simulations were designed to integrate specific competencies based on the Neurology Milestones.

**Participants**

- 8 residents, all in PGY-2, completed both simulations of neurological emergencies.
- Each simulation session was recorded by video for future review.
- All simulations were completed between July and September of the PGY-2 year.

**Participant Surveys**

- Each resident completed an anonymous pre- and post-simulation survey.
- Questionnaires explored self-reported comfort with specific elements of the simulation, based on the Neurology Milestones sub-competencies (before and after the simulation was complete), and satisfaction with the simulation process.

**Assessments**

- Three types of assessment were performed for each resident:  
  1. A checklist based on each simulation script.
  2. Milestones-based evaluations based on a limited number of Neurology Milestone sub-competencies.
  3. Entrustment assessments, based on selected Observable Practice Activities, based on a previously published task.

The Milestones and OPA assessments were completed independently by the faculty member conducting the simulation, and an independent study author, using video review.

**RESULTS**

**Pre- and post-simulation self-reported comfort with managing acute ischemic stroke**

<table>
<thead>
<tr>
<th>Component</th>
<th>Pre-Simulation (Mean)</th>
<th>Post-Simulation (Mean)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtaining a history</td>
<td>4.0 (0.3)</td>
<td>4.8 (0.2)</td>
<td>0.03</td>
</tr>
<tr>
<td>Examining a patient</td>
<td>4.5 (0.2)</td>
<td>4.6 (0.2)</td>
<td>0.3</td>
</tr>
<tr>
<td>Obtaining emergent Neuroimaging</td>
<td>4.5 (0.2)</td>
<td>4.8 (0.2)</td>
<td>0.03</td>
</tr>
<tr>
<td>Obtaining diagnostic tests</td>
<td>4.5 (0.2)</td>
<td>4.7 (0.2)</td>
<td>0.03</td>
</tr>
<tr>
<td>Completing history and physical</td>
<td>4.0 (0.3)</td>
<td>4.5 (0.2)</td>
<td>0.03</td>
</tr>
</tbody>
</table>

**Pre- and post-simulation self-reported comfort with managing status epilepticus**

<table>
<thead>
<tr>
<th>Component</th>
<th>Pre-Simulation (Mean)</th>
<th>Post-Simulation (Mean)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtaining a history</td>
<td>3.8 (0.4)</td>
<td>4.0 (0.4)</td>
<td>0.02</td>
</tr>
<tr>
<td>Selecting diagnostic tests</td>
<td>4.0 (0.4)</td>
<td>4.1 (0.4)</td>
<td>0.09</td>
</tr>
<tr>
<td>Interpreting EEG</td>
<td>2.6 (0.3)</td>
<td>2.5 (0.4)</td>
<td>0.7</td>
</tr>
<tr>
<td>Recognizing recognition status epilepticus</td>
<td>3.5 (0.5)</td>
<td>3.6 (0.5)</td>
<td>0.8</td>
</tr>
<tr>
<td>Choosing and administering medications for patients and special cases</td>
<td>3.5 (0.5)</td>
<td>3.6 (0.5)</td>
<td>0.8</td>
</tr>
<tr>
<td>Mental management of a patient with status epilepticus</td>
<td>3.5 (0.5)</td>
<td>3.6 (0.5)</td>
<td>0.8</td>
</tr>
</tbody>
</table>

**Inter-observer difference in assessment scores for each resident for all Competencies and OPAs**

- Analysis conducted for each resident for all Competencies and OPAs.

**Simulation was acceptable to residents, who felt that it improved their self-reported comfort in several competencies and professional activities related to managing status epilepticus and acute ischemic stroke.**

Assessments of simulation performance, based on the Neurology Milestones and Observable Practice Activities, may be valid in determining the level of entrustment in neurology residents. The median scores in most OPAs and Milestones Competencies matched well with the PGY level of this group of residents.

Although most of the assessment scores fell within 1 point between assessors, there was up to 2-point variability on some assessments. This would confirm previous evidence which suggests that a single assessment cannot be used to reliably assess competence or entrustment.

There was no difference in either validity or reliability between the Milestones Competencies and the Observable Practice Activities rubric. Likely, these are complementary assessment tools.

**FUTURE DIRECTIONS**

We have several goals beyond this initial study:

1. Further investigating reliability and validity using simulation for all 3 years of neurology residents.
2. Analyzing whether there are correlations between checklist items and competency or OPA scores.
3. Expanding the program to involve more simulations, matched to the competencies and OPAs, and focusing on uncommon clinical scenarios.
4. Exploring the relationship between performance in the simulation and overall performance in the Milestones based on Clinical Competency Committee Assessments.

**REFERENCES**


**CONTACT**

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