



## 5 Tracking Resident Cognitive Maturation with Natural Language Processing

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**Background:** Cognitive maturation, the development of the ability to manage patients independently, is an important goal of graduate medical education. In contrast to assessments of procedural competency or knowledge base, there is no structured transparent scalable way to track the cognitive maturation of residents. An important component of residency training is the solicitation of evaluations by attending physicians to gauge a resident’s performance and provide actionable feedback. These evaluations provide insight into cognitive maturation, but their analysis is time-consuming and subjective.

**Educational Objectives:** We developed software to analyze freetext evaluations of residents that attendings conducted after each clinical shift in the Emergency Department. The software uses natural language processing to automatically identify areas for improvement or commendation, based on milestones set by the Accreditation Council for Graduate Medical Education and American Board of Emergency Medicine. Our underlying conceptual hypothesis is that linguistic markers track the development of medical decision making, which we term cognitive maturation. The software is written in Python and freely available, with extensive documentation, on GitHub.

**Curricular Design:** In this proof-of concept study we simulated faculty evaluations from 100 residents over the course of one year. The resident performance was created from four archetypes, the rock star, the late bloomer, the laggard, and the work horse. The tone of the faculty evaluation was created from four faculty archetypes: laconic, effusive, disapproving, or diligent. It correctly identified 22/25 notes where the “laggard” archetype predominated.

**Impact/Effectiveness:** Ours is the first demonstration of natural language processing to use faculty evaluations to track the cognitive maturation of residents. This innovation

may help facilitate automatic pervasive real-time tracking of resident progress, identifying competency-based developmental progression or deficits and allowing for early initiation of tailored educational interventions. Automation also provides an opportunity to include novel data streams, such as clinical documentation, in tracking resident progression.

## 6 Using the ACGME’s CLER Pathways to Excellence Framework in Assessing Residency Competency in a Patient Safety Curriculum

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**Background:** The ACGME CLER Pathways to Excellence has created well-defined priorities for a culture of patient safety which include: reporting, education, creation of a supporting culture, resident experience, and monitoring of engagement in safety practices. Procedural sedation in the pediatric population is a high-risk situation with myriad potential safety issues. Many adverse outcomes can be mitigated by following pre-procedure protocols, and by participating in event reporting systems (ERS) to prevent future mishap.

**Educational Objectives:** To assess resident’s retention of our patient safety curriculum, using the ACGME Pathways to Excellence framework in Safety, in the setting of a high-risk pediatric procedure.

**Curricular Design:** The annual competency assessment for EM residents included a simulated patient encounter requiring procedural sedation for a child. The residents were handed a syringe containing 10 times the weight-based ordered dose along with the empty drug vial. Residents were observed for adherence to patient safety practices including; appropriate equipment/ room preparation, medication time-out, procedural time out, and response to airway compromise during the event. Following the simulation, residents were asked to log an error/near miss report in the institutional on-line ERS. The quality of these reports was evaluated for accuracy of event description, ability to identify contributing factors, and inclusion of suggestions to prevent future occurrences.

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