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Letter to the Editor

The quest for an ideal EEG competency assessment

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EEG competency assessments have varied widely in content, format, and scoring. Beyond a lack of standardization, existing assessments also tend to fall short in rigor and measurement of higher-level outcomes (Fernandez et al., 2025). These shortcomings suggest that an ideal EEG test has yet to be designed. If so, what would such a test look like, and how might we design it?

The first dimension to consider is content. EEG has an extensive pattern space. For instance, more than 100 distinct pattern combinations have been proposed in critical care EEG (Hirsch et al., 2021), and 68 essential findings have been proposed in non-critical care, non-neonatal EEG (Nascimento et al., 2022b).

We posit that an ideal test should include clinically relevant ("must-know") findings, with multiple examples of each finding at varying levels of interpretive difficulty. Although the optimal number of examples per finding is unknown, we believe that at least 100 would be needed. With a large enough EEG item bank, psychometric methodologies such as item response theory could determine both the optimal number and difficulty range of EEG samples for each skill level.

The second dimension relates to format. We argue that interactive recordings should be preferred over static screenshots because they better mirror real-world clinical EEG practice. Further, we believe that short clips and full studies each serve distinct purposes and may be better suited to particular subgroups of test-takers and the specific skill set being assessed. As to the optimal response format, multiple-choice questions may work well for short clips as they are finding-specific and can incorporate relevant distractors (Nascimento et al., 2023), whereas a standardized classification framework[1] (Tveit et al., 2023) may be better for full studies as it mirrors real-world clinical reporting.

The last core dimension is scoring (i.e., how to establish the correct answer against which responses are judged). An external gold standard, such as long-term video-EEG recordings and/or long-term clinical outcome data, would be preferable, but it is not widely available in practice and is inevitably tied to select patient subpopulations. Alternatively, a more feasible option may be expert consensus (Nascimento et al., 2022a).

The primary goal of obtaining a reference standard based on the distribution of expert opinions is to estimate the consensus with sufficiently low probability of error. Statistical methods based on the binomial distribution can be used to determine the number of raters needed so that the probability of misclassifying the true majority (due to sampling variability) falls below a pre-specified threshold (e.g., 5%). In parallel, reporting the proportion of experts endorsing each interpretation provides a measure of case ambiguity, which may itself be clinically and educationally informative. Importantly, raters should be EEG experts with, ideally, diverse training backgrounds.

The quest for an ideal EEG competency assessment demands obtaining sufficiently strong evidence to substantiate the inference that scores reflect accurate and reliable EEG interpretation in practice. Collecting such evidence should be an iterative process and should include examining test performances across diverse subgroups of test-takers (Royal, 2017). Ultimately, the stakes are considerable because an ideal assessment can ensure that certified electroencephalographers possess the skills necessary to deliver accurate, reliable, and safe EEG interpretations.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: M. Brandon Westover is a co-founder, scientific advisor, and consultant to Beacon Biosignals and has a personal equity interest in the company; the company was not involved in this work. F. Nascimento, S. Beniczky and D. Yuan have no relevant conflicts of interest.

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[1] Such as categorizing recordings as normal vs. focal epileptiform, focal non-epileptiform, generalized epileptiform, and/or generalized non-epileptiform.

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