

Letter to the Editor: New Observation

The Case for Peer Review in EEG: An Institution's Call to Arms

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In epilepsy, one important source of diagnostic error is electroencephalogram (EEG) interpretation. Approximately 30% of patients seen in specialized epilepsy clinics or admitted for EEG video monitoring for refractory seizures are misdiagnosed, an occurrence frequently predicated on the finding of an 'abnormal' EEG.¹ Similarly, a Canadian center found that 32% of recordings reporting abnormalities in the temporal region were ultimately determined to be within normal limits.² An inaccurate diagnosis of epilepsy has significant social, financial, and health implications for the patient. Furthermore, failure to recognize epileptiform discharges can lead to undertreatment, and misinterpretation of EEG findings can result in unnecessary investigations such as neuroimaging. While these errors and misdiagnoses may be significantly reduced by having only neurologists trained and formally certified in electroencephalography interpret EEGs, this is not always routinely done in practice.³ There is also evidence to suggest that misinterpretation of EEGs is more likely observed when EEGs are reviewed by neurologists without specialty training.⁴

In Canada, there is no current formal and mandated certification required to read EEGs. Most provincial health authorities (except for Alberta), hospitals, and other facilities do not mandate the obtention of the Canadian Society of Clinical Neurophysiology (CSCN) EEG certification for their physicians to read and interpret EEGs. Furthermore, even if that were to suddenly change, there would be many physicians who would be 'grandfathered' into the process without having received formal EEG/epilepsy training. This is compounded by the fact that the Royal College of Physicians and Surgeons of Canada does not provide EEG courses or educational materials for electroencephalographers to ensure their maintenance of certification.

Though most tertiary care institutions hold some form of EEG rounds for educational purposes, to our knowledge, no center has previously attempted to implement a more structured peer review process for EEG interpretation. In our center, we adapted the radiology peer review to pilot a structured Peer-to-Peer EEG Quality Improvement Program (PEQUIP).

Our process was well-intended and was meant to bridge the gap between the wide-ranging EEG experience of our interpreting physicians. We wanted to briefly highlight our experience by way of this communication.

In our center, there are seven neurologists that report routine EEGs. They have a wide range of experience, ranging from less than 5 years to more than 20 years; however, only two are board-certified to read EEGs. For this program, each of the neurologists were asked to review four randomly selected EEGs per month that had previously been interpreted by another colleague. The original report, including the name of the reporting neurologist, was available to them. EEGs were randomly assigned by the charge technologist from recently performed routine inpatient and outpatient EEGs. If the reviewing neurologist's interpretation of the EEG differed enough from the original interpretation that patient management could be affected, the reviewing neurologist was asked to provide structured feedback to the reporting neurologist using a purpose-built email template. A copy of the email was sent to the director for quality improvement for the neurology division and to the head of the division.

The receiving neurologist was directed to review the EEG in question and indicate the action taken in a reply email. Irreconcilable differences between the reviewers were settled by a respected third-party neurologist outside our institution. Concurrently, monthly rounds to discuss EEG interpretation were organized. To have structured feedback about the program, the neurologists were asked to complete an anonymous survey at 9 months.

Neurologists rated PEQUIP negatively overall. Some indicated that the program caused stress or anxiety. One concern was the legal implication of peer EEG review, which we tried to mitigate prior to launching the program by advising participants that each province and territory in Canada has legislation that protects information collected for quality improvement purposes.⁵ Although participants were assured that PEQUIP was not tied to career remediation or promotion, all neurologists who report EEGs were required to participate and the division head and division of neurology quality lead were copied on PEQUIP emails, which may be why some participants reported that the program felt punitive. Several participants indicated that PEQUIP was too time-consuming, and most reported that it did not contribute to their learning. Unfortunately, our findings are similar to what has previously been reported in the radiology literature.⁶

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Our experience suggests that a different approach may be worth pursuing but that there is value in a structured peer review process for EEG. We unconsciously repeated similar mistakes in our methods to what the radiology literature had cautioned against, namely using unblinded studies and particularly copying the division head on the generated peer reviews, which was done in the interest of transparency not as a punitive measure, but triggered undue anxiety in participants. Additionally, we do not feel that institutional EEG rounds are sufficient for bridging knowledge gaps between readers of different training backgrounds, certification, and experience levels, especially if most of the readers are trained in their own institutions or adhere to a shared scoring system. We would instead propose the creation of a national peer review program, administered by the Royal College of Physicians and Surgeons of Canada, that leverages technology and artificial intelligence with the goal of providing near-instantaneous feedback. Any Canadian institution performing EEGs would automatically upload a certain number of studies to an encrypted, anonymized, and deidentified pan-Canadian platform which would redistribute studies to readers from other institutions, ideally outside the original province. They would review the studies and the reports and provide feedback, with differences in opinion going to a wider peer review panel for adjudication. The response would be sent back to the initial reader instantaneously, who could then action the recommendations. None of the peer reviews would be tracked and would eventually disappear from the cloud though the participants would be able to use them in their maintenance of certification yearly credit allocation. Participating institutions and EEG labs could similarly use this framework in their accreditation efforts, since outside Alberta health authorities and institutes do not even enforce adherence to the minimal standards of electroencephalography in Canada.⁷ Though we anticipate some level of inertia for this endeavor to move forward, such a system would enrich the EEG reading across the country and lend significant credence to EEG interpretations overall, in contrast to the current, opaquer, system in existence. This movement could be spearheaded by the

Canadian Society of Clinical Neurophysiologists in collaboration with the Royal College. The ultimate objective of course is that learning opportunities are maximized in a collaborative, nonpunitive, and safe environment, enhanced by technology.⁸

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