week 4 compared to week 1, with a concomitant increase in green interactions ($P < .001$ for each). Exploratory outcomes that we deemed hypothesis-generating included analyses of heart rate, blood pressure, cortisol levels, and their relationship to the "color" of the interaction.

The GoProEmo technology is proprietary to our hospital and was approved for use in this study by the Institutional Review Board committee. Development of the GoProEmo receptor patch was outsourced to a biomedical technology company funded by the study grant. A total of 100 patches were made at a cost of $20 per patch and are reusable.

Acceptability of the intervention was assessed at the patient and provider levels using focus groups. Patients found that the implementation of personal visual recording devices improved communication with providers and enhanced the perceived level of compassion. Privacy concerns were addressed during the consent process, and data were permanently erased after review. Learners were initially concerned about being recorded, but focus groups at the end of the study revealed that, overall, residents appreciated the improved feedback quality.

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NEW IDEAS

Taking the Lid Off Learner Cognition in 2030: Measuring Competence in Nonprocedural Specialties Using Brain-Computer Interfaces

Setting and Problem

The competency-based medical education movement of the early 2000s led to improvements in systems we use to assess resident performance. Initially, residency programs relied heavily on direct observation of clinical care. In non-procedural specialties, however, it was difficult to "observe" cognitive processes or to attribute decisions to a single individual in a team-based environment. Programs tested multiple technologies over the years to measure cognition. First, many used electronic health records to analyze trainees' orders, documentation, and workflow patterns. Then, wearable biometric monitors (eg, Fitbits) were developed to detect learner movements and speech. These approaches revealed shadows of a learner's cognition, but none of them provided a true picture. Today, neurobionics provides the clearest window yet into a learner's cognition. Neurobionics began in the 1960s with cochlear implants and progressed to more advanced (but invasive) brain-computer interfaces (BCI) in the 2010s with development of thought control of prosthetic limbs and voice generators. Modern BCI technology is wearable (rather than implanted) and more affordable than in the past. We report a pilot showing the feasibility of using BCI for assessment of learner cognition.

Intervention

We collaborated with researchers from the fields of neuroscience, linguistics, computer science, and artificial intelligence (AI) to adapt commercially available BCI devices for a pilot feasibility study.

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Each device consists of 4 ultra-high sensitivity electroencephalography electrodes adhered to a learner's scalp without the need for hair removal and connects to a small transmitter that clips to the learner's lapel or collar. The electrodes sense individual neuron action potentials, which are converted to computer code and transmitted in real time to a HIPAA-compliant cloud server.

We recruited 16 internal medicine interns for a 1-month pilot study. Each participant underwent a 6-hour session in which they wore the devices during conversations, reading, and cognitive exercises to "train" AI algorithms to convert the transmitted computer code into verbal output. AI algorithms were also "trained" to filter out neuronal activity for thoughts unrelated to professional activities (personal thoughts) and remove them from the output stream.

Outcomes to Date

Participants wore the devices daily for 1 month during their general internal medicine ward rotations, with no reported physical side effects. Captured neuronal data were translated into thought narrative transcripts, along with quantitative data of multiple cognitive variables, including the number of diagnoses considered, decision-making time, and quantitative rating of decision confidence. Overall, 93% of filtered and transcribed data were related to professional activities, while 7% were related to personal thoughts. Personal thought data were immediately deleted by the study team. Debriefing with residents showed that transcribed thoughts matched their recalled thought processes with high fidelity.

Our study demonstrates the feasibility of using wearable BCI technology to gather unprecedented data on resident cognition in real time. However, many challenges and questions remain before widespread implementation. First, AI was not perfect in differentiating professional from personal thoughts, raising issues of confidentiality and ethical dilemmas. What if problematic thoughts (eg, unprofessional thoughts or thoughts of self-harm) are detected? Should program leaders intervene on thoughts or on behaviors only? Higher specificity AI algorithms and input from learners and ethics experts are needed. Second, we did not assess the effects of this approach on the learner or the program. Does cognition truly equal competence? Do resulting data help learners? Will clinical competency committees be able to review such vast data in a meaningful way? Finally, this pilot focused on cognition, not emotion, so use of BCI to measure wellness and burnout requires further investigation. Future studies should address ethical and emotional implications, in addition to further refinement and validation of the approach.

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NEW IDEAS

An Adaptive, Open Source, Faculty Development Platform for Medical Educators in 2030

Setting and Problem

There is a widening gap between traditionally delivered faculty development resources and

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