Designing with the Patient in Mind: The Challenge of Ambulatory EEG monitoring

Joseph A. Cafazzo

Advances in sensors and low-power systems have brought about the potential for ambulatory encephalography (EEG) [1]. Depending on the specific application, the practicality of field studies outside of a controlled environment varies. The challenge of developing a practical, usable design requires that some major technical challenges be addressed, such that patients are able to use and operate such systems beyond the research setting.

THE PATIENT EXPERIENCE (PX)

The transformation of ambulatory EEG from a research concept to practical application for clinical diagnoses, monitoring, and self-care will require a level of design rigour that is often forgotten in conventional research circles. User-centered design (UCD) is widely used in the development of consumer products design but is largely under-utilized in biomedical engineering and medical device design [3].

As a result, products are often far too complex for use by patients and clinicians alike, requiring a high degree of training to operate the technology. These excessive levels of training are largely to address a lack of insight to the user requirements and ultimately the system design. UCD addresses this through a systematic process of methods that encompass user testing at every point of the design process (Figure 1). A variety of methods are employed from the realms of qualitative research and derivative methods that are commonly used in human factors engineering. In the end, successful deployment of personal health technologies for patients requires a variety of specialized skills for the design team to address the patient experience (PX). A lack of consideration for patient experience risks the viability of the technology in practice, regardless of the advancements in the technology itself.

CHALLENGES IN AMBULATORY EEG

UCD suggests that the system requirements be informed through specifics of the intended application: What is to be achieved? This question should be referred to often in the iterative design process of the application; removing features as much as possible to minimize the unnecessary complexity that is often present in the transition from the research realm to patient use. Hence, the designer should question even the most common of features if it could impact the viability of the patient experience.

Often, advanced technological features are required to ensure a positive patient experience. Power management of the system cannot be left to the patient, nor should the nuances of electrode conditioning and placement. The technological advancements in textile-based active electrodes, ultra lower power electronics, and flexible printed circuits all have the potential to contribute to improvements in the patient experience and overall viability of the design.

Finally, aesthetics do matter. Despite the efforts to date, there are few examples of ambulatory EEG headgear in existence that is truly unobtrusive and wearable in public without notice. Hence, the challenges faced in ambulatory EEG will require a diverse set of professionals to address them. Human factors engineering, coupled with user experience and interaction designers, together with the industrial design are examples of the skill set necessary for a truly practical design to address the challenge.

REFERENCES

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J.A. Cafazzo is with the Centre for Global eHealth Innovation, Techna Institute, Toronto General Hospital, and the Institute of Biomaterials and Biomedical Engineering, University of Toronto, Toronto, Ontario M5G2C4 CANADA (e-mail: joseph.cafazzo@utoronto.ca).