

Letter to the Editor on “Consumer Electronics in Healthcare and Medicine: A Report From the EMBS Young Professional Roundtable”

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DEAR EDITOR

WEARABLE consumer electronics such as smart watches, rings, and hearables are increasingly used to collect real-time physiological and activity data for health monitoring and disease prevention. As researchers and practitioners at the forefront of wearable technologies in health and medicine, the Young Professionals of EMBS organized a Roundtable Discussion on the 17 July 2025 at the 47th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC’25) to identify key challenges and recommendations for the field and we would like to highlight some key recommendations and insights from our discussions for the broader community.

VISION FOR THE FUTURE

Widespread use of wearable sensor technologies provides an excellent opportunity to study the human body and mind by continuously monitoring behavior and physiology over a long period of time in realistic settings. In the future, wearable technologies have the potential to revolutionize healthcare and well-being through personalization and enhanced insights from the home and daily life. Nevertheless, there are many challenges to be considered to ensure that wearable technologies live up to their promise in research, wellbeing, and health.

KEY CHALLENGES AND RECOMMENDATIONS

Based on the participants’ experiences, the Young Professional Roundtable highlighted four key challenges to the integration of wearable technology into our research and translation of these devices into practice:

1. Although global in reach, much research on wearable technology relies on small study populations, generally sourced in the region where the researcher is based. It can be difficult to generalize results from the studies in which the demographic data is unavailable, or the demographics differ across studies.
2. Even when intended for clinical use, many studies evaluate and report proxy metrics derived from benchmark datasets. Thus, there are limited opportunities for validating those findings in routine care, against clinical endpoints or patient-reported outcomes. Without such data, it is difficult to translate wearables to clinical use and what the potential safety and ethical limitations.
3. State-of-the-art performance often uses internally developed devices. Even though these devices are often the best available, some details, such as versioning and exact configurations, are often not available to consumers, researchers, or the public. While acknowledging understandable commercial sensitivities, such a lack of transparency makes replication of findings difficult and reduces trust in emerging technology.

4. Creating and maintaining comprehensive datasets with large, diverse populations and appropriate metadata is costly, time-consuming and difficult to achieve without strong international collaboration.

In this context, we propose the following concrete actions that members of EMBS could take to improve the ecosystem for the next generation of researchers and devices:

1. Establish minimum information models (MIMs) and reporting standards for demographic data and recruitment procedures to help identify health data poverty and enable systematic reviews with knowledge of the demographics.
2. Encourage clinically relevant evaluation criteria over benchmark performance to highlight how the results fit into the patient pathway, e.g., how the work on wearable technology can be externally validated against clinical and patient-reported outcomes as well as safety, ethical, and other considerations.
3. Promote the development of transparent and open-source platforms for data acquisition and processing, including guidelines for calibration and validation. Where commercial systems are used, encourage reporting that allows for reproducible research.
4. Facilitate interdisciplinary collaboration of researchers across the globe to target gaps in data and address different cultural and infrastructural barriers that limit global translation.

Many EMBS members are research leaders in the field of engineering, medicine, and biology, and Young Professionals believe that EMBS is well-positioned to ensure the vision of wearables in the healthcare system and in health research is realized. We are confident that Young Professional Members have an important role to play in advancing the field of wearable technologies in healthcare and medicine, and look forward to working with all EMBS members to facilitate and encourage the translation of wearable technologies into practice.

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