eHealth Wearables Detecting Cognitive Impairment: Systematic Review

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eHealth Wearables Facts

- eHealth wearables –are electronic devices worn on the body to continuously track, record, and transmit physiological and lifestyle data for medical monitoring, wellness, and preventive care
- Wearable health technology market, including smart clothing, is forecast at $175 billion in 2026, on track toward $383.5 billion by 2032
- Medical smartwatches and the clinical wearable market are the fastest-growing segment, expanding at roughly 25% annually

Cognitive impairment

Cognitive impairment is an inclusive term to describe any characteristic that acts as a barrier to the cognition process or different areas of cognition
Key facts:

- Cognitive impairment is when the person has problems remembering things, concentrating, making decisions and solving problems.
- Changes in behaviour, difficulty controlling emotions and trouble communicating with others can also happen.
- Cognitive impairment is not an illness but it can be a sign that for other health conditions.
- Causes of cognitive impairment include dementia, depression, delirium, head injury or stroke.
- Lifestyle changes can help to prevent or slow cognitive impairment.

eHealth Wearables Detecting Cognitive Impairment

Early and Mild Cognitive Impairment are studied by tracking digital biomarkers (heart rate, sleep cycles, physical activity …) with lifestyle factors (stress, diet, exercise …) in reality



Method

- Period – 1.1. 2022-1.10.2026
- Databases

PubMed® APA PsycNet® IEEE Xplore® Google Scholar

- Reviews and systematic reviews only
- Inclusion criteria:
  - Focus on both wearables and Cognitive Impairment detection;
  - Published in a journal;
  - Published in English, original and for the first time;
  - The patients are adults;
  - Introduces or discussed application of wearables for detection of cognitive impairment;
  - Papers that did not meet one or more of the above criteria were excluded.
- Microsoft Excel template was created, helping to extract the information needed for the analysis: list of authors, country of research, methodology used; information about subjects included in the study (age, gender, ethnicity), description of findings, impact statements.
- To synthesize and describe the data, the narrative approach was applied.
- From original 45 publications remain 15.

Results

- Studies are mostly qualitative and varied in patients / subjects size from 5 up to 184 participants;
- Wide range of methods to monitor cognitive functions are used:
  - Speech analysis tools - in the background during phone calls or through specific voice recording exercises – monitor speech patterns, vocabulary richness, pronunciation …
  - Movement and gait - walking speed, balance, dual-task performance, sleep pattern …
  - Brain activity - EEG during task execution or daily activities;
  - Posture-improving sensors;
  - …
- The range of wearables is also wide:
  - Mobile phones – speech analyses, movement and gait …
  - Wireless monitoring – incl. smart watches and/or bracelets; incontinence pad sensors - movement and gait, task fulfilment …
  - Wearable EEG devices
  - …



Best sleep trackers for 2026



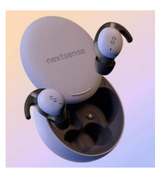
Vital-sign monitoring -blood pressure without the use of a cuff, pulse rate, electrocardiogram, blood oxygenation, respiration rate and skin temperature



Detects moisture, urine, or saturation levels in an incontinence pad, diaper, or bed sheet



Smart Posture Guiding Sensor



NextSense Smartbuds — wireless in-ear EEG



Contact Tracing Wristband Sensor

- Studies highlights substantial heterogeneity among wearable devices currently used for detection of cognitive impairment
- Heterogeneity in recording protocols and lack of consensus for signal acquisition protocols
- Problem is the complexity of neurophysiological biomarkers and validation of the registrations and applied methodology especially when the sample size is small (<33 participants)
- Unstable connectivity, digital inequality, privacy risks and infrastructure limitations.

Main Challenges

- Substantial methodological variability in the application of wearables;
- Lack of consensus for signal acquisition protocols;
- Data Overload & Alert Fatigue: Generating massive daily data streams can overwhelm both patients and caregivers;
- Accuracy & Interoperability;
- Privacy & Security.

Conclusions and Recommendations for the Future

- Detecting cognitive decline earlier allows for more timely interventions and treatment plans, resp. lifestyle modification, better medication effectiveness …
- Wearables offer advantages over traditional assessment methods, i.e. frequency, objectivity, natural setting …
- Future:
  - The unified framework for the use of wearables for detection of mild cognitive impairment is a must,
  - More studies should focus on community-based recruitment to improve ecological validity and generalizability.

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