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Harnessing Digital Measures Of Physical Function In Neurological Conditions: Findings From A Targeted Literature Review

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Objectives

- Digital technologies provide an opportunity to improve the measurement of physical function and ability to carry out activities of daily living (ADLs) in real-world settings.
- This study aimed to identify studies in people with neurological conditions in which digital measures were used to capture physical function in real-world settings.

Methods

- A targeted literature review was conducted in December 2024 using PubMed and Google Scholar.
- Studies published since 2010 in English that included digital devices (e.g., accelerometers) to capture physical function (e.g., upper limb function) in real-world settings for neurological conditions (amyotrophic lateral sclerosis [ALS], Charcot-Marie-Tooth disease [CMT], multiple sclerosis [MS], muscular dystrophy [MD], myasthenia gravis [MG], myositis, spinal muscular atrophy [SMA]) were included.
- Studies conducted in clinical or lab settings or requiring clinician/researcher interaction were excluded.
- Outcomes of interest included those capturing aspects of motor function or ADLs.
- All studies reviewed had to be in English.

Results

- The search identified 486 studies, 100 were considered for full text review, and 33 studies were extracted (**Figure 1**).

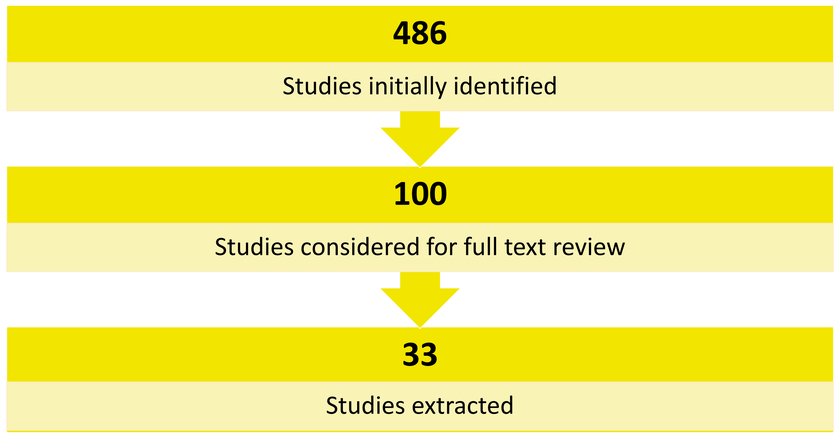

Figure 1. Search process

- Most studies were carried out in EU5 countries or the United States.
- 25/33 studies were published from 2020 onwards.
- Studies were identified in most (ALS [n=11], MS [n=11], MD [n=5], MG [n=3], SMA [n=3]) but not all diseases of interest (CMT, myositis).
- Aspects of motor function that were measured included physical activity (n=17); other aspects of lower limb function (n=9), such as gait/balance (n=6); upper limb function (n=13), including hand dexterity (n=7); and speech (n=4) (**Figure 2**).
- There was large variation in the outcome variables used to represent these aspects of motor function (**Figure 3**).
- Devices used for data capture included accelerometers (n=16), smartphone applications (n=15), activity/smart watches (n=1), and cameras (n=1) (**Figure 4**).
- Wrist worn accelerometers demonstrated high levels of compliance (e.g., 124 days with 21 hours wear time over 6 months), and hip worn accelerometers demonstrated moderate compliance (e.g., mean wear time, 907 minutes per day).
- Smartphone applications demonstrated mixed adherence (e.g., average of 92% over a 4-week period; 50% daily adherence over a 7-day period).
- Compliance/adherence for activity/smart watches and cameras was not reported.
- Few studies were designed to evaluate the feasibility and validity of these measures in real-world settings and with long-term follow-up.

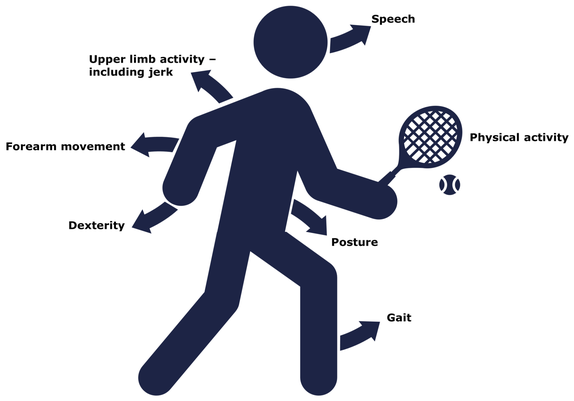

Figure 2. Sub-aspects of motor function measured by digital technologies

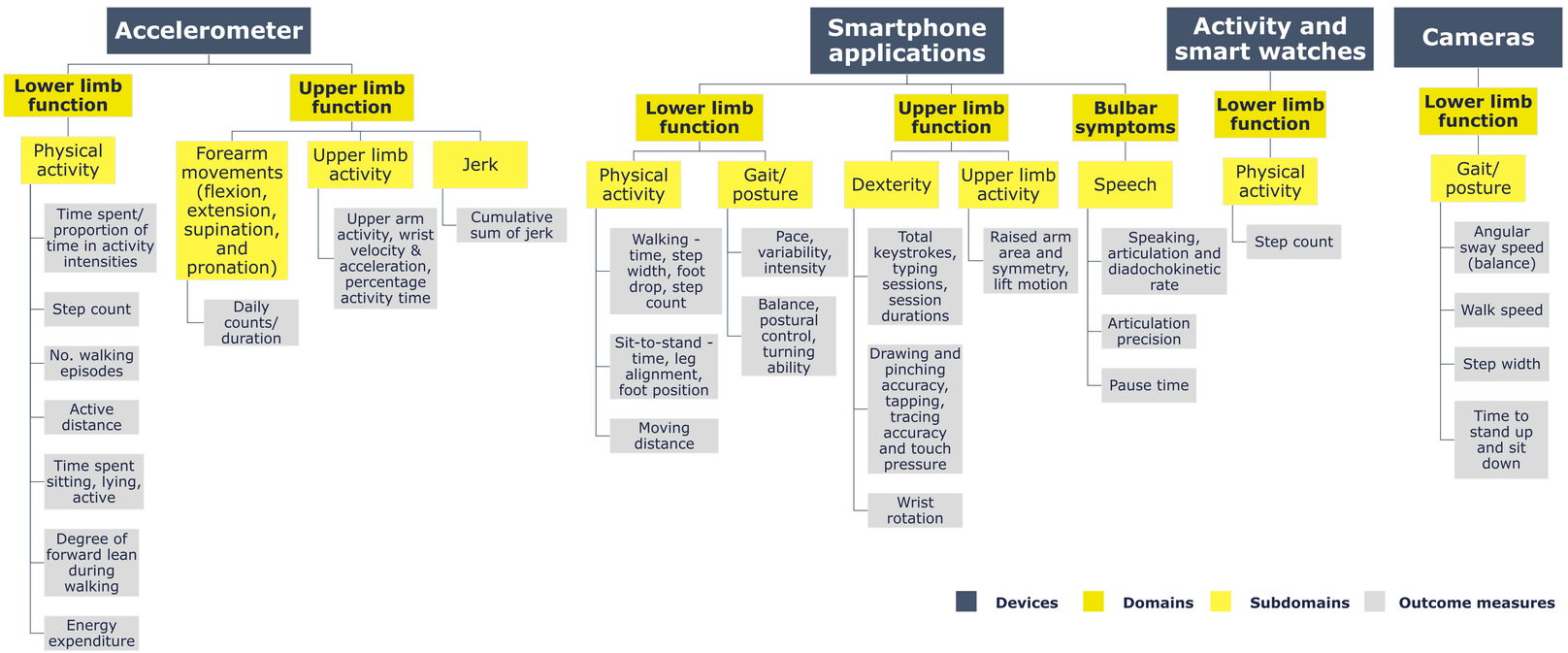

Figure 3. Devices, domains, subdomains and outcome measures

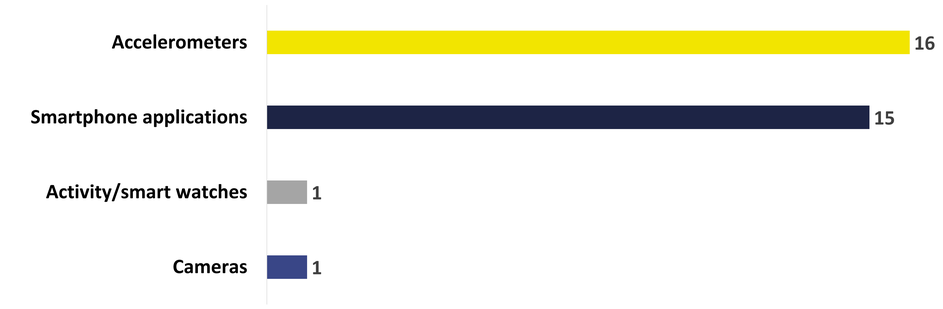

Figure 4. Devices used in data capture (number of studies)

Conclusions

Digital measures, including wearable devices and smartphones, provide the opportunity to remotely and passively assess various aspects of physical function and ADLs in this population, thereby minimizing burden associated with traditional outcome assessment. Further research to evaluate the feasibility and validity of long-term measurement using digital devices is warranted.

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