Unsupervised mobility and motion assessment in neuromuscular and musculoskeletal disorders using mobile health technology

Muhammad Osama[1], Bruno Bonnechere[2], Sabah Afridi[3]

Madam, Mobility deficits are not uncommon in persons with neuromuscular and musculoskeletal disorders. This can have a negative impact in terms of morbidity, mortality, quality of life and activities of daily living.[1] Conventionally, mobility and physical activity have been measured in a clinical and laboratory setting by a qualified health professional and is thus called supervised assessment.[1] It is either a qualitative or quantitative one- time snapshot evaluation of physical activity, mobility or motion and is highly influenced by factors such as the Hawthorne effect, the time of day when the measurement was taken, white coat and reverse white coat effect.[1] Moreover, supervised mobility assessment may have many limitations such as limited ecological validity, lack of patient-centered focus, inability to record real-world challenges, absence of real-time feedback, lack of ability to consider patient's environment, and an omission in observing the range of performance across the day or week.[1]

To tackle the above mentioned limitations, recently unsupervised assessment of mobility and physical activity using mobile health technology has emerged as an alternative to conventional supervised assessment.[1-3] Significant differences may be observed when comparing identical mobility outcomes measured under supervised and unsupervised conditions.[1-3] A systematic review revealed significant variations of 40-180% in identical mobility measures acquired from the same participants across different settings.[1] The disparities between supervised and unsupervised measurements are notably greater than the effects observed in treatment interventions. Minor to moderate treatment effects may be overshadowed by these substantial differences in measurement modes.[1]

Unsupervised assessment holds the potential to address the limitations of supervised assessment as it is patient-centered, ecologically valid, capable of recording fluctuating and rare events, unaffected by the white coat and Hawthorne effects, provides real-time treatment feedback, records real-world challenges, is influenced by a person's mood and fatigue, considers the environment, and reports performance across the day or week.[1] Moreover, unsupervised assessment does not require the presence of a trained professional, or the patient to report to a clinic or hospital, and thus can be of great value in rural environments and in tele-medicine/rehabilitation. Not only would this be cost effective, it will also decrease the load on the health care system and the need for health care human resource. Moreover, patients can have their outcomes monitored from the comfort of their home, which is of utmost importance as persons with movement or mobility disorders may face difficulties reporting to a clinic or a hospital in the first place. Moreover, with the use of mobile health technology to monitor patient outcomes and the advancements in machine learning and predictive artificial intelligence, the potential of unsupervised assessment is limitless, as research has shown that data acquired through unsupervised assessment has proven to be more accurate in terms of differentiating fallers from non-fallers as well as predicting fall risk in stroke[4] and geriatrics.[5,6] The significance of unsupervised assessment is also recognized by the United States Food & Drug Administration and the European Medicines Agency, recommending using unsupervised mobility and motion assessment in clinical trials.[1] Despite the advantages of unsupervised assessment, it faces several limitations. These include the absence of established normative values and test-retest reliability, complexities in interpreting and analyzing data, challenges in validating algorithms (which may be disease- or age-specific but not generalizable), a lack of standardized validation methods and assessment protocols, and potential incompatibility with supervised assessments and patient-reported outcome measures.[6] Moreover, there is a lack of studies focussing on measuring unsupervised upper body movements and the influence of unsupervised assessment on the patient.[5] Despite these limitations, unsupervised mobility and motion assessment through mobile health technology holds significant potential in neuromuscular and musculoskeletal disorders. It can be utilized as primary and secondary outcome measures in clinical practice and health research. However,

[1]Foundation University College of Physical Therapy, Foundation University, Islamabad, Pakistan; [2]REVAL Rehabilitation Research Center, University of Hasselt (UHasselt), Hasselt, Belgium; [3]Department of Physical Therapy, Rawal Institute of Health Sciences, Islamabad, Pakistan.

Correspondence: Muhammad Osama. e-mail: osamadpt@gmail.com

ORCID ID. 0000-0003-1467-2038

health professionals should be mindful of both the benefits and limitations of supervised and unsupervised assessments.

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All authors agree to be accountable for all aspects of the work.