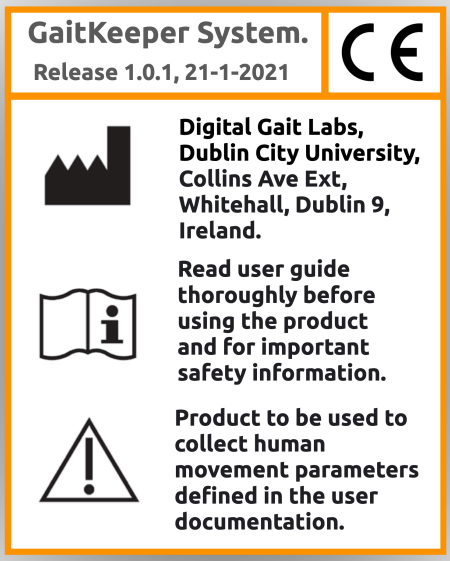
WHITE PAPER:

The Value of Walking Speed as a Measure for Functional and Overall Health Status.

BY DIGITAL GAIT LABS

PRODUCT INFORMATION

This white paper refers to the GaitKeeper system. It is valid for system version identified in the labelling below.



IMPORTANT SAFETY INFORMATION

Intended Use: The intended use of GaitKeeper is to provide automated collection methods for human movement data.

The device is software only. It graphically displays human physiological movement patterns for movement analysis in the fields of gait analysis.

GaitKeeper is a tool that captures human motion using a single mobile phone camera. It is CE marked and registered as a Class 1 Medical Device.

Digital Gait Labs
Dublin City University (Alpha Campus),
Old Finglas Road, Glasnevin, Dublin 11,
D11 KXN4, Ireland.

1. INTRODUCTION

Walking speed, commonly known as "gait speed," is a fundamental clinical measure for assessing and monitoring functional status and overall health in various populations. Its validity, reliability, and sensitivity render it an essential metric in clinical settings.

Frailty is a significant concern, particularly in the aging population. It is a distinctive health state related to the aging process where multiple body systems gradually lose their reserve capacity. As reported by Clegg et al. (2013), frailty affects approximately 20% of those over 65.

2. WALKING SPEED EXPLAINED

Collection of Gait Speed in Clinical Practice

Gait speed is typically measured by timing how long it takes for a person to walk a predetermined distance, often 4 or 10 meters. The process involves:

- **Standardised Walking Course**: A marked pathway in a clinic or hospital setting.
- **Timing Device**: A stopwatch or similar timing device is used to measure the time taken to cover the distance.
- **Minimal Equipment Requirement**: The test requires minimal equipment, often just a measured walkway and a timing device.

Cost of Performing a Gait Speed Test

One of the advantages of using gait speed as a clinical measure is its cost-effectiveness:

- **Low Equipment Costs**: The test requires minimal equipment, which is inexpensive and often already available in clinical settings.
- **Time-Efficient**: The test is quick to administer, usually taking less than 5 minutes, including setup and measurement.
- **No Need for Specialised Training**: Healthcare professionals can easily perform the test without needing specialised training.

Validity of Walking Speed

Walking speed effectively mirrors an individual's functional capabilities. It correlates strongly with various health parameters, including balance, strength, and endurance. This correlation has been extensively validated across different age groups, clinical conditions, and healthcare settings.

- **Elderly Population**: Studies have demonstrated that slower walking speeds in older adults are predictive of adverse outcomes like falls, hospitalisation, and even mortality (Studenski et al., 2011).
- **Chronic Conditions**: In patients with chronic diseases such as Parkinson's disease, multiple sclerosis, or arthritis, walking speed serves as an indicator of disease progression and response to treatment (Matsuda et al., 2013; Goldman et al., 2008).

Reliability of Walking Speed Measurements

The reliability of walking speed as a clinical measure is supported by its consistency and reproducibility under standardised conditions.

- **Standardised Testing Conditions**: When measured over a fixed distance in a controlled environment, walking speed yields highly reproducible results (Graham et al., 2008).
- **Inter-Rater Reliability**: Various studies have shown that walking speed measurements remain consistent across different evaluators and testing sessions (VanSwearingen et al., 2011).

Sensitivity of Walking Speed

The sensitivity of walking speed as a measure lies in its ability to detect subtle changes in an individual's functional status.

- **Detecting Functional Decline**: Even small decreases in walking speed can indicate the onset of functional decline

or the need for medical intervention (Verghese et al., 2009).

- **Monitoring Rehabilitation Progress**: Incremental improvements in walking speed can reflect positive responses to rehabilitation therapies in post-surgical patients or those recovering from injuries (Shumway-Cook et al., 2007).

3. WALKING SPEED APPLIED

Application in a Wide Range of Populations

Walking speed's versatility makes it applicable in diverse clinical scenarios.

- **Geriatric Care**: Regular monitoring of walking speed can guide interventions aimed at preventing mobility loss and maintaining independence in older adults (Fritz & Lusardi, 2009).
- **Chronic Disease Management**: For patients with chronic illnesses, tracking changes in walking speed can help in adjusting treatment plans and managing disease progression (Cesari et al., 2009).
- **Postoperative Care**: In surgical patients, particularly those undergoing orthopaedic procedures, walking speed can be a key indicator of recovery and rehabilitation progress (Harding et al., 2010).

4. UNDERSTANDING AND ADDRESSING FRAILTY WITH GAITKEEPER

What is Frailty?

Frailty is a significant concern, particularly in the aging population. It is a distinctive health state related to the aging process where multiple body systems gradually lose their reserve capacity. This condition is characterised by a state of vulnerability to poor resolution of homeostasis after a stressor event, resulting from the cumulative decline in various physiological systems over a lifetime. This decline depletes homeostatic reserves to a point where even minor stressors can trigger disproportionate changes in health status. As reported by Clegg et al. (2013), frailty affects approximately 20% of those over 65.

Why Understanding Frailty is Important

In Acute Hospitals

- **High Occupancy**: People aged 65 and over occupy 54% of acute hospital inpatient beds.
- **Dementia Prevalence**: About 30% of older people admitted to acute hospitals have dementia, often leading to longer hospital stays.
- **Delayed Discharges**: This age group accounts for 90% of delayed discharges from acute hospitals.
- **Extended Emergency Department Stays**: Those aged 75 and over spend three times longer in the Emergency Department than those under 65.
- **Post-Hospital Functional Decline**: 35% of patients over 70 show functional loss at discharge, rising to 65% for 90-year-olds.

In Nursing Homes

- **High Proportion of Elderly Residents**: 88% of nursing home residents are over 65.

- **Continuous Care Need**: Approximately 22% of those aged 85+ require continuous care.
- **Dementia Impact**: 50% of nursing home residents live with dementia.

Impact on Health and Social Care

Frailty ranges from mild (pre-frail) to advanced states, necessitating varying levels of intervention. It is a strong predictor of healthcare use, emergency department visits, hospitalisation, extended hospital stays, readmissions, and in-hospital mortality. Understanding and managing frailty is crucial for healthcare professionals and policy makers, given its significant impact on health services and associated costs.

How GaitKeeper Contributes

Innovation in Frailty Assessment

GaitKeeper, developed by Digital Gait Labs, is the world's first digital patient frailty assessment tool. It represents a breakthrough in assessing and managing frailty.

Features and Capabilities

- **Accessibility and Ease of Use**: GaitKeeper allows for frailty assessments to be conducted by anyone, anywhere, at any time, without the need for specialised equipment like sensors, mats, or special clothing.
- **Advanced Data Collection**: It captures over 20 points on the subject's body 60 times per second, detecting gait events with high precision and spatial accuracy.
- **Comprehensive Gait Analysis**: The tool collects longitudinal data on walking speed, support base, swing, flexion, and symmetry measures.
- **Clinical Validation**: GaitKeeper has been clinically validated using the GaitRite system and technically validated with the Vicon motion capture system.
- **Regulatory Compliance**: It is a CE Marked, class 1 medical device, regulated under EU-MDR regulations.

Impact of Walking Speed as a Metric

Walking speed, often referred to as the "sixth vital sign," is a sensitive measure for

assessing and monitoring functional status and overall health. A reduction in gait speed correlates with an increased risk of cardiovascular disease and elderly mortality. It reflects frailty status and helps in identifying risks of adverse events like falls, prolonged hospital stays, and functional decline.

4. CONCLUSION

Walking speed is a valid, reliable, and sensitive clinical measure for assessing and monitoring functional status and overall health. Its simplicity, non-invasiveness, and applicability to a wide range of populations make it an invaluable tool in healthcare settings. Incorporating walking speed assessments into regular clinical practice can significantly enhance patient care by providing a clear and objective measure of an individual's functional abilities and overall health status.

5. REFERENCES

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ABOUT DIGITAL GAIT LABS

Digital Gait Labs Ltd is a spin out company from Dublin City University (Insight Centre for Data Analytics) and achieved certification as a Class 1 Medical Device with CE marking in 2022.
Further reports and assessment types can be created for GaitKeeper system.