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Commentary

Gait Speed as a Functional Vital Sign in Musculoskeletal Physiotherapy: Normative Values, Clinical Thresholds, and Digital Measurement

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Featured Application

Gait speed provides a scalable, clinically interpretable metric that can be embedded into musculoskeletal physiotherapy assessment and combined with wearable sensor data to monitor adaptive locomotion and personalise rehabilitation.

Abstract

Walking (or gait) speed is recognised as a robust indicator of health status, functional capacity, and physiological reserve across the lifespan; however, its objective measurement remains underused in routine musculoskeletal physiotherapy practice. This commentary argues that gait speed is underutilised in musculoskeletal physiotherapy despite its strong prognostic and functional relevance, and proposes its cautious adoption as a functional vital sign to support more objective, standardised, and interpretable rehabilitation decision making. Evidence from an orthopaedic population undergoing total hip and knee arthroplasty illustrates the persistent gap between surgical success and functional recovery, as reflected in sustained deficits in walking speed relative to healthy benchmarks. Methodological issues in gait speed assessment are considered, and the potential future role of wearable sensors and digital health technologies in capturing real-world locomotor performance is highlighted. Overall, the evidence suggests that gait speed can provide an objective, low-cost, and scalable measure that integrates multiple domains of musculoskeletal function. Therefore, the routine integration of gait speed into physiotherapy assessment may help to quantify functional impairment, support personalised rehabilitation, reduce practice variation, and align musculoskeletal care with contemporary adaptive and digitally enabled healthcare models.

Keywords: gait speed; musculoskeletal physiotherapy; functional assessment; hip replacement; knee replacement; wearable sensors; rehabilitation outcomes

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1. Background

Walking speed is increasingly recognised as a fundamental indicator of health status, functional capacity, and physiological reserve across the lifespan, with recent synthesis work highlighting its predictive value across multiple domains including disability, hospitalisation, cognitive decline, and mortality in older populations [1]. Large cohort studies and meta-analyses generally report peak usual walking speeds in early to mid-adulthood of approximately 1.3–1.4 m/s, and progressively decline with age, although reported values

vary according to measurement protocol, population characteristics, and the definition of walking speed used [2–10]. Reductions in walking speed may reflect longer-term reductions in physiological reserve but can also be transient and influenced by factors such as pain, confidence, fatigue, or compensatory movement strategies. These normative benchmarks are further influenced by factors such as sex, height, neuromuscular capacity, and habitual physical activity [11–14]. Given this context, within the wider public health and ageing academic literature, gait speed has become an important reference point for interpreting deviations from expected ageing trajectories, supporting differential diagnosis, and quantifying functional recovery following illness, injury, or surgery.

Beyond its descriptive value, gait speed can also be a powerful predictor of clinically meaningful outcomes. A usual walking speed below 0.8 m/s is consistently associated with increased risk of disability, hospitalisation, cognitive decline, and mortality [14–21], whereas speeds below 0.6 m/s indicate more severe functional impairment [22,23]. These thresholds are derived primarily from studies of older and hospitalised populations and should therefore be interpreted as context-dependent reference points rather than universal cut-offs when applied to musculoskeletal or working-age cohorts. For example, thresholds below 0.8 m/s and 0.6 m/s are most frequently derived from geriatric and hospital-based cohorts in relation to adverse health outcomes, whereas higher reference values (e.g., 1.2–1.34 m/s) are more commonly cited in relation to functional independence or optimal performance in community-dwelling or postoperative populations [1].

Such indicative thresholds may provide clinicians with a practical, explainable framework for identifying at-risk patients and evaluating the impact of rehabilitation interventions. Therefore, measuring gait speed can be a valuable component of patient assessment. When added to the wider subjective and objective assessment of the patient and the results of specific functional tests such as sit-to-stand and the Short Physical Performance Battery, these measures may help quantify rehabilitation progress in individuals with impaired muscle strength, balance, or mobility [24–26].

However, despite its substantial predictive value, ease of measurement, and alignment with physiotherapy's focus on functional outcomes, gait speed is still not routinely assessed in musculoskeletal practice. Harradine et al.'s systematic review found that real-time, non-instrumented gait assessment, the form most used by clinicians, is highly inconsistent, lacks standardisation, and is not supported by validated protocols, with no clear evidence that clinicians use gait assessment systematically or apply it to guide treatment [27]. This inconsistency and absence of an approach help explain why objective measures such as gait speed remain underutilised, despite their clinical value.

Indeed, for gait speed to meaningfully inform practice, measurement must be linked to interpretation against appropriate reference values, the setting of individualised functional goals, targeted intervention selection, and planned re-assessment to monitor response. Interestingly, this knowing-doing gap persists even though contemporary physiotherapy increasingly emphasises objective assessment, digital innovation, personalised rehabilitation, and interdisciplinary models of care. As hybrid and technology-enhanced service models continue to evolve, gait speed is one objective measure that may offer physiotherapists a scalable, evidence-based metric that clinicians can capture quickly in the clinic and continuously monitor in real-world environments using wearable devices [28,29].

Therefore, the purpose of this commentary is to emphasise why gait speed should be adopted as a routinely used functional vital sign within musculoskeletal physiotherapy practice. In this context, a functional vital sign refers to an objective, repeatable, and interpretable measure of physical function that is sensitive to change over time and informative for clinical decision making, rather than diagnostic in isolation. Unlike traditional physiological vital signs, functional vital signs reflect integrated system performance and are

intended to support monitoring, goal setting, and treatment progression within routine clinical care.

By summarising the evidence on normative values, clinically meaningful thresholds, and practical measurement considerations, the aim is to demonstrate the clinical utility of gait speed across orthopaedic and musculoskeletal populations. To highlight this, the article will explore the gap between surgical success and functional recovery, illustrated by walking speed deficits following total hip and knee arthroplasty, and explore how the routine use of gait speed could enhance assessment, support clinical decision making, reduce practice variation, and align physiotherapy with emerging digital and interdisciplinary innovations in healthcare.

2. Clinical Assessment

If it is accepted that normative gait speed benchmarks may provide crucial context for clinical decision making in musculoskeletal physiotherapy practice, then, as highlighted, deviations from these benchmarks (due to age and other biological factors) may indicate musculoskeletal impairment, reduced reserve capacity, and early functional decline. Walking speed represents an integrated functional outcome that is highly relevant to musculoskeletal physiotherapy, as it reflects the combined influence of pain, strength, balance, and motor control, while also being influenced by cardiovascular, cognitive, and behavioural factors.

For clinicians to integrate this into their everyday practice, they need to be able to perform accurate and reliable gait speed assessment and understand how to test this with methodological consistency. Normative and threshold data are derived from a range of fixed-distance protocols, most commonly 4-m and 10-m walk tests, with longer distances (e.g., 20–40 m) also used depending on clinical and research purpose [3,4,6,9]. Variability in walkway length, surface, start procedures, and patient instructions can meaningfully affect measured speed [3,6], and so physiotherapists should standardise these factors within their clinical setting.

In terms of choosing a reliable and valid test, the 10-Meter Walk Test (10 MWT) has excellent test-retest reliability and validity across diverse populations, including healthy older adults. While very high reliability has been reported under controlled conditions, reliability in routine clinical practice may be lower due to assessor variability and environmental factors [30–32]. Shorter tests, such as the 4-Meter Walk Test (4 MWT), also show high reliability and validity, especially when space is limited. Although differences between the 4-m and 10-m walk tests can be statistically significant, their clinical relevance depends on the population assessed, the magnitude of change observed, and the intended use of the measure [30,33]. Longer or alternative tests (e.g., 6 MWT, instrumented walkways) are valid but may not offer practical advantages over the 10 MWT for routine clinical use [31]. The 40-m walk test is also a highly reliable and generally valid tool for assessing walking speed particularly in adults with osteoarthritis [34] and is recommended by international societies [35] for both clinical and research settings. In practice, services should select a single fixed-distance protocol for routine use wherever possible to maximise comparability over time, reserving alternative distances for specific clinical indications or environmental constraints.

Measuring both comfortable and fast walking speeds provides a deeper picture of mobility. Comfortable speed reflects typical daily function, whereas fast speed reflects physiological reserve and adaptability. Physiotherapists need to know reference values (just as they would for other objective tests) for expected gait speeds in their patients, as provided in Table 1. The narrowing difference between comfortable and fast walking speeds has been proposed as a potential indicator of reduced neuromuscular reserve, although this

remains an emerging area of research rather than an established clinical marker [2,4,6,10,12]. Wearable and smartphone-based technologies offer opportunities to capture walking speed beyond the clinic, including average daily performance and variability across contexts. However, accuracy and validity vary by device and algorithm, and clinical application in musculoskeletal populations remains limited by issues of validation, data interpretation, and integration into routine workflows [28,29].

Table 1. Example Indicative Walking Speeds by Age Group.

Age Group (years)	Comfortable Speed (m/s)	Fast/Max Speed (m/s)	Supporting Studies
18–29	1.3 to 1.4	1.7 to 1.85	(Rössler et al., 2024 [3]; Mobbs et al., 2025 [4]; Herssens et al., 2018 [5]; Zheng et al., 2022 [6]; Stamatakis et al., 2018 [7]; Andrews et al., 2023 [8]; Popelsky et al., 2023 [9]; Jung et al., 2023 [10]; Bohannon & Wang, 2019 [12])
30–49	1.3 to 1.4	1.6 to 1.8	(Fukuchi et al., 2019 [2]; Rössler et al., 2024 [3]; Mobbs et al., 2025 [4]; Herssens et al., 2018 [5]; Zheng et al., 2022 [6]; Stamatakis et al., 2018 [7]; Andrews et al., 2023 [8]; Popelsky et al., 2023 [9]; Jung et al., 2023 [10]; Bohannon & Wang, 2019 [12])
50–69	1.2 to 1.3	1.5 to 1.7	(Fukuchi et al., 2019 [2]; Rössler et al., 2024 [3]; Mobbs et al., 2025 [4]; Herssens et al., 2018 [5]; Zheng et al., 2022 [6]; Stamatakis et al., 2018 [7]; Andrews et al., 2023 [8]; Popelsky et al., 2023 [9]; Jung et al., 2023 [10]; Bohannon & Wang, 2019 [12])
70–79	1.0 to 1.2	1.4 to 1.6	(Fukuchi et al., 2019 [2]; Rössler et al., 2024 [3]; Mobbs et al., 2025 [4]; Herssens et al., 2018 [5]; Zheng et al., 2022 [6]; Stamatakis et al., 2018 [7]; Andrews et al., 2023 [8]; Popelsky et al., 2023 [9]; Jung et al., 2023 [10]; Bohannon & Wang, 2019 [12])
80+	0.9 to 1.1	1.2 to 1.4	(Rössler et al., 2024 [3]; Herssens et al., 2018 [5]; Zheng et al., 2022 [6]; Czech et al., 2020 [29]; Bohannon et al., 1996 [11]; Jung et al., 2023 [10]; Bohannon & Wang, 2019 [12])
90+	0.5 to 0.7	(not enough data)	(Bohannon et al., 1996 [11]; Bohannon & Wang, 2019 [12])

As digital musculoskeletal care expands, the integration of wearable devices that capture gait metrics may become a powerful adjunct to traditional physiotherapy assessment. However, such technologies will likely range from consumer-grade accelerometer-based smartphones and smartwatches to research-grade inertial measurement units, each with differing levels of transparency, cost, and regulatory oversight; and so, issues such as data governance, proprietary algorithm 'black box' processing, and equitable access will remain important considerations for clinical adoption.

3. Implications for Musculoskeletal Physiotherapy Practice

A key theme emerging is that gait speed should not only be regarded as a vital functional sign in musculoskeletal physiotherapy practice but also be easy to measure and integrate into routine clinical practice. However, to enhance rehabilitation, a patient's gait speed needs to be interpreted alongside normative values linked not only to age and demographic factors but, crucially, to the patient's clinical diagnosis and specific presentation. It must also be acknowledged that whilst improvements in walking speed are

commonly observed following rehabilitation, the magnitude and rate of change vary by condition, pain severity, and individual adaptation, and improvements in gait quality may occur without substantial changes in speed. Given this understanding, clinicians are able to quantify improvements and compare progress against reference data and each individual patient's clinical context. In this way, gait speed can guide shared decisions about treatment progression, given the everyday importance of walking as a functional activity and its potential responsiveness to rehabilitation interventions.

Such condition-specific data is available in the literature for more commonly seen presentations in outpatient musculoskeletal physiotherapy departments. For example, hip and knee arthroplasty represent common and well-described clinical populations, and whilst there is substantial heterogeneity in age, comorbidity burden, baseline function, and rehabilitation pathways across these patients, pre- and post-operative walking speeds are well described in the literature. Not surprisingly, walking speed improves after both hip and knee arthroplasty. Still, the available evidence consistently shows that most patients do not recover to the levels observed in healthy age-matched adults. A finding that physiotherapists should be aware of and could try to improve through routine measurement that may support clinical awareness, goal setting, and feedback. Although evidence that measurement alone improves postoperative outcomes is limited.

Before total hip arthroplasty (THA), walking speeds vary widely, ranging from approximately 0.42 m/s in older women with severe osteoarthritis to around 1.00 m/s in average adults [36–39]. Early after surgery, hip replacement patients commonly walk at approximately 0.8 m/s at two weeks, with many still below clinically relevant thresholds [40]. Between 3 and 6 months, walking speeds generally range from 0.72 to 1.00 m/s [36,38,39]. By twelve months, some individuals achieve fast-paced speeds of 1.44–1.88 m/s depending on sex and age [41], although self-selected speeds more commonly fall around 1.2 ± 0.12 m/s [39] or 1.03 ± 0.14 m/s during free-living ambulation [38]. Importantly, only approximately 37% of patients reach the proposed benchmark of 1.34 m/s for a "good" postoperative walking outcome [39].

A similar pattern emerges in total knee arthroplasty (TKA). Preoperative walking speeds range from 0.41 m/s in patients with severe osteoarthritis to 1.00 m/s or more in less impaired individuals [38,42,43]. Short-term postoperative walking speed at six weeks may remain very low, around 0.47 ± 0.022 m/s [42]. Recovery thereafter accelerates, with speeds between 0.69 and 1.00 m/s recorded from 6 months to 1 year [38,42,43]. At approximately 1.5 years, some individuals continue to walk at only about 0.69 m/s [42]. However, other studies report recovery to preoperative levels, reaching around 1.00 m/s by 21 weeks [38]. Peak walking speeds after TKA at one year or later may reach 1.6 m/s but remain substantially lower than those of healthy controls, who typically walk at around 2.2 m/s [44].

Taken together, these data show that while both THA and TKA improve walking speed, most patients, even after 12 months, do not achieve walking speeds comparable to those of healthy individuals. Short-term recovery is particularly limited (the time at which most patients will receive physiotherapy), with many postoperative values falling below 1.0 m/s, and even long-term recovery often results in persistent deficits relative to normative healthy benchmarks. This may cause difficulties for individual patients in regard to certain daily activities, for example, typical road crossing times assume a gait speed of 1.2 m/s to cross safely during the green pedestrian signal [45].

4. Discussion

Normative gait speed values and clinically meaningful thresholds may provide physiotherapists with a powerful, objective means of assessing musculoskeletal function. When

measured consistently and interpreted in relation to age, sex, and clinical presentation, gait speed may serve as a functional vital sign by reflecting the integrated contributions of strength, balance, neuromuscular control, and cardiovascular capacity. The example clinical scenario presented demonstrates that individuals undergoing THA and TKA frequently exhibit substantial and sustained gait speed deficits, often failing to regain levels observed in healthy adults.

However, when translating changes in walking speed from research reference values to clinical practice, consideration of effect size magnitude and clinically meaningful difference is important to contextualise rehabilitation impact. Whilst small absolute changes in gait speed may represent meaningful functional improvement, particularly in mobility-impaired populations, effect sizes must also be considered to help distinguish statistical from clinically relevant change [46]. Effect sizes can vary substantially across populations, testing protocols, and intervention types, reinforcing the need for cautious interpretation within specific clinical contexts rather than total reliance on universal benchmarks. Accordingly, incorporating effect size considerations alongside threshold-based interpretation may strengthen the clinical utility of gait speed as a monitoring metric and support more nuanced rehabilitation decision making.

Recognising that meaningful interpretation depends on both threshold-based and effect-size-informed evaluation, embedding gait speed measurement into routine musculoskeletal physiotherapy practice represents a logical next step and a potentially scalable innovation aligned with contemporary developments in physiotherapy. However, although gait speed is technically simple to measure, it is acknowledged that routine implementation may be influenced by organisational constraints, including appointment duration, competing clinical priorities, and the absence of explicit decision-making pathways linked to specific gait speed values. Integrating timed walk tests with wearable and smartphone-based monitoring offers a scalable way to assess real-world gait performance beyond the clinic. Used appropriately, such tools can support personalised rehabilitation, earlier detection of functional decline, and more consistent hybrid physiotherapy models.

Gait speed represents a strong candidate for a functional vital sign for musculoskeletal physiotherapy, if measurement is standardised, interpretation is population-appropriate, and results are explicitly linked to clinical decision making. Its value lies not in replacing existing assessment approaches, but in offering an objective, scalable complement that can support more consistent and interpretable rehabilitation practice.

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References

1. Hainline, G.; Hainline, R.D.; Handlery, R.; Fritz, S. A Scoping Review of the Predictive Qualities of Walking Speed in Older Adults. *J. Geriatr. Phys. Ther.* **2024**, *47*, 183–191. [CrossRef] [PubMed]
2. Fukuchi, C.A.; Fukuchi, R.K.; Duarte, M. Effects of walking speed on gait biomechanics in healthy participants: A systematic review and meta-analysis. *Syst. Rev.* **2019**, *8*, 153. [CrossRef]

3. Rössler, R.; Wagner, J.; Knaier, R.; Rommers, N.; Kressig, R.W.; Schmidt-Trucksäss, A.; Hinrichs, T. Spatiotemporal gait characteristics across the adult lifespan: Reference values from a healthy population—Analysis of the COmPLETE cohort study. *Gait Posture* **2024**, *109*, 101–108. [CrossRef]
4. Mobbs, L.; Fernando, V.; Fonseka, R.D.; Natarajan, P.; Maharaj, M.; Mobbs, R.J. Normative database of spatiotemporal gait metrics across age groups: An observational case–control study. *Sensors* **2025**, *25*, 581. [CrossRef]
5. Herssens, N.; Verbecque, E.; Hallemans, A.; Vereeck, L.; Van Rompaey, V.; Saeys, W. Do spatiotemporal parameters and gait variability differ across the lifespan of healthy adults? A systematic review. *Gait Posture* **2018**, *64*, 181–190. [CrossRef] [PubMed]
6. Zheng, P.; Ducharme, S.W.; Moore, C.C.; Tudor-Locke, C.; Aguiar, E.J. Classification of moderate-intensity overground walking speed in 21- to 85-year-old adults. *J. Sports Sci.* **2022**, *40*, 1732–1740. [CrossRef]
7. Stamatakis, E.; Kelly, P.; Strain, T.; Murtagh, E.M.; Ding, D.; Murphy, M.H. Self-rated walking pace and all-cause, cardiovascular disease and cancer mortality: Individual participant pooled analysis of 50,225 walkers from 11 population British cohorts. *Br. J. Sports Med.* **2018**, *52*, 761–768. [CrossRef]
8. Andrews, A.W.; Vallabhajosula, S.; Boise, S.; Bohannon, R.W. Normal gait speed varies by age and sex but not by geographical region: A systematic review. *J. Physiother.* **2023**, *69*, 47–52. [CrossRef]
9. Popelsky, B.; Ylitalo, K.; Hockett, S. Backward walking speed: A novel mobility measure for younger and older adults. *Innov. Aging* **2023**, *7*, 831–832. [CrossRef]
10. Jung, H.; Yamashina, S.; Yamasaki, R.; Inoue, Y.; Hamada, K.; Hirohama, K.; Tanaka, S.; Tanaka, R. Estimation of reference values of gait spatiotemporal and kinematic parameters in the lower extremities and trunk using a markerless motion capture system for healthy older japanese adults. *Phys. Ther. Res.* **2023**, *26*, 106–113. [CrossRef] [PubMed]
11. Bohannon, R.W.; Andrews, A.W.; Thomas, M.W. Walking speed: Reference values and correlates for older adults. *J. Orthop. Sports Phys. Ther.* **1996**, *24*, 86–90. [CrossRef]
12. Bohannon, R.W.; Wang, Y.-C. Four-meter gait speed: Normative values and reliability determined for adults participating in the NIH Toolbox Study. *Arch. Phys. Med. Rehabil.* **2019**, *100*, 509–513. [CrossRef]
13. Himann, J.E.; Cunningham, D.A.; Rechnitzer, P.A.; Paterson, D.H. Age-related changes in speed of walking. *Med. Sci. Sports Exerc.* **1988**, *20*, 161–166. [CrossRef] [PubMed]
14. Zhou, Y.; Romijnders, R.; Hansen, C.; Campen, J.V.; Maetzler, W.; Hortobágyi, T.; Lamoth, C.J. The detection of age groups by dynamic gait outcomes using machine learning approaches. *Sci. Rep.* **2020**, *10*, 4426. [CrossRef] [PubMed]
15. Cawthon, P.M.; Patel, S.M.; Kritchevsky, S.B.; Newman, A.B.; Santanasto, A.; Kiel, D.P.; Travison, T.G.; Lane, N.; Cummings, S.R.; Orwoll, E.S.; et al. What cut-point in gait speed best discriminates community-dwelling older adults with mobility complaints from those without? A pooled analysis from the Sarcopenia Definitions and Outcomes Consortium. *J. Gerontol. Ser. A* **2021**, *76*, e321–e327. [CrossRef]
16. de Souza Barbosa, J.F.; Zepeda, M.U.P.; Béland, F.; Guralnik, J.M.; Zunzunegui, M.V.; Guerra, R.O. Clinically relevant weakness in diverse populations of older adults participating in the International Mobility in Aging Study. *Age* **2016**, *38*, 25. [CrossRef]
17. Stover, E.; Andrew, S.; Batesole, J.; Berntson, M.; Carling, C.; FitzSimmons, S.; Hoang, T.; Nauer, J.; McGrath, R. Prevalence and trends of slow gait speed in the United States. *Geriatrics* **2023**, *8*, 95. [CrossRef] [PubMed]
18. Miller, M.E.; Magaziner, J.; Marsh, A.P.; Fielding, R.A.; Gill, T.M.; King, A.C.; Kritchevsky, S.; Manini, T.; McDermott, M.M.; Neiberg, R. Gait speed and mobility disability: Revisiting meaningful levels in diverse clinical populations. *J. Am. Geriatr. Soc.* **2018**, *66*, 954–961. [CrossRef]
19. de Souza, A.F.; de Oliveira, D.C.; Ramírez, P.C.; de Oliveira Máximo, R.; Luiz, M.M.; Delinocente, M.L.B.; Steptoe, A.; de Oliveira, C.; da Silva Alexandre, T. Low gait speed is better than frailty and sarcopenia at identifying the risk of disability in older adults. *Age Ageing* **2025**, *54*, afaf104. [CrossRef]
20. Perera, S.; Patel, K.V.; Rosano, C.; Rubin, S.M.; Satterfield, S.; Harris, T.; Ensrud, K.; Orwoll, E.; Lee, C.G.; Chandler, J.M.; et al. Gait speed predicts incident disability: A pooled analysis. *J. Gerontol. Ser. A* **2016**, *71*, 63–71. [CrossRef]
21. Lau, L.K.W.S.; Pang, W.J.B.; Chen, K.K.; Abdul Jabbar, K.; Yap, P.L.K.; Mallya, J.U.; Ng, D.H.M.; Tan, Q.L.L.; Seah, W.T.; Ng, T.P. Reference values of gait speed and gait spatiotemporal parameters for a south east asian population: The Yishun Study. *Clin. Interv. Aging* **2020**, *15*, 1753–1765. [CrossRef]
22. McGrath, B.M.; Johnson, P.J.; McGrath, R.; Cawthon, P.M.; Klawitter, L.; Choi, B.-J. A matched cohort analysis for examining the association between slow gait speed and shortened longevity in older americans. *J. Appl. Gerontol.* **2022**, *41*, 1905–1913. [CrossRef]
23. Ostir, G.V.; Berges, I.M.; Ottenbacher, K.J.; Fisher, S.R.; Barr, E.; Hebel, J.R.; Guralnik, J.M. Gait speed and dismobility in older adults. *Arch. Phys. Med. Rehabil.* **2015**, *96*, 1641–1645. [CrossRef]
24. Kim, M.; Won, C.W. Cut points of chair stand test for poor physical function and its association with adverse health outcomes in community-dwelling older adults: A cross-sectional and longitudinal study. *J. Am. Med. Dir. Assoc.* **2022**, *23*, 1375–1382.e3. [CrossRef]

25. Máximo, R.d.O.; Luiz, M.M.; Lima, S.S.; Steptoe, A.; de Oliveira, C.; da Silva Alexandre, T. Short physical performance battery or chair stand: Which better predicts disability among high-functioning older adults? *J. Am. Med. Dir. Assoc.* **2025**, *26*, 105720. [CrossRef] [PubMed]
26. Pua, Y.H.; Tay, L.; Clark, R.A.; Thumboo, J.; Tay, E.L.; Mah, S.M.; Ng, Y.S. Reference ranges for gait speed and sit-to-stand performance in a cohort of mobility-intact community-dwelling older adults from Singapore. *J. Am. Med. Dir. Assoc.* **2022**, *23*, 1579–1584.e1. [CrossRef]
27. Harradine, P.; Gates, L.; Bowen, C. Real time non-instrumented clinical gait analysis as part of a clinical musculoskeletal assessment in the treatment of lower limb symptoms in adults: A systematic review. *Gait Posture* **2018**, *62*, 135–139. [CrossRef]
28. Rispens, S.M.; Cox, L.G.E.; Ejupi, A.; Delbaere, K.; Annegarn, J.; Bonomi, A.G. Validation of walking speed estimation from trunk mounted accelerometers for a range of walking speeds. *Sensors* **2021**, *21*, 1854. [CrossRef] [PubMed]
29. Czech, M.D.; Psaltos, D.; Zhang, H.; Adamusiak, T.; Calicchio, M.; Kelekar, A.; Messere, A.; Van Dijk, K.R.; Ramos, V.; Demanuele, C.; et al. Age and environment-related differences in gait in healthy adults using wearables. *NPJ Digit. Med.* **2020**, *3*, 127. [CrossRef] [PubMed]
30. Peters, D.M.; Fritz, S.L.; Krotish, D.E. Assessing the reliability and validity of a shorter walk test compared with the 10-Meter Walk Test for measurements of gait speed in healthy, older adults. *J. Geriatr. Phys. Ther.* **2013**, *36*, 24–30. [CrossRef]
31. Roush, J.H.; Hawk, J.D.; Eurek, T.; Wallis, D.; Kiflu, A.D. Agreement in walking speed measured using four different outcome measures: 6-meter walk test, 10-meter walk test, 2-minute walk test, and 6-minute walk test. *Internet J. Allied Health Sci. Pract.* **2021**, *19*, 7. [CrossRef]
32. Saito, Y.; Nakamura, S.; Tanaka, A.; Watanabe, R.; Narimatsu, H.; Chung, U.I. Evaluation of the validity and reliability of the 10-meter walk test using a smartphone application among Japanese older adults. *Front. Sports Act. Living* **2022**, *4*, 904924. [CrossRef]
33. Cabanas-Valdés, R.; García-Rueda, L.; Salgueiro, C.; Pérez-Bellmunt, A.; Rodríguez-Sanz, J.; López-de-Celis, C. Assessment of the 4-meter walk test test-retest reliability and concurrent validity and its correlation with the five sit-to-stand test in chronic ambulatory stroke survivors. *Gait Posture* **2023**, *101*, 8–13. [CrossRef] [PubMed]
34. Master, H.; Coleman, G.; Dobson, F.; Bennell, K.; Hinman, R.S.; Jakiela, J.T.; White, D.K. A narrative review on measurement properties of fixed-distance walk tests up to 40 meters for adults with knee osteoarthritis. *J. Rheumatol.* **2021**, *48*, 638–647. [CrossRef] [PubMed]
35. Dobson, F.; Hinman, R.S.; Roos, E.M.; Abbott, J.H. Recommended Performance-Based Tests to Assess Physical Function in People Diagnosed with Hip or Knee Osteoarthritis: OARSI. Available online: https://oarsi.org/sites/oarsi/files/docs/2013/manual.pdf (accessed on 1 December 2025).
36. Aleksandrowicz, K.; Kosowski, W.; Michalska, A.; Winiarski, S. SPM Differences in gait pattern of women after total hip replacement: A longitudinal study. *J. Clin. Med.* **2025**, *14*, 4316. [CrossRef] [PubMed]
37. Shibuya, M.; Nanri, Y.; Kamiya, K.; Fukushima, K.; Uchiyama, K.; Takahira, N.; Takaso, M.; Fukuda, M.; Matsunaga, A. The maximal gait speed is a simple and useful prognostic indicator for functional recovery after total hip arthroplasty. *BMC Musculoskelet. Disord.* **2020**, *21*, 84. [CrossRef]
38. Fary, C.; Cholewa, J.; Abshagen, S.; Van Andel, D.; Ren, A.; Anderson, M.B.; Tripuraneni, K.R. Stepping beyond counts in recovery of total knee arthroplasty: A prospective study on passively collected gait metrics. *Sensors* **2023**, *23*, 5588. [CrossRef]
39. Foucher, K.C. Identifying clinically meaningful benchmarks for gait improvement after total hip arthroplasty. *J. Orthop. Res.* **2016**, *34*, 88–96. [CrossRef]
40. Shinonaga, A.; Matsumoto, H.; Uekawa, M.; Fujii, K.; Sato, H.; Furuichi, S.; Mitani, S.; Tanaka, S.; Deguchi, N.; Tanaka, R. Fatty infiltration of muscles influences short-term walking speed after primary total hip arthroplasty. *Prog. Rehabil. Med.* **2025**, *10*, 20250007. [CrossRef]
41. Svinøy, O.E.; Nordbø, J.V.; Pripp, A.H.; Risberg, M.A.; Bergland, A.; Borgen, P.O.; Hilde, G. The effect of prehabilitation for older patients awaiting total hip replacement. A randomized controlled trial with long-term follow up. *BMC Musculoskelet. Disord.* **2025**, *26*, 227. [CrossRef]
42. Szczypiór-Piasecka, K.; Adamczewska, P.; Kołodziej, Ł.; Ziętek, P. The temporal–spatial parameters of gait after total knee arthroplasty. *J. Clin. Med.* **2025**, *14*, 4548. [CrossRef]
43. Lee, D.W.; Han, H.-S.; Lee, M.C.; Ro, D.H. Prediction of postoperative gait speed change after bilateral primary total knee arthroplasty in female patients using a machine learning algorithm. *Orthop. Traumatol. Surg. Res.* **2024**, *110*, 103842. [CrossRef] [PubMed]
44. Jones, G.G.; Kotti, M.; Wiik, A.V.; Collins, R.; Brevadt, M.J.; Strachan, R.K.; Cobb, J.P. Gait comparison of unicompartmental and total knee arthroplasties with healthy controls. *Bone Jt. J.* **2016**, *98*, 16–21. [CrossRef] [PubMed]

45. Western, M.J.; Withall, J.; Sheppard, R.; Greaves, C.; Hillsdon, M.; Stathi, A. Why didn't the senior citizen cross the road? Gait speed in community-dwelling older adults with mobility limitations relative to pedestrian crossing times. *Age Ageing* **2025**, *54*, afaf345. [CrossRef] [PubMed]
46. Page, P. Beyond statistical significance: Clinical interpretation of rehabilitation research literature. *Int. J. Sports Phys. Ther.* **2014**, *9*, 726–736.