Mapping the challenges and facilitators faced by orthotists, physiotherapists and prosthetists to integrating non-3D gait evaluation into routine practice: A scoping review of key concepts and knowledge gaps

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Mapping the challenges and facilitators faced by orthotists, physiotherapists and prosthetists to integrating non-3D gait evaluation into routine practice: A scoping review of key concepts and knowledge gaps

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Abstract

Objective

To systematically map the existing literature on the challenges and facilitators associated with integrating non-3D gait evaluation into routine clinical practice by orthotists, physiotherapists and prosthetists across diverse settings and contexts, while identifying gaps in the evidence base related to these challenges and facilitators.

Data Sources

Following PRISMA-ScR guidelines, we searched databases from 1980 to December 2024 (*CINAHL*, *OVID* [including *APA PSYCH]*, *PEDRO* and *WEB OF SCIENCE – ALL DATABASES* [including *MEDLINE]*). We also carried out secondary searching through reference lists and Google Scholar.

Study Selection

Two authors separately screened 100 sources for calibration. One author screened the remaining sources and referred ambiguous sources to two others. Included sources studied challenges and facilitators to non-3D gait evaluation.

Data Extraction

Two authors developed and piloted an Excel™ data extraction form using 20 sources. Thereafter, one author extracted data, spot-checked by a second author.

Data Synthesis

We screened 11,641 sources, selecting 11 for inclusion. Ten focused solely on physiotherapy, one examined physiotherapy and prosthetics, none addressed orthotics.

Conclusions

This scoping review examines challenges and facilitators to the adoption of non-3D gait evaluation methods in orthotics, physiotherapy and prosthetics. Despite benefits, these methods are underused due to clinician awareness, confidence, experience, motivation, environmental constraints, resource limitations (e.g., cost) and time pressures. Gait evaluation methods may also be difficult to use, unrealistic, or lack meaningful data. Clearer guidelines, targeted education and healthcare provider support are essential. Improving the usability of gait evaluation methods and their integration into clinical practice is critical. Research gaps in prosthetics, orthotics and specific gait evaluation methods highlight the need for further investigation to enhance training and inform policy adjustments, improving patient outcomes. Future research should investigate clinician perspectives on specific gait evaluation methods, such as video vector and standardised observational gait assessments, across specialties and their different specialisms.

Keywords

Assessment
Gait
Orthosis
Outcome measure
Prosthesis
Scoping review

Abbreviations

NHS	National Health Service
Non3DGE	Non-3D gait evaluation
PROM	Patient reported outcome measure

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Globally, an estimated 1.3 billion people live with significant disabilities[1]. Among these, mobility restrictions are the most common. For instance, in the UK, 16 million people (24%) experienced disability in 2021/22, with nearly half reporting mobility limitations[2]. Gait disturbances account for a significant portion of these restrictions, affecting up to 32% of some populations[3]. Various health conditions lead to gait disorders[4], and successful management can enhance function and quality of life[5]. Management options are diverse and rely on inter-professional areas of expertise that utilise gait evaluation to inform decision making. This paper focuses on the orthotics, physiotherapy and prosthetics professions, where gait evaluation is reportedly underutilised[6,7,8,9,10,11,12,13,14].

In 2022 the global prosthetics and orthotics market had a value of $6.6 billion[15]. Lower limb orthotic and prosthetic users constitute a substantial portion of this market, imposing significant demands on healthcare systems worldwide. Data suggests that the need for lower limb orthoses is growing. For example, in England the number of orthotic users rose from approximately 1.2[16] to 2 million between 2007 and 2011[17]. Orthotists spend a large proportion of clinical time prescribing lower limb orthoses to improve gait[18], saving the UK National Health Service (NHS) around £4 for every £1 spent on orthoses due to reduced impact on other services[16]. Similarly, the NHS allocates approximately £60 million each year to support up to 60,000 prosthetic users[19], many of whom present with gait disorders. Physiotherapists also play a crucial role with gait disorders, with up to 94% of UK physiotherapists working with patients who have gait issues[7]. Given the substantial resources invested in managing lower limb impairments and associated gait disorders through orthotics, physiotherapy and prosthetics, it is imperative that clinicians can access useful measurement tools to support their clinical decisions.

Gait disorders arise from a plethora of health conditions[4], resulting in a heterogeneous and complicated array of clinical presentations where ‘one size does not fit all’ in terms of clinical management. Therefore, it is imperative that clinicians collect individualised measurements of walking characteristics to understand unique presentations. Furthermore, since walking movements occur simultaneously in different planes and at speeds that are difficult to track and record with the naked eye, precise measures are required to slow down movements and analyse complex presentations. Clinical measurements support clinicians in diagnosing, predicting prognoses, selecting effective treatments and measuring treatment outcomes[4].

Published standards, such as the UK Health and Care Professions Council standards of proficiency (parts 11.2, 11.3 and 11.5)[20,21], stipulate that healthcare professionals are expected to use such measures.

Clinical measures are often referred to as outcome measures, used to evaluate intervention efficacy and identify whether change has occurred over time[22]. However, it is important to recognise that some clinical measures, traditionally referred to as 'assessment tools', which clinicians use to diagnose and plan interventions, can double up as outcome measures[22]. This is particularly true for gait measurement, whereby the same clinical measures (discussed below) play an important role in assessment, diagnosis/prognosis, management and charting outcomes. To reflect this, 'gait evaluation methods' is the preferred term used in this paper, rather than 'outcome measures' or 'assessment tools'.

Gait evaluation is multi-faceted and can focus on quantity (such as temporal-spatial parameters), quality (for example, kinematics / kinetics) or function (for instance, activity / participation)[23,24]. Gait evaluation methods collected directly by clinicians tend to focus on the quantity and quality of gait and can be referred to as 'performance based'. Alternatively, function (for example, activity and participation) is often assessed using patient-reported outcome measures (PROMs). This paper focuses on clinician administered performance-based methods, which are reportedly underutilised[6,7,8,9,10,11,12,13,14], and not PROMs. In terms of performance-based methods, 3D (instrumented) gait analysis using optoelectronic marker-based three-dimensional motion capture is currently considered the gold standard[24]. However, whilst associated with many benefits[25,26], access to 3D (instrumented) gait analysis centres can be highly limited. This is particularly applicable to the UK, precluding access for large proportions of service users and clinicians[7,27,28]. Therefore, in routine clinical settings, alternative forms of gait evaluation are often more practical because they do not depend on advanced 3D motion capture technologies, yet still offer valuable insights into gait characteristics[29]. These methods are accessible to routine settings and can be selected from a 'toolkit' of options, allowing clinicians to tailor their choice based on the specific needs of the service user, as well as the available resources and clinical environment, ensuring that the assessment is both effective and contextually appropriate. Given this, it is reasonable to group these various non-3D gait evaluation methods (non3DGE) into one broad category, which is the focus of this paper.

Non3DGE may comprise the following tools: real time visual observation, temporal and spatial measures (including pressure sensitive walkways), photography, a locally developed (in-house, non-standardised) gait form, video, video-vector, functional measures including a functional gait component (for example, the Functional Independence Measure), and standardised observational gait assessment tools (for instance the Edinburgh Visual Gait Score / Rancho Los Amigos Observational Checklist / Rivermead Visual Gait Assessment / Salford Gait Tool)[30,31]. Several benefits are associated with non3DGE in routine clinical settings (Table 1), and as such it is advised in healthcare guidance documents (for instance 'Falls in older people: assessing risk and prevention'[32]). Clinicians also rate non3DGE as an important part of their practice, as demonstrated by Heinemann et al.[33] whereby in the U.S 70% of orthotists and physiotherapists working with ankle foot orthosis users believed that documenting their gait pattern is highly important.

Table 1

Despite consensus on the benefits of non3DGE in routine clinical settings, there is considerable variation in its uptake in the UK and overseas over the last two decades (Table 1). In 2003 Toro et al.[7] reported that 43% of UK physiotherapists did not routinely use non3DGE in their practice. Whilst the present-day picture lacks clarity, it appears that the last two decades have seen little change, and non3DGE is still underutilised in physiotherapy (Table 1). In the context of orthotics and prosthetics, there exists an absence of data regarding the current use of non3DGE. However, insights can be drawn from existing data on the use of more general outcome measures. For instance, in England, there are concerns over 'postcode lotteries' of poorer quality orthotic services[8] and a paucity of routinely collected outcome measures[8,16,37]. Service user groups such as The Orthotics Campaign[38] have echoed these concerns, whilst NHS England[39] published an agreed set of core key performance indicators for orthotic services, some focussing on outcome measures. However, it is unclear how many services have adopted this optional guidance. This raises concerns about care quality, which could be compromised if clinicians and services are unable to understand their diagnostic accuracy and treatment efficacy[33].

Despite the recognised benefits of non3DGE for individuals using orthotics, physiotherapy and prosthetics, its use appears limited. Understanding the current evidence base, including research gaps, regarding the challenges and facilitators to its integration is crucial. This will provide a clearer understanding of the current state of knowledge, inform future research, and potentially guide strategies to increase the adoption of non3DGE. This, in turn, could improve care for individuals with complex impairments leading to severe gait disorders. Therefore, this scoping review aimed to answer the review question (developed using PICO[40]): *What evidence exists on the challenges and facilitators to the use of non3DGE in orthotics, physiotherapy and prosthetics?*

Methods

Overview

Scoping review methodology was selected as it offers a systematic approach to identifying and mapping the breadth of existing evidence and knowledge gaps[41-43]. This approach aligns closely with our review question, which sought to establish the extent of the knowledge base in this field, encompassing a broad and multifaceted subject area that includes various populations, settings and contexts. Unlike traditional systematic reviews, which require narrowly defined inclusion criteria and a focused research question, the scoping review approach allows for broader eligibility criteria. This inclusivity accommodates diverse study designs, both qualitative and quantitative, enabling a comprehensive mapping of non3DGE literature. Our review adhered to the validated framework proposed by Arksey and O'Malley[44], as further refined by Daudt, Van Mossel and Scott[45], and followed the PRISMA-ScR reporting guidelines[71]. By employing this exploratory approach, we aimed to provide an in-depth overview of the challenges and facilitators associated with non3DGE, a topic where mature evidence is not yet suitable for the stringent focus of a systematic review. As such, the intention of this scoping review was not to appraise the quality of the evidence but rather to map the landscape of research in this area comprehensively.

Stage 1: Study objectives and protocol

Primary objective:

To systematically map the existing literature on the challenges and facilitators associated with integrating non3DGE into routine clinical practice by orthotists, physiotherapists and prosthetists, across diverse settings and contexts.

Secondary objective:

To identify gaps in the evidence base regarding the challenges and facilitators to the use of non3DGE in routine practice by orthotists, physiotherapists and prosthetists.

A research protocol was developed and refined following a pilot search of the literature (via *OVID*) to ensure that it remained aligned to the review question and objectives. The protocol was scrutinised by three members of the inter-professional research team (physiotherapist, professor of clinical biomechanics/sports scientist, and an engineer) which enabled depth and breadth of knowledge. The protocol was not uploaded to the PROSPERO database to prospectively register a review, as PROSPERO does not align with scoping reviews.

Stage 2: Identifying relevant sources

We conducted an extensive literature search across several databases between February and August 2022, with a follow-up search performed in December 2024 to ensure the inclusion of the most recent studies. The databases included *CINAHL, OVID* (including *SalfordUniversityJournals@OVID, Journals@OVIDFullText, APA PSYCH*), *PEDRO*, and *WEB OF SCIENCE* (including *MEDLINE*). Table 2 details the search terms which were filtered to the English language from 1980 when non3DGE was very much growing in popularity[23]. Whilst this scoping review aimed to establish challenges and facilitators relating to the type of full body non3DGE used by orthotists, physiotherapists and prosthetists, search terms relating to podiatry were included to identify any podiatry sources that also focussed on orthotics, physiotherapy and prosthetics.

Secondly, the reference list of all papers eligible to be included in this scoping review were hand searched for additional sources that met the eligibility criteria. Whilst review papers were excluded from our scoping review (see below), reference lists of systematic reviews and narratives in this field were also searched.

Finally, the titles of all sources eligible to be included in our scoping review were searched via the 'cited by' function in Google Scholar™.

We recorded search strategies alongside the date of searches and number of citations returned. Results were stored on Endnote Web™ using reference management.

Figure 1
Table 2

Stage 3: Selection of sources

Literature searching generated 11,641 sources (Figure 1). Eligibility criteria (Table 2) were used to select suitable sources.

The first step in screening the sources was a calibration exercise whereby two authors (JR, SD) separately screened the same 100 citations via title and abstract (plus full text where ambiguous). Then three authors (JR, SD and RJ) met to discuss the level of agreement. As there was 100% agreement no further action was taken to refine the protocol. Following the calibration exercise, the remaining citations were screened via title and abstract by one author (JR) and those that were inconclusive were further screened via the full text source (Figure 1). Ambiguous sources were discussed for a team decision (JR, SD, RJ).

Of note, sources that focused entirely on PROMs were excluded because our scoping review relates to clinician administered performance-based methods only. Reviews (systematic/scoping/meta-analyses) were also excluded to enable consistency in applying eligibility criteria to each primary source. Whilst eligible sources were not officially screened for quality and bias, all had been subject to a peer review process via their publication.

Stage 4: Charting the data

A Microsoft Excel™ data extraction spreadsheet was created for included studies which we piloted using 20 sources, checking for accuracy and consistency (JR, SD). Thereafter one author (JR) extracted the data with spot checks by a second author (SD). The spreadsheet aligned sources to the appropriate scoping review objective and charted the following information: Author(s) of source / publication year, storage location, study objective, population and findings (challenges and facilitators).

Stage 5: Collating and summarising the data

The purpose of a scoping review is to provide an overview of the existing literature[42,43] and this was achieved by identifying a range of challenges and facilitators for non3DGE. These were mapped to key themes on a second Microsoft Excel™ document.

Results

Description of studies

From 11,641 sources we selected 11 for inclusion in this review (Figure 1). These 11 sources included studies employing quantitative, qualitative, and mixed methods approaches, all published as full length papers (Table 3). Although conference papers and theses were identified in this area, they did not meet the inclusion criteria. The selected sources originated from Canada (2)[12,13], Saudi Arabia (1)[46], South Korea (1)[47], Republic of Ireland (1)[6], UK (1)[7], USA (4)[9,10,36,48] and Zambia (1)[34]. Of these, ten focussed exclusively on physiotherapy, while one examined physiotherapy alongside prosthetics and medicine (physicians). None addressed orthotics. The studies investigated various types of non3DGE, including real time visual observation (n = 5), temporal and spatial measures (7), photography (3), a locally developed (in-house and non-standardised) gait assessment form (n = 4), video (n = 5), video vector (n = 1), functional tests including a gait component (n = 5), and standardised observational gait assessment tools (n = 5).

Key themes in the challenges to implementing non-3D gait evaluation

Table 3 outlines the challenges and facilitators associated with non3DGE. From the 11 sources included in our review, we identified 16 distinct challenges, which we categorised into six themes: 'national / international professional culture', 'physical environment', 'properties of the measure', 'service user opinion / requirements', 'within therapist' and 'workplace structure'. The 'properties of the measure' category contained the highest number of different challenges (n = 6), indicating a spread of complex barriers relating to non3DGE methods themselves. The five most reported challenges (% sources that cited each challenge) were: lack of time for various reasons (100%), unsuitable physical environment (90.9%), unavailability of measures due to cost of measure or required resources (63.6%), reduced awareness, confidence or experience within the therapist (63.6%) and inappropriate / inadequate measures with questionable benefit (54.5%). These spanned the 'physical environment', 'properties of the measure', 'within therapist' and 'workplace structure' categories. Figure 2 presents the 16 different challenges, whilst table 3 provides more detail underpinning each theme.

Key themes in the facilitators to implementing non-3D gait evaluation

Twenty four different facilitators for non3DGE were reported (Table 3, Figure 2). We grouped these into the same six categories as the challenges (above). Again, the 'properties of the measure' category contained the most facilitators (n = 9). Figure 2 shows that out of 24 facilitators, the most common suggestions were access to professional guidance on non3DGE (45.5%) and sufficient clinical time for its integration (36.4%).

Geographical variation

The 11 included studies comprised both UK-based and international research. Two studies focused on clinicians in the UK and Republic of Ireland, while the remaining nine examined clinicians in other countries. Despite variations in geographic locations and healthcare systems, common challenges and facilitators were identified across the studies (Figure 3).

Professional differences

Since the majority of sources (10) focused solely on physiotherapy, with only one examining both physiotherapy and prosthetics, and none addressing orthotics, it was not possible to identify profession-specific trends in the challenges and facilitators associated with non3DGE. Although the sources included various physiotherapy specialisms, it was difficult to identify trends specific to each specialism due to the different types of non3DGE methods examined across the studies.

Changes over the decades

Published between 2003 and 2023, the eleven included sources reveal consistent challenges and facilitators over two decades (Figure 4). Common issues include inappropriate and unavailable gait evaluation methods, and clinicians lacking awareness, suitable environments, and time for non3DGE.

Gaps in the evidence base

No studies specifically examined the challenges and facilitators of non3DGE in orthotics, and only one study included prosthetics, alongside physiotherapy and medical professionals.

Of the eleven studies focusing on physiotherapy, some did not specify the area of physiotherapy they examined[46,47], while others clearly defined their focus (Table 3). A synthesis of the evidence suggests that most key areas of physiotherapy were represented; however, not all forms of non3DGE were investigated across all studies. As a result, key areas of physiotherapy were not consistently represented for every type of non3DGE. Notably, video vector analysis was addressed in only one study[7], conducted over two decades ago, while most other types of non3DGE were explored in fewer than half of the studies (Table 3).

Figures 2 to 4

Table 3

Discussion

Overview

Our aim was to systematically map the challenges and facilitators to integrating non3DGE into routine clinical practice by orthotists, physiotherapists and prosthetists across diverse settings, and identify evidence gaps in this area. Sources employed qualitative, quantitative and mixed methods, ensuring comprehensive insights from seven countries.

The majority of studies focused on physiotherapists, with only one addressing prosthetists and none examining orthotists. The challenges and facilitators identified remained largely consistent over two decades and across seven countries, reflecting a persistent and similar international trend.

Our scoping review shows that integrating non3DGE into clinical practice is complex. Increased adoption depends on considering several interconnected categories: ‘national / international professional culture’, ‘physical environment’, ‘properties of the measure’, ‘service user opinion / requirements’, ‘within therapist’ and ‘workplace structure’.

‘National and International professional culture’

National and International consensus is essential for incorporating clinical measures into practice. However, our review highlights significant challenges for non3DGE, including a lack of professional consensus (27.3% of sources) and disagreements among clinicians, service providers and guidelines (9.1%). Despite the existence of professional networks and clinical guidelines, in countries like the UK these bodies do not address non3DGE, a gap also reflected in national healthcare standards. Overcoming these challenges requires unified collaboration among clinicians, researchers, employers and professional networks to facilitate clear guidance (45.5%) and foster the integration of non3DGE into routine practice.

Our review found that a supportive professional culture, facilitated by accessible training (27.3%) and opportunities to learn as an undergraduate (18.2%) or from others (9.1%), is essential. These key facilitators are discussed below, as they overlap with the ‘within therapist’ qualities.

‘Within therapist’

A common challenge identified by our review is a lack of clinician awareness, confidence or experience, which was documented by 63.6% of sources. In contrast, facilitators in this area include familiarity with the measure (9.1%) and a positive attitude or motivation toward its use (9.1%).

These findings highlight the need for targeted training to bridge knowledge gaps and enhance clinician confidence and engagement with non3DGE. This raises the question of when orthotists, physiotherapists and prosthetists should acquire knowledge of gait evaluation methods. While learning during undergraduate education is recognised as a facilitator (18.2%), undergraduate curricula tend to be broad and often lack specificity. Furthermore, inconsistency in the delivery of training is likely[49], highlighting the need for consensus and transparency in curriculum development[50].

In addition to learning about clinical measures, it is essential that undergraduates are supported in developing strategies to ensure they practice evidence-based care throughout their careers. Professional standards advocate for the routine use of clinical measures[20,21], and clinicians should be equipped to search for and critically evaluate relevant literature. Several resources are available to support this, such as the 'Clinician Readiness for Measuring Outcomes Scale'[51], materials provided by professional bodies[52] and guidance described in journal papers[53]. Clinicians also need a comprehensive understanding of the psychometric properties that underpin robust measures[51]. However, translating evidence into practice is often complex, and individual clinician-level factors, such as insufficient knowledge and skills to appraise literature, can pose significant barriers[53]. The role of workplace support (discussed below) and professional networks (discussed previously), in overcoming these barriers cannot be underestimated. In fact, 27.3% of sources in our review highlighted that being a member of a clinical network serves as a facilitator for using non3DGE. Away from non3DGE, long-term exposure to ongoing education has been shown to positively influence clinicians' perceptions of clinical measures. For example, prosthetists in the US reported increased confidence in using various clinical measures after participating in educational activities[54] and physiotherapists in the US saw significant uptake in gait speed measures following knowledge brokering[48].

Regarding non3DGE specifically, clinicians may benefit from guidance on when to use different gait evaluation methods, recognising variations in their intended applications. For instance, kinematic data collected in a standardised setting may be optimal for identifying the cause of excessive knee flexion during walking, whereas a PROM may be more appropriate for evaluating how an orthosis impacts community participation. A challenge lies in supporting clinicians to navigate the wide range of methods under the umbrella of 'non3DGE,' as data suggests that clinicians are less familiar with standardised or richer methods of gait evaluation. It appears that real-time visual observation and simple temporal and spatial measures are preferred over standardised observational gait tools, despite the availability of numerous tools for assessing gait kinematics and video vector for assessing kinetics. A future gait measurement toolkit, offering greater flexibility of use and evidence based guidance[55] may be an appropriate facilitator.

Clinician experience was identified as a facilitator (18.2%) with clinicians working at more senior levels reported to be more familiar with non3DGE. However, this information needs to be interpreted with caution as the evidence appears contradictory. Toro et al.[7] surveyed UK physiotherapists on their confidence in assessing gait, whereby less experienced clinicians rated themselves lower than more experienced staff. Conversely, in the US, physiotherapists with less than 20 years of experience were more inclined to use video gait measures than those with over 20 years of experience[9,10].

This picture is unclear and requires further research. It may indicate a shift in recognising the importance of clinical measures over the past two decades, or increased confidence with technology.

One source (9.1%) highlighted that intrinsic motivation, and a positive clinician attitude is a key facilitator to adopting non3DGE. With adequate support, clinicians may be more internally motivated to embrace non3DGE, as mandated by professional standards[20,21]. In cases where clinicians exhibit lower motivation, some sources[56,57,58] suggest that mandatory requirements or national registries, such as the SPARG database (Scottish Physiotherapy Amputee Research Group)[59] can drive greater utilisation. However, many services do not mandate the use of clinical measures. This is evident in a recent study of Canadian prosthetists[60], where only 16% of participants reported being required to use outcome measures.

'Physical environment'

The physical working environment was identified as a critical factor in our review, with 90.9% of sources highlighting it as a major challenge. Insufficient space[6,7,9,10,12,34,36,46,48,] unsuitable[6] or crowded therapy gyms[48], and restrictions on permanent clinical setups, such as the inability to apply tape marks on floors[12], were common issues. For example, one US study[36] noted that while most physiotherapists working with lower-limb amputations had access to gyms, few physiatrists and prosthetists had large indoor spaces available. Conversely, our review also found that a suitable physical environment was a key facilitator (18.2%), underscoring the importance of addressing these environmental barriers to improve clinical practice.

Although our review found no suitable sources specific to orthotics and only one for prosthetics, related research highlights similar challenges. Young et al.[14] observed that UK orthotists and prosthetists view inadequate space as a barrier to using more general clinical outcome measures. Similarly, a recent Canadian survey[60] reported that while 94% of prosthetists had access to a 5m walkway, only 29% had access to a gym or large indoor space.

Despite recommendations such as providing a minimum 10m walkway for UK orthotists and prosthetists[61], these standards are often unmet. Therapy gyms typically offer sizeable spaces, but similar provisions appear to be lacking for orthotists, some physiotherapists and prosthetists. Addressing these disparities is critical to support clinical practice and align with current recommendations.

'Properties of the measure'

'Unavailability due to the cost of measures or required resources' was identified as a challenge by 63.6% of non3DGE sources. This issue was linked to factors such as insufficient funding for expensive equipment[9,10,34], the high cost of the measures themselves[6,34], difficulties in obtaining the measures[6,7,13,46] and limited internet access required for certain measures[9,10]. Although our review identified no suitable sources specific to orthotics and only one for prosthetics, evidence from research on other clinical measures suggests that unavailability may be a broader issue in the field of prosthetics and orthotics, reflecting a wider trend of limited funding for allied health measures. For example, when surveyed[14], 37.6% of UK orthotists and prosthetists reported that securing finance for licensed instruments is a challenge.

Clearly, facilitators such as cost-effectiveness (9.1%) and the accessibility of measures and associated equipment (9.1%) are well aligned to these challenges. Compared to other health sectors, the cost of allied health clinical measures is likely to be minimal and many standardised observational gait tools are accessible at no cost[31] representing a worthwhile investment for services. Similarly, simple and affordable video gait systems can be constructed in large enough settings supported by free playback software[62]. Consequently, accessing non3DGE methods should be relatively straightforward for services.

'User friendliness' was identified as both a challenge (27.3%) and facilitator (27.3%) by our review. User friendliness may also relate to how successfully measures are integrated into electronic record systems, an essential facilitator for contemporary practice noted by one source (9.1%). Not all clinicians agree that clinical measures are easy to upload to electronic records systems[63] but believe that such systems are valuable, allowing extraction and compilation of data to support a variety of tasks[64].

More than half of the sources in our review (54.5%) noted the challenge that non3DGE methods are deemed inappropriate or inadequate or do not align to different environments such as community settings (9.1%). They are often considered too generalised or poorly constructed to be beneficial and some also believe that there is simply no appropriate method available for specific populations[34]. Ambiguity within measures, including the challenge of a lack of normative data comparisons[13] (9.1%), impacts clinical meaningfulness, as does the challenge of reduced confidence in psychometric properties, such as poor or unknown sensitivity to change (9.1%). These issues limit the ability to detect meaningful change. However, facilitators such as measures that generate meaningful results (27.3%), are realistic to integrate into practice (27.3%) and allow comparisons to normative data (9.1%) were noted as key to overcoming these challenges. Additionally, measures that are suitable for the care continuum (9.1%) are recognised as more effective in real-world settings. The importance of clinician involvement in measurement tool design and development cannot be underestimated. Furthermore, measures must be clearly described, with originators providing precise instructions. It is recognised that inadequate systematic reporting has persisted for many years[65], highlighting the need to standardise how measures are reported[66].

'Service user opinion / requirements'

Non3DGE for service users with cognitive and communication changes may pose challenges (9.1%), especially when gait evaluation methods rely on service users following a variety of instructions, for example during functional gait measures such as during the Chedoke McMaster Stroke assessment[12]. Methods that require minimal instruction and are suited to the service user's ability may facilitate this issue (9.1%). Fatigue, lack of endurance and pain can also pose challenges to non3DGE (18.2%) in addition to methods that require service users to address (18.2%). Clinicians must be equipped to comprehend and select the most suitable methods for the clinical picture, such as utilising video recordings to minimise the amount of walking required. Familiarity with the array of different non3DGE methods, discussed earlier, should facilitate clinicians in selecting appropriate methods.

'Workplace structure'

All sources in our review (100%) identified time constraints as a significant challenge. The reasons for this varied, with large caseloads limiting the amount of quality time available for service users[34] which in turn impacted the prioritisation of gait evaluations[12]. Other factors included the need for multiple clinicians to support non3DGE, particularly in cases such as post-stroke rehabilitation[12] as well as the time required to set up temporary evaluation environments[12]. While our review found only one relevant source pertaining to prosthetics and none for orthotics, broader research on the use of outcome measures in these fields[14] highlighted time constraints as the most commonly reported challenge among UK orthotists and prosthetists. This research suggested that service redesign and additional support from senior management may be necessary to improve the feasibility of implementing outcome measures. Similarly, other broader research[67] indicates that physiotherapists and prosthetists working with lower limb amputations were often limited to just ten minutes for administering measures during initial evaluations, with even less time allocated during follow-up appointments.

Considering that clinical measures are a foundation of high-quality services[8,16,37,38,39], support should be given to clinicians so that they can invest appropriate time to using measures. Workplaces have an obligation to assist staff in adopting such an approach and also stand to gain from this practice. However, our review highlights that a lack of organisation or workplace support is a challenge to non3DGE adoption (9.1%), with some workplaces precluding its use (27.3%). We identified much needed facilitators: fostering opportunities for knowledge exchange among colleagues (9.1%), promoting positive workplace cultures (18.2%), freeing up clinician time (36.4%) through enhanced administration support and ensuring good organisation, such as granting clinicians access to a comprehensive record of previously utilised, well documented measures. When integrating measures into services, the importance of stable, well-organised workplaces with clear consensus and a record of using clinical measures (9.1%) should be acknowledged. This was highlighted during a broader quality improvement prosthetics project, where services with robust infrastructure, perseverance and meticulous planning were more successful in integrating PROMs for outcome monitoring and quality improvement support[68]. Other sources have highlighted the broader advantages of workplaces adopting measures such as their ability to support audit and research[69,70].

Evidence gaps and study limitations

The limited research on prosthetics and the absence of sources on orthotics led to a review primarily focused on physiotherapy. While different physiotherapy specialisms were represented, the review provides an incomplete understanding of the challenges and facilitators specific to each non3DGE method by specialty. Additionally, sources examining various types of non3DGE often grouped results, rather than addressing the challenges associated with each individual method. This approach limits our understanding of the challenges and facilitators to individual methods. Some methods, like video vector, have been studied less than others, such as temporal-spatial measures, and this raises the question of whether video vector is used less in practice. Furthermore, only one study in the past five years has explored the challenges and facilitators related to standardised observational gait assessment tools, highlighting another under-researched area.

These tools, which provide valuable non3DGE information (kinetics and kinematics for video vector and kinematics for standardised observational assessment tools) remain underrepresented in recent studies, pointing to significant gaps in contemporary research.

Conclusions

This scoping review evaluated themes from the current evidence on challenges and facilitators influencing the uptake of non3DGE methods in orthotics, physiotherapy and prosthetics. Despite their benefits to practice, these methods are underused due to various barriers. Many clinicians lack awareness, confidence, experience and motivation and desire clearer professional guidelines and targeted educational programs to improve their familiarity with these methods. Environmental factors, resource limitations (e.g. cost and availability) and time constraints also pose barriers. Furthermore, gait evaluation methods can be difficult to use, unrealistic or lack meaning. Clinicians would welcome the opportunity to co-create measures with robust usability and psychometric properties that can integrate well into their practice and medical record systems. Addressing these challenges requires clearer professional guidelines, targeted education and better support from healthcare providers.

Research gaps, particularly in prosthetics, orthotics and specific non3DGE methods, point to the need for further investigation to enhance integration and improve clinical outcomes. Future research should encompass orthotics, physiotherapy and prosthetics across their different specialisms, examining clinician usage, challenges, facilitators and opinion on specific gait evaluation tools, such as video vector and standardised observational gait assessments. This research should aim to inform training, guide policy development, and ultimately enhance patient outcomes.

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Figure and table legends

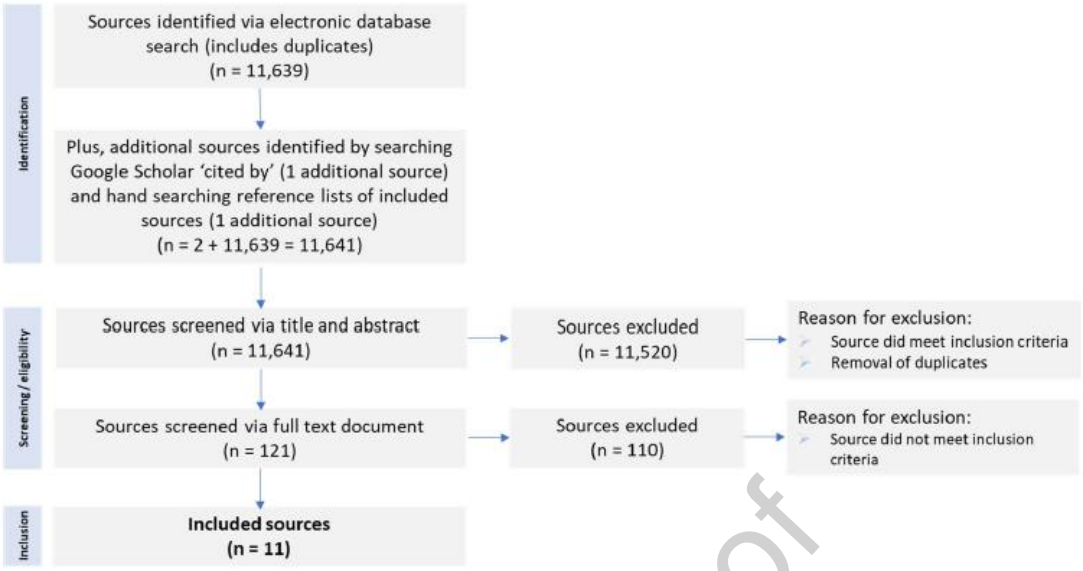

Figure 1 Searching and screening process

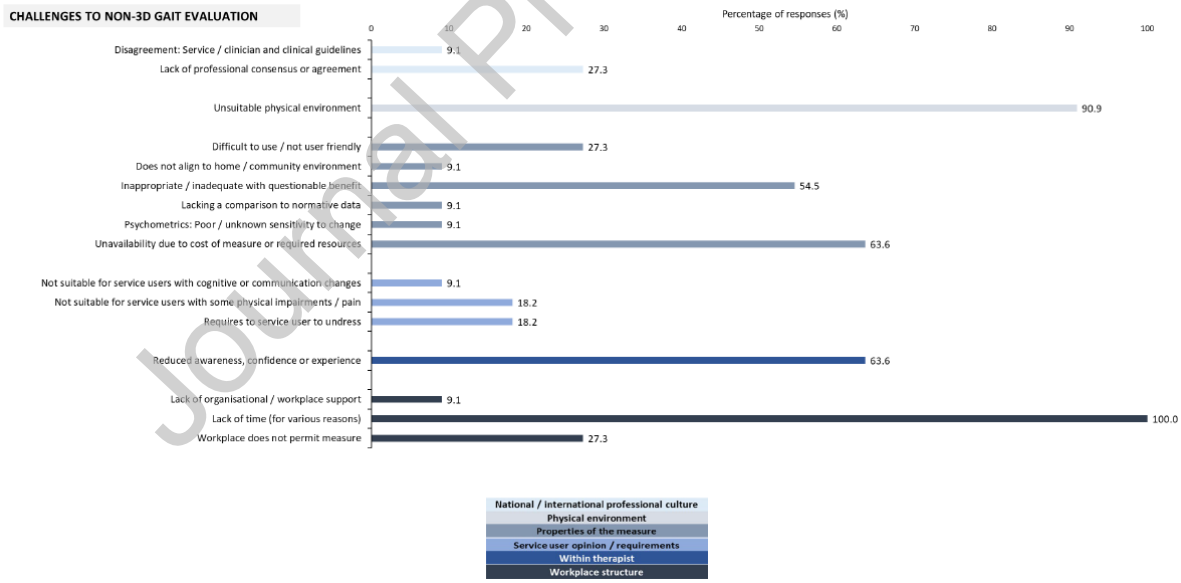

Figure 2 Challenges and facilitators to non-3D gait evaluation

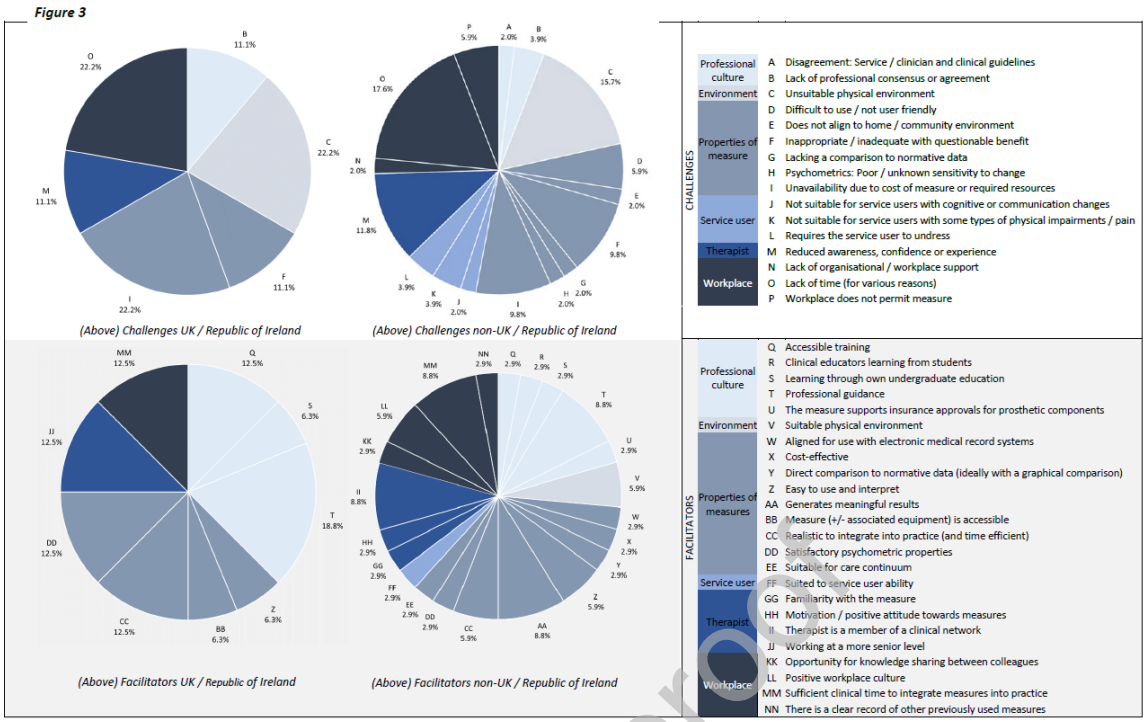

Figure 3 Summary of UK / Republic of Ireland, and non-UK / -Republic of Ireland challenges and facilitators to non-3D gait evaluation

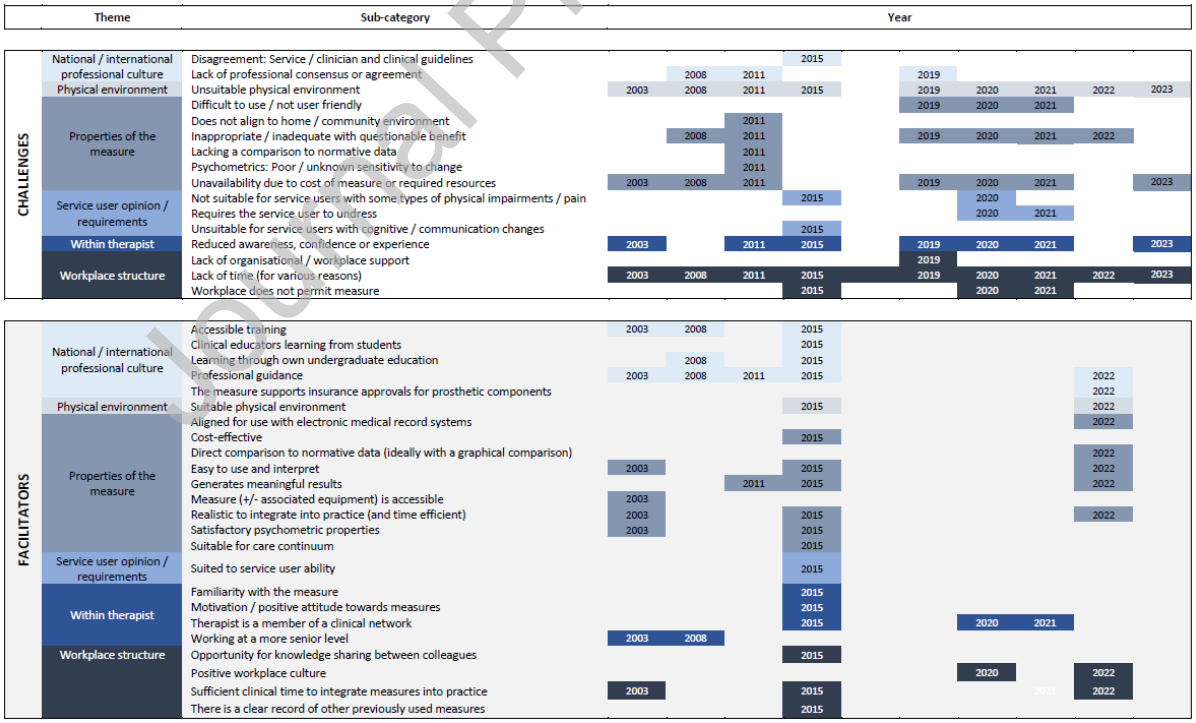

Figure 4 Challenges / facilitators to non-3D gait evaluation over the last two decades (Shaded areas indicate presence of challenge / facilitator)

Table 1 Examples of the benefits and usage of non-3D gait evaluation

Table 1

Author/s	Participants (Specialism) [Location]	Type of gait method(s) studied	Benefits or desired uses (% of responses)	Usage
Chiluba et al.[34]	36 physiotherapists (Different specialities within a university hospital) [Zambia]	• Real time visual observation • Standardised observational gait assessment tools (Gait Assessment and Intervention Tool, Hemiplegic Gait Analysis Form, Rivermead Visual Gait Assessment, Rancho Los Amigos Observational Checklist, Wisconsin Gait Scale) • 3D (Instrumented) Gait analysis (Vicon system)	-	• 71% had strongly heard of observational gait assessment and a standardised assessment tool • 14% had never heard of observational gait assessment or a standardised assessment tool
Chockalingam et al.[8]	Freedom of information responses received from 101 orthotic services associated with NHS Trusts in England and Northern Ireland, 18 health boards in Wales and Scotland [UK]	• Temporal and spatial measures (10m walk test) • Functional measures including a functional gait component (Timed Up and Go)	-	In terms of trusts / health boards: • 35% used outcome measures to assess orthotic interventions • 85% had no access to 3D (instrumented) gait analysis or a 2D video vector analysis system used outcome measures to assess orthotic interventions • 79% reported not having access to simple video analysis
Flannery & O'Sullivan[6]	185 physiotherapists (Members of three clinical interest groups of the Irish Society of Chartered Physiotherapists: Neurology/gerontology, paediatrics, sports medicine) [Republic of Ireland]	• Real time visual observation • Temporal and spatial measures (including the GAITRite system) • Photography • A locally developed (in-house and non-standardised) gait assessment form • Video • Standardised observational gait assessment tool (Rivermead Visual Gait Assessment)	• Plays an important role in managing gait problems (96%)	• 93% used visual observation • 43% did not use any other method than visual observation • 34% used video equipment but did not use any other method than visual observation • Other forms of gait assessment were used but less so (standardised gait assessment form [26%], still photography [15%], locally developed assessment [12%])
Hensley et al.[9]	477 physiotherapists (Members of the Academy of Orthopaedic Physical Therapy) [USA]	• Video	• Analysis of movement (92%) • Visual feedback (92%) • Assessment of progress (52%) • Quantification of movement (36%)	• 48% used video based gait assessment to some extent

Hensley et al.[10]	261 physiotherapists (Members of the American Academy of Sports Physical Therapy) [USA]	• Video	(94%) • Visual feedback for service user education (88%) • Assessment of progress (59%) • Quantification of movement (43%)	• 74% used video based gait assessment to some extent
Kane et al.[11]	60 physiotherapists (Paediatric physiotherapy) [Canada]	• Consideration of the gait pattern to inform the prescription of ankle-foot orthoses for children with cerebral palsy	-	• 100% of physiotherapists considered gait on assessment / re-assessment
MacFarlane et al.[35]	11 children with a diagnosis of cerebral palsy [Australia]	• Standardised observational gait assessment tool (Edinburgh Visual Gait Score)	• The Edinburgh Visual Gait Score was used to differentiate the effect of ankle foot orthoses and 'sensomotoric' orthoses on gait	-
Morgan et al.[36]	Clinicians who regularly work with people who have lower-limb amputation: 8 physiatrists, 9 physical therapists, 8 prosthetists (Hospitals, outpatient clinics or home health settings) [USA: 12 US States]	• Temporal and spatial measures (2 minute walk test, 6 minute walk test, 10 minute walk test) • Functional measures including a functional gait component (Amputee Mobility Predictor, Comprehensive High-Level Activity Mobility Predictor, L-Test, Timed Up and Go)	• Compare outcomes over time (72%) • Document service user progress (72%) • Determine functional level (44%) • Justify services to funders (44%) • Determining the prosthetic or therapy plan of care (36%) • Communicating with service users (28%) • Communicating with other rehabilitation providers (24%)	• 8% did not collect non-3D gait assessment measures in their clinics
Pattison et al.[12]	28 physiotherapists (Physiotherapy for stroke, registered with the College of Physiotherapists Ontario) [Canada]	• Real time visual observation • Temporal and spatial measures (2 minute walk test, 6 minute walk test) • A locally developed (in-house and non-standardised) gait assessment form • Functional measures including a functional gait component (Chedoke-McMaster Stroke Assessment, Timed Up and Go)	• Communication with other health professionals / the service user • Education of the service user / parent / carer • Formulate a prognosis • Motivation of service user • Plan and validate treatment • Plan discharge / termination of care • To establish the confidence of the service user	• 28% did not regularly use a standardized tool to assess walking ability poststroke
Salbach et al.[13]	270 physiotherapists (Physiotherapists providing services to people with stroke, Ontario) [Canada]	• Temporal and spatial measures (gait speed, 2 minute walk test, 6 minute walk test) • Functional measures including a functional gait component (Chedoke-McMaster Stroke Assessment, Functional Independence Measure)	• Evaluate walking ability (27%) • Monitor change in walking ability (26%) • Determine prognosis for walking recovery (12%) • Determine readiness for discharge (19%)	• 68% used the Chedoke-McMaster stroke assessment • 38% measured gait speed • 33% used the two minute walk test • 16% used the six minute walk test • 49% used the functional independence measure
Toro et al.[7]	1826 physiotherapists	• Real time visual	• Assess a physiotherapy	• 43% did not routinely use

	community NHS Trusts – 15 different specialisms) [UK]	• Temporal and spatial measures (10m walk) • Video • Video vector • Functional measures including a functional gait component (Elderly Mobility Scale, Functional Ambulation Classification, Gross Motor Function Measure, Motor Assessment Scale) • Standardised observational gait assessment tool (Rivermead Visual Gait Assessment, Rancho Los Amigos Gait tool)	• Assist in the diagnosis of a gait abnormality (40%) • Monitor service user progress (32%) • Take a baseline assessment (31%) • To assist with orthotic prescription (9%) • Service user awareness	
Young et al.[14]	109 orthotists and prosthetists (Via the British Association of Prosthetists and Orthotists – those registered with the Health and Care Professions Council employed by the NHS, commercial companies or self-employed/other) [UK]	72 different outcome measures used in orthotics and prosthetics including the following gait assessment measures: • Temporal and spatial measures (distance walking, timed walk test, 2 minute walk test, 6 minute walk test, 10 minute walk test, 10 meter walk test) • Video • Functional measures including a functional gait component (Amputee Mobility Predictor, Comprehensive High-Level Activity Mobility Predictor, Timed Up and Go) • Standardised observational gait tool (Edinburgh Visual Gait Score, Prosthetic Observational Gait Score)		• 28% reported routine use of outcome measures (of which some include gait assessment)

Table 2a Search terms

'Or' search terms (searched within title)
'AFO*', 'ankle foot orthos*', 'orthos*', 'orthotic*' 'prosthe*', 'amput*', 'artificial limb', 'artificial leg', 'false leg', 'false limb' **And** 'assess*', 'analys*', 'clinical decision*', 'clinical practice*', 'clinical reason*', 'evaluat*', 'measure*', 'tool*', 'outcome measure*', 'outcom*' **And** 'advantage*', 'barrier*', 'benefit*', 'clinical usefulness', 'clinical utility', 'disadvantage*', 'decision-making', 'feasib*', 'obstacle*', 'perception*', 'status', 'usability', 'use*'
'AHP*', 'allied health practition*', 'allied health profession*', 'chiropod*', 'healthcare profession*', 'healthcare provider*', 'healthcare provider*', 'orthotic personnel', 'orthotic practice*', 'orthotic practition*', 'orthotic profession*', 'orthotic workforce', 'orthotist*', 'pedorthist*', 'physical therap*', 'physio*', 'podiatric*', 'podiatrist*', 'profession*', 'prosthet*', 'prosthet* personnel', 'prosthet* practition*', 'prosthet* workforce', 'prosthet*', 'rehab* therap*', 'rehab*' **And** 'analys*', 'assess*', 'clinical decision*', 'clinical practice*', 'clinical reason', 'evaluat*', 'measure*', 'outcom*', 'outcome measures', 'tool*' **And** 'gait', 'function*', 'walk*'
'AHP*', 'allied health practition*', 'allied health profession*', 'chiropod*', 'health care profession*', 'health care provider*', 'healthcare provider*', 'orthotic personnel', 'orthotic practice*', 'orthotic practition*', 'orthotic profession*', 'orthotic workforce', 'orthotist*', 'pedorthist*', 'physical therap*', 'physio*', 'podiatric*', 'podiatrist*', 'prosthet* personnel', 'prosthet* practition*', 'prosthet* profession*', 'prosthet* workforce', 'prosthet*', 'rehab* therap*', 'rehab*' **And** 'advantage*', 'barrier*', 'benefit*', 'clinical usefulness', 'clinical utility', 'decision-making', 'disadvantage*', 'feasib*', 'obstacle*', 'perception*', 'status', 'usability', 'use*' **And** 'analys*', 'assess*', 'clinical decision*', 'clinical practice*', 'clinical reason', 'evaluat*', 'measure*', 'outcom*', 'outcome measures', 'tool*'
'AHP*', 'allied health practition*', 'allied health profession*', 'chiropod*', 'health care profession*', 'healthcare provider*', 'orthotic personnel', 'orthotic practice*', 'orthotic practition*', 'orthotic profession*', 'orthotic workforce', 'orthotist*', 'pedorthist*', 'physical therap*', 'physio*', 'podiatric*', 'podiatrist*', 'prosthet* personnel', 'prosthet* practition*', 'prosthet* profession*', 'prosthet* workforce', 'prosthet*', 'rehab* therap*', 'rehab*'
'10 minute walk', '10MWT', '6 minute walk', '6MWT', 'edinburgh visual gait score', 'EVGS', 'G.A.I.T', 'gait abnormality rating scale', 'gait assessment and intervention tool', 'hemiplegic gait analysis form', 'observational gait analysis', 'observational gait scale', 'physician rating scale', 'rancho los amigos observational', 'rivermead visual gait assessment', 'salford gait tool', 'shaw gait assessment tool', 'standardised gait score', 'tinetti gait scale', 'VGA', 'video gait analysis', 'video gait assessment', 'visual gait analysis', 'visual gait assessment scale', 'visual gait score', 'wisconsin gait scale', '10-meter walking test'

Table 2b Eligibility criteria

Inclusion	Any primary study design (qualitative, quantitative or mixed methods) and type of publication (including conference presentations and posters)
	The study aims to collect data on the challenges / facilitators to gait evaluation* (excluding 3D analysis)
	The study focuses exclusively on non-3D gait evaluation*
	Study participants include orthotists, physiotherapists or prosthetists
	Study participants work with adults, children or both
	Study published during or after 1980 to search date, and in English language
Exclusion	Studies that focus on patient reported outcome measures (PROMs) that relate to gait evaluation
	Studies that focus entirely on 3D (instrumented) gait analysis
	Meta-analyses, scoping reviews and systematic reviews

**Gait evaluation (excluding 3D analysis) = administered by a clinician (not a PROM), not 3D (instrumented) gait analysis: Real time visual observation, temporal and spatial measures (including pressure sensitive walkways), photography, video, video-vector, a locally developed (in-house and non-standardised) gait assessment form, functional measures including a functional gait component*

Table 3 Sources relating to the primary objective (challenges and facilitators experienced by orthotists, physiotherapists and prosthetists to non-3D gait evaluation

Author(s)	Type of study	Participants (Specialism) [Location]	Gait evaluation methods discussed in the publication	Reported challenges [% of agreement with statement]	Reported facilitators
Chiluba & Mwansa[34]	Cross sectional descriptive survey	36 physiotherapists (Specialism not specified) [Lusaka, Zambia]	• Real time visual observation • Standardised observational gait assessment tools: Gait Assessment and Intervention Tool, Hemiplegic Gait Analysis Form, Rancho Los Amigos Observational Checklist, Rivermead Visual Gait Assessment, Wisconsin Gait Scale	*National / international professional culture* • Lack of guidelines on the use of non-3D gait assessment measures [80.9%] • Existence of numerous measures [28.6%] *Physical environment* • Lack of space [19.1%] *Properties of the measure* • No availability of measures [61.9%] • No measures appropriate for the population [33.3%] • Expensive equipment [28.5%] • Ease of use [23.8%] • Excessive cost of measures [4.8%] *Within therapist* • Lack of knowledge on the use of non-3D gait assessment measures [76.2%] • Lack of formal knowledge on how to adopt a new measure [66.7%] *Workplace structure* • Lack of workplace / organisational support [71.4%] • Lack of time secondary to busy clinical settings [47.6%] • Low priority [47.6%] • Lack at time at initial assessment [33.4%]	-
Flannery & O'Sullivan[6]	Cross sectional survey	185 physiotherapists (Neurology/gerontology, paediatrics and sports medicine) [Republic of Ireland]	• Real time visual observation • Temporal and spatial measures	*Physical environment* • Lack of space [46%] • Workplace unsuitable [31%]	*National / international professional culture* • Access to gait measures training at every level [94%] • More training at an

			Gait Rite system) • Photography • A locally developed (in-house and non-standardised) gait assessment form • Video • Standardised observational gait assessment tool (Rivermead Visual Gait Assessment)	• Lack of measure due to budget constraints [60%] or lack of available measures [40%] • Standard measure unnecessary [21%] *Within therapist* • Unaware of standard measures [20%] *Workplace structure* • Lack of time [56%]	• Standardised protocols [78%] • National guidelines [71%] • Onsite and weekend courses [50%] *Within therapist* • Working at clinical specialist or manager level
Hensley et al.[9]	Cross sectional observational survey	477 physiotherapists (Orthopaedic physiotherapy) [USA]	• Video	*Physical environment* • Lack of space [48.6%] *Properties of the measure* • Lack of device or equipment [48.8%] • Cost of measure [28.7%] • Difficult to use [6.1%] • Do not find the measure benefits service users [5.0%] • Lack of internet access required for measure [2.3%] *Service user opinion / requirements* • Concerns around service user privacy / state of undress [19.5%] *Within therapist* • Unfamiliar with measure [4.0%] *Workplace structure* • Time restraint [32.1%] • Not allowed to use measure [3.8%]	*Within therapist* • 'Fellows of the American Academy of Orthopaedic Manual Physical Therapists (vs physical therapists without any other certificates/degrees)' •' Physiotherapists with ≤20 years of experience / graduates from an orthopedic residency program (vs physical therapists without any other certificates/degrees)
Hensley et al.[10]	Cross sectional observational survey	261 physiotherapists (Sports physiotherapy) [USA]	• Video	*Physical environment* • Lack of space [10.3%] *Properties of the measure* • Lack of equipment [18.4%] • Cost of measure [17.2%] • Difficult to use [3.5%] • Do not find the measure benefits service users [3.1%] • Lack of internet access [1.9%]	*Within therapist* • 'For every 5-year increase of age, there was a 12% decreased likelihood of VBMA use' • 'Having dual board certifications of Orthopedic Clinical Specialist and Sports Clinical Specialist (vs. no certification) increased the likelihood of VBMA use by sixfold' • 'Respondents who spent more time with patients at

				requirements • Concerns regarding service user privacy / state of undress [17.2%] *Within therapist* • Unfamiliar with measure [19.2%] *Workplace structure* • Time restraint [30.7%] • Not allowed to use measure [5.8%]	30 min) were more likely to use VBMA compared to those who spend < 30 min with patients'
Hobani et al.[46]	Cross sectional survey	320 physiotherapists (Clinicians who work in private or governmental sectors managing adults with musculoskeletal problems in out-patient settings) [Saudi Arabia]	• Real time visual observation • Photography • Video • A locally developed (in-house and non-standardised) gait assessment form • Standardised observational gait assessment tools	*Physical environment* • Lack of space [28.7%] • Working in an unsuitable environment [11.3%] *Properties of the measure* • Lack of available measure [53.5%] *Within therapist* • Lack of interest [8.2%] • Unaware of any gait assessment tools [9.2%] *Workplace structure* • Budget constraints [11.3%] • Lack of time [22.3%]	-
Jang et al.[47]	Cross sectional survey	210 physiotherapists (General hospitals, hospice, public health centres) [Seoul, South Korea]	• Temporal and spatial measures (6 minute walk test, 10 minute walk test) • Functional measures including a functional gait component (Chedoke McMaster Stroke Assessment, Dynamic Gait Index, Functional Ambulation Classification, Functional Independent Measure, Motor Assessment Scale, Timed Up and Go) • Standardised observational	*Workplace structure* • Lack of time	-

			tools (Rivermead Visual Gait Assessment)		
Morgan et al.[36]	Cross sectional semi structured interviews	25 – a combination of prosthetists, physiotherapists and physicians (Clinicians who work with service users with lower limb amputation – in-patient, out-patient and patient homes) [12 different states, USA]	• Temporal and spatial measures (10 metre walk test, 2 minute walk test, 6 minute walk test) • Functional measures including a functional gait component (Amputee Mobility Predictor, Comprehensive High Level Mobility Predictor, L Test of Functional Mobility, Timed Up and Go)	*Physical environment* • Unsuitable physical environment – particularly: Lack of access to large enough rooms (particularly applicable to prosthetists and physiatrists), lack of access to treadmills and ramps *Properties of the measure* • Measures are not always suitable *Workplace structure* • Lack of time	*National / international professional culture* • Guidance on standardised measures to use • The measure supports insurance approvals for prosthetic components *Physical environment* • Having a permanent test set up in clinic *Properties of the measure* • Aligns to electronic medical records • Easy to use and interpret • Realistic to integrate into clinical practice • The measure assists with the justification for prosthetic care *Workplace structure* • An extra pair of hands to conduct the measures or support • Support from the employer to integrate measures into practice
Pattison et al.[12]	Qualitative: Descriptive semi-structured telephone interviews	28 physiotherapists (Assessing a minimum of 10 people with stroke per year) [Ontario, Canada]	• Real time visual observation • Temporal and spatial measures (2 minute walk test, 6 minute walk test) • A locally developed (in-house and non-standardised) gait assessment form • Functional measures including a functional gait component (Chedoke-McMaster Stroke Assessment, Functional Independence Measure, Timed	*National / international professional culture* • Disagreement with clinical guidelines *Physical environment* • Inadequate space • Not being allowed to tailor a space to its purpose e.g. restrictions in placing tape on the floor due to infection control *Service user opinion / requirements* • Cognitive barriers within the service user • Language barriers within the service user • Physical barriers such as fatigue, visual neglect and impaired proprioception • The physical ability of the service user (increased difficulty measuring walking	*National / international professional culture* • Learning about measures through professional degree programme • National guidelines on gait measures • Supervising pre-registration students • Learning through own undergraduate education *Physical environment* • Having adequate space • No limits on modifying the space to accommodate the measure *Properties of measure* • Acceptable reliability and validity • An array of measures that vary across the continuum or are suitable to across the whole care continuum

				independent ambulators) *Within therapist* • Being unfamiliar with a measure *Workplace structure* • Little time due to large caseloads • Low priority • Workplace does not permit all measures	• Meaningful results • Reasonable cost *Service user opinion / requirements* • Service users who have adequate postural control, balance and exercise tolerance *Structure of workplace* • Having time to administer the measure • Positive influence from more senior clinicians • There is a clear record of previous measures that have been administered with a service user • Working with colleagues who are familiar with the measure / have more experience *Within therapist* • Attending research study days and reading research literature • Being part of a network • Familiarity with the measure • Time to become personally familiar with the measure (e.g. reading published research)
Romney et al.[48]	Mixed methods and quasi experimental study (Knowledge transfer study)	11 physiotherapists (In-patient physiotherapists working with a mixed caseload of elderly service users [over 60 years] in a subacute inpatient rehabilitation hospital) [USA]	• Temporal and spatial measures (4 metre walk test)	*Physical environment* • Crowded therapy gym / lack of space *Service user opinion / requirements* • Lack of service user endurance • Service user pain *Workplace structure* • Lack of time	*Workplace structure* • Social support (seeing colleagues using measures) • Environmental cues (e.g. having measurement sheets included as part of the documents to be completed during a service user visit) • Local documentation changes (e.g. having a formula to calculate gait speed written down and accessible)
Salbach et al.[13]	Quantitative: Cross sectional survey	270 physiotherapists (Providing care to people with stroke) [Ontario, Canada]	• Temporal and spatial measures (Shuttle test, 2 minute walk test, 6 minute walk test, 5 or 10 metre timed walk) • Functional	*National / international professional culture* • Lack of consensus about which measures to use *Physical environment* • Measure is difficult to administer in the work setting	*Professional culture* • Clinical practice guidelines *Properties of the measure* • Suitable measures that have been developed in association with clinicians

			including a functional gait component (Barthel index, Chedoke McMaster Stroke Assessment, Clinical Outcome Variables Scale, Functional Ambulation Classification, Functional Independence Measure, Motor Assessment Scale, Stroke Rehabilitation Assessment of Movement, Timed up and Go)	*Properties of the measure* • Measure does not align to the home/community environment • Lack of clear evidence for measure • The measure lacks a comparison to normative data • Unknown or poor sensitivity to change • Lack of available measures *Within therapist* • Lack of knowledge *Workplace structure* • Lack of time • Low priority	
Toro et al.[7]	Quantitative: Cross sectional survey	1826 NHS physiotherapists (Orthopaedics, paediatrics, elderly care, adult neurology and community, acute care, sports injuries, outpatients, amputees, musculoskeletal rheumatology, chronic pain, occupational health, learning disabilities, mental health, oncology) [UK]	• Real time visual observation • Temporal and spatial measures (10 metre walk test) • Photography • A locally developed (in-house and non-standardised) gait assessment form • Video • Video vector • Functional measures including a functional gait component (Elderly Mobility Scale, Functional Ambulation Classification, Gross Motor Function Measure, Motor Assessment Scale) • Standardised observational gait assessment tool (Rivermead Visual Gait Assessment,	*Physical environment* • Lack of space [28.4%] • Budget constraints [38.8%] *Properties of the measure* • Availability of tool [27%] *Structure of workplace* • Lack of time [41.8%] *Within therapist* • Lack of awareness of [27%]	*Professional culture* • Training package • National guidelines *Properties of the measure* • Accessible • Clear and easy to use and understand with accompanying protocols • Realistic in terms of time needed to complete measure • Quick to use (consensus was 10-20 minutes) • Valid and reliable *Within therapist* • Toro et al. noted that senior 1 (contemporary band 7 NHS) physiotherapists were the most common users of standardised forms (47.6% of senior 1 staff vs 4.3% junior grade staff) • It was also noted that senior staff rated themselves higher than junior staff in their ability to analyse gait visually. Physiotherapists who had formal training in gait analysis rated themselves consistently higher than those who had no training.

Amigos Gait tool) Other: Physiological cost index	