Journal of Intellectual Disability Research

ORIGINAL ARTICLE OPEN ACCESS

Feasibility of Physical Fitness Measurements in Older Adults With Intellectual Disabilities Within Two Large Cohort Studies: The HA-ID and IDS-TILDA Study

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Received: 19 December 2024 | **Revised:** 19 November 2025 | **Accepted:** 23 March 2026

Keywords: assessment | Clinimetrics | functioning | instruments | intellectual development disorders | physical capability

ABSTRACT

Background: Research has shown significant underdiagnoses in adults with intellectual disabilities, highlighting the need for objective health measurements to prevent overshadowing. Physical fitness, crucial for health and functioning, is consistently poor in this population, increasing the risk of adverse outcomes. Fitness tests are promising but to date lack specific reference values from large datasets for broader applicability. This study examines the feasibility of four physical fitness tests in two large European cohort studies, IDS-TILDA in Ireland and the HA-ID study in the Netherlands, to address barriers and improve inclusion in research and care.

Method: This study used data from IDS-TILDA (40+ years) and HA-ID (60+ years) cohort studies. Static balance was measured by the capability of maintaining three stances; muscle strength was measured as grip strength; muscular endurance was measured with the Five-Times Chair Stand; and cardiorespiratory fitness was measured with the Two-Minute Step Test. Reasons for non-compliance were documented. The feasibility of these tests and reasons for non-successful performance were described for the total group and across participant characteristics.

Results: The IDS-TILDA sample was younger than the HA-ID sample, with more participants being independent in mobility. All fitness tests showed moderate to good feasibility, except the Full-Tandem stance in the IDS-TILDA sample. Lower feasibility was found in adults with severe and profound intellectual disabilities, walking aids and wheelchair users. Key barriers for participation were physical limitations and difficulties understanding the task.

Conclusions: This study showed overall moderate to good feasibility. Physical limitations and difficulties understanding the task were important barriers, emphasising the need for the person-centred approach taken by both studies. Feasibility for including standardised physical fitness assessments, with a person-centred approach, in large cohort studies is shown. Including physical fitness assessment is recommended to allow for comparability and combining of data for more knowledge on physical fitness in adults with intellectual disabilities.

1 | Introduction

Longitudinal cohort studies show that individuals with intellectual disabilities demonstrate unhealthier ageing than the general population, with more health issues starting at a younger age (Barnett et al. 2012; Hermans and Evenhuis 2014; McCarron et al. 2013; Schoufour et al. 2013). Adults with intellectual disabilities show high levels of physical inactivity and poor physical fitness levels (Dairo et al. 2016; Hilgenkamp and Oppewal 2022; Hilgenkamp, Reis, et al. 2012). Physical fitness levels of adults with intellectual disabilities aged 50 years and over were found to be comparable to or even worse than those of adults in the general population aged 20–30 years older (Hilgenkamp et al. 2012b). These poor physical fitness levels have consistently been demonstrated in adults with intellectual disabilities (Hilgenkamp et al. 2012b; Lahtinen et al. 2007; Oppewal et al. 2013a; Oppewal et al. 2020) and are associated with a higher risk of early mortality and a decline in daily functioning and mobility (Oppewal et al. 2014; Oppewal et al. 2015; Oppewal and Hilgenkamp 2019). Poor physical fitness thereby places older adults with intellectual disabilities at an unnecessary high risk for adverse health outcomes.

For older adults with intellectual disabilities, it is most relevant to focus on the components of physical fitness that support health and daily functioning, such as body composition, balance, muscular strength, muscular endurance, flexibility, cardiorespiratory fitness, coordination and reaction time (American College of Sports Medicine 2025; Oppewal and Hilgenkamp 2020). Notably, the importance of physical fitness for adults with intellectual disabilities is increasingly recognised, and therefore the importance of measuring physical fitness in this population is imperative. Fitness tests used in the general population are not always suitable for adults with intellectual disabilities due to their cognitive and physical limitations and shorter attention span. Therefore, studies have focused on finding or creating fitness tests that are suitable for adults with intellectual disabilities and have sufficient clinimetric properties (Alcántara-Cordero et al. 2020; Boer and Moss 2016; Cabeza-Ruiz et al. 2020; Oppewal et al. 2013a; Weterings et al. 2022). The ID-fitscan has been proposed as a selection of tests for adults with intellectual disabilities with sufficient feasibility, reliability and validity (Oppewal and Hilgenkamp 2020). The ID-fitscan includes tests for body composition, static and dynamic balance, muscular strength and muscular endurance. Unfortunately, for other relevant fitness components, such as cardiorespiratory fitness, the available tests appeared promising but at the time lacked sufficient evidence on clinimetric properties, and could not yet be recommended for routine use .

Further, reference values to interpret results specifically for adults with intellectual disabilities are still limited, which hinders the use of physical fitness tests in clinical practice. Criterion-referenced values are especially needed to identify individuals at increased risk for adverse health outcomes. Thereby, big datasets are needed to obtain more insight into the relationship between physical fitness and health over time, for the intellectual disability population as a whole, as well as for specific subgroups and locations (Oppewal and Hilgenkamp 2020). Therefore, the use of physical fitness tests in large-scale longitudinal studies is required, and uniformity across studies is important for comparability and combining data. Ultimately, evaluating consistency strengthens the generalisability of the findings, supports standardisation of protocols and enhances the integration of evidence informing clinical practice interventions.

For physical fitness tests to be used in large-scale longitudinal studies, feasibility is an extremely important aspect. Performing physical fitness tests with large numbers of adults with intellectual disabilities can require a lot of time, expenses, space, materials and staff. Furthermore, many studies do not include these tests as they feel adults with intellectual disabilities may not be capable of doing the tests or they are underestimated for their ability (Krahn and Fox 2014). Therefore, to include physical fitness tests in large-scale (longitudinal) studies the feasibility in specific study settings has to be known. The longitudinal cohort studies IDS-TILDA and HA-ID both have included a set of physical fitness tests in their measurement protocols, allowing them to assess the feasibility of physical fitness tests in these cohort studies and compare results between cohorts. Both studies have selected tests based on the criteria that tests can be performed in the field without expensive materials and that they require relatively little time, space and staff to perform.

The aim of this study is to examine the feasibility of the four physical fitness tests used in both the IDS-TILDA and HA-ID studies (balance stances, grip strength [GS], Five-Times Chair Stand [5xCS], Two-Minute Step Test [TMST]) for adults with intellectual disabilities. We will also assess the feasibility for specific subgroups based on participant characteristics and the reasons for a non-successful performance. Although the feasibility of some of these physical fitness tests has been studied before, it is important to assess the feasibility in the setting of longitudinal cohort studies and see whether the feasibility is consistent across two different cohort studies. This is important not only for uniformity and integration into practice but also to allow researchers and healthcare practitioners to better interpret results, guide interventions and monitor any functional decline or improvement over time among those with intellectual disabilities who are at higher risk of morbidity.

2 | Methods

2.1 | Study Design and Participants

This is a cross-sectional study based on data from two large cohort studies, the IDS-TILDA study in Ireland and the HA-ID study in the Netherlands. The broader aims of both studies are to investigate the health and well-being of adults with intellectual disabilities through scientific research, to provide healthcare professionals with knowledge to underpin education and care delivery and to innovate care by implementing research outcomes.

IDS-TILDA includes adults with intellectual disabilities aged 40 years and above with no upper limit, of all levels of intellectual disability, living in a variety of settings, sampled from the National Ability Support System (previously NIDD) which includes all service providers across Ireland (Kelly et al. 2007; National Ability Supports System 2019). The decision to sample from the age of 40 years was made in 2007 when the study began, and the landscape and life expectancy of those with intellectual disabilities were significantly different in Ireland. Typically, individuals with intellectual disabilities experience older age conditions earlier than their counterparts in the general population, justifying the earlier starting age. Additionally, despite improvements in longevity, evidence shows that on average individuals with intellectual disabilities die approximately 20 years earlier than those in the general population (O'Leary et al. 2018), often experiencing premature ageing and associated comorbidities, those with Down syndrome for example (Peng et al. 2023). Therefore, capturing data from those aged 40 and above enables the study to capture early onset ageing effects and allows the study to monitor changes over time comprehensively in the study sample. Full methodological details can be viewed elsewhere (McCarron et al. 2022). A suite of objective measurements, called the Health Fair, is included in the study (Burke et al. 2020). Further details on measures included can be viewed elsewhere (Ryan et al. 2023). Overall, 260 participants who completed at least one assessment in the Health Fair are included in this feasibility study.

The HA-ID Academic Collaborative Research Center was founded in 2006 and consists of three intellectual disability care organisations (Abrona, Amarant and Ipse de Bruggen) and the Intellectual Disability Medicine Research group of the Erasmus MC, University Medical Center Rotterdam. In 2008, the HA-ID multicentre cohort study started with a near-representative sample of 1050 older adults with intellectual disabilities aged 50 years and over (Hilgenkamp et al. 2011). Between October 2020 and July 2023, data collection of the 10-year follow-up was performed ($n=278$), from which data for this study was used. More details about the study design and measurements can be found in the protocol papers (de Leeuw et al. 2022; Hilgenkamp et al. 2011).

2.2 | Procedures

Within the IDS-TILDA Health Fair, individuals were invited to participate in all measures they wished to or were capable of completing. In line with the functional approach outlined in the Assisted Decision-Making (Capacity) Act, IDS-TILDA operated on the presumption that all participants had the capacity to provide informed consent, unless proven otherwise. An accessible information booklet, consent form and individual appointment were posted to participants in advance to facilitate understanding and decision-making. On the day of their appointment, consent was confirmed and reaffirmed before each assessment. Research nurses with extensive experience in the field of intellectual disability underwent a weeklong comprehensive training programme and quality assessment process. All training and assessment protocols adhere to the NHANES anthropometric standards (Fryar et al. 2021). Each assessment was supported with an easy-to-read explanatory document and additional support to communicate their preferences or understand the process was provided, such as simplified explanations or accessible communication aids. This approach, along with the flexibility and mobility of the Health Fair, ensured that every participant could exercise their autonomy to the greatest extent possible. The research nurses contacted each of the involved services ($n=149$) throughout Ireland, invited the participants, confirmed the space requirements and conducted the assessments onsite within each service provider.

Within the HA-ID study, two separate consent procedures were followed. If a potential participant was considered capable of providing informed consent for participation by the involved behavioural therapists, an easy-to-read information letter and consent form was sent to them. If the potential participant was considered not capable of deciding about participation, an information letter and consent form was sent to their legal representative (de Leeuw et al. 2022). All physical fitness measurements were performed at settings close to the participants and carried out by trained test administrators who were physiotherapists and physical activity instructors working in the participating care organisations. Test administrators received an instruction manual and training in which they obtained additional clarification and practised the fitness measurements. It was emphasised that the test administrators had to be convinced that participants understood the task and performed with maximal effort; otherwise, the results should not be recorded. 'Maximal motivation' was prescribed for all tests, and the test administrators, background, knowledge and experience were essential for motivating each participant appropriately while simultaneously ensuring safety.

Both IDS-TILDA and HA-ID used a person-centred approach with reasonable adjustments, informed by advisory and advocacy groups, including modifications in supportive equipment, communication and procedures to ensure accessibility for individuals with varying levels of intellectual disabilities.

2.3 | Measurements

2.3.1 | Participant Characteristics

Age, sex and residential status (central setting, community based, independent or with family, independent with ambulatory support) were confirmed through a pre-interview questionnaire in IDS-TILDA and retrieved from the administrative systems in HA-ID. Level of intellectual disability (borderline: IQ = 70–84, mild: IQ = 50–69, moderate: IQ = 35–49, severe: IQ = 20–34, profound: IQ < 20) was established via the NASS database and confirmed via the pre-interview questionnaire (IDS-TILDA) and obtained from behavioural therapists' files (HA-ID). The presence of Down syndrome was obtained from the medical files (IDS-TILDA and HA-ID). Information on mobility (independent, walking with an aid, wheelchair-bound) was established during an interview (IDS-TILDA) and provided by the professional caregiver (HA-ID). In IDS-TILDA, some wheelchair users, although identifying themselves as using a wheelchair, had limited ambulation and were able to engage in some assessments.

2.3.2 | Physical Fitness

Static balance was measured by the capability of maintaining three stances in order of increasing difficulty: Side-by-Side stand (SbS), Semi-Tandem (ST) and Full-Tandem (FT) (Guralnik, Simonsick, et al. 1994). The participant had to try to hold each stance for 10 s, for one side in IDS-TILDA and both sides in HA-ID. If the participant succeeded, they continued to the next stand. Each successful stand was recorded. Multiple attempts were allowed, up to a maximum of five. Support or manual queuing was allowed to help the participant obtain the correct starting position. Support during the test itself was not allowed.

The validity and reliability of this test are good in the general population (Franchignoni et al. 1998; Freire et al. 2012; Giorgetti et al. 1998; Guralnik, Seeman, et al. 1994; Rossiter-Fornoff et al. 1995; Wolinsky et al. 2005). The feasibility of the SbS and FT stand was good in older adults with intellectual disabilities, except for those with profound intellectual disabilities (Oppewal et al. 2013b).

Muscle strength was measured as GS. GS was measured with the Jamar Hand Dynamometer (Sammons Preston Rolyan, Bolingbrook, IL), in a seated position according to the recommendations of the American Society of Hand Therapists (Fess and Moran 1981). Participants squeezed the dynamometer with maximal force with both hands, two times in IDS-TILDA and three times in HA-ID, with 1-min rest in between attempts. The maximal produced force of all attempts was the test result (in kilograms). The validity and reliability of this test are good in the general population (Abizanda et al. 2012; Stark et al. 2011). Previously, in the HA-ID study, feasibility and test–retest reliability in older adults with intellectual disabilities were found good (Hilgenkamp et al. 2012a; Hilgenkamp et al. 2013).

Muscular endurance was measured with the 5xCS (Guralnik, Simonsick, et al. 1994). Participants were instructed to stand up and sit down again as fast as possible five times, without using their hands. The time needed to complete five stances was the test result (in seconds). The validity and reliability of this test are good in the general population (Freire et al. 2012; Guralnik, Simonsick, et al. 1994).

Cardiorespiratory fitness was measured with the TMST (Rikli and Jones 2001). For this test, participants raised their knees as often as possible to a predetermined height in 2 min. Step height was established per participant, at the centre between the iliac crest and the patella. For HA-ID, if participants were not able to reach the required step height, for example, because of limited range of motion, adjustments were made to the step height. If, with these adjustments, the test could be performed successfully, this was considered a feasible performance. Participants were encouraged to provide maximum effort. The test result was the number of times the correct step height was reached with the right knee. For IDS-TILDA, if participants were unable to reach the pre-determined height, the assessment was deemed unsuccessful. If a participant was able to perform the test but took moments of rest in between or was unable to complete 2 min due to exhaustion, the test was considered successful, in line with the test protocol as established in the general population (Bohannon and Crouch 2019; Rikli and Jones 2001).

2.3.3 | Non-Successful Performance

If a participant was unable to complete a test the reason was documented. For this purpose, the following categories were used: experiencing concentration difficulties, difficulties with understanding the instructions or the task, being unable to perform the task due to physical limitations, lack of motivation, anxiety, not allowed to exert him/herself or other reasons (e.g., did not attend) with open space for the assessor to provide additional information.

2.4 | Statistical Analyses

Descriptive statistics are presented for participant characteristics, for IDS-TILDA and the HA-ID study separately. Feasibility was defined by the percentage of successful completion of the physical fitness tests, according to protocol. Feasibility was calculated for the total IDS-TILDA and total HA-ID group, as well as for subgroups based on age, sex, level of intellectual disability, Down syndrome, mobility and residential status. Feasibility was classified as low ($\leq 25\%$), moderate ($> 25\%$ and $\leq 50\%$), good ($> 50\%$ and $\leq 75\%$) and excellent feasibility ($> 75\%$) (Hilgenkamp et al. 2013; Oppewal et al. 2013b). Reasons for non-successful performance were described. All analyses were performed with the Statistical Package for Social Sciences (SPSS) (IBM Corporation, New York). Statistical significance was set at 5% ($p < 0.05$).

3 | Results

Participant characteristics of the IDS-TILDA and HA-ID study sample are described in Table 1. The IDS-TILDA study sample was younger (61.1 ± 9.7) than the HA-ID study sample (70.6 ± 5.9 years). The HA-ID sample in this wave consisted of participants aged 60+ years, whereas the IDS-TILDA sample also included participants aged 40–60 years. In the IDS-TILDA sample, 64.6% was female, whereas in HA-ID, this was 49.4%. In both samples, most participants had moderate ID, followed by mild or severe ID, and most participants lived in a central or community-based setting. In the IDS-TILDA sample, 50.4% were independent in mobility, whereas in HA-ID, this was 38.9%.

3.1 | Feasibility

The feasibility of the physical fitness tests is described in Table 2.

3.1.1 | Static Balance Stances

Feasibility of the static balance stances was low (FT: 23.8%, $n = 62/260$) to moderate (SbS: 42.7%, $n = 111/260$ and ST: 31.5%, $n = 82/260$) in IDS-TILDA and moderate (FT: 34.4%, $n = 62/180$) to good (SbS: 63.9%, $n = 115/180$ and ST: 55.0%, $n = 99/180$) in HA-ID.

Feasibility of the SbS was lowest (moderate feasibility) for adults with severe (HA-ID: 33.3%, $n = 11/33$; IDS-TILDA: 14.3%, $n = 9/63$) and profound (HA-ID: 15.4%, $n = 2/13$; IDS-TILDA: 18.2%, $n = 4/22$) intellectual disabilities in both samples. For adults with a walking aid, the feasibility was excellent (82.4%, $n = 29/35$) in HA-ID and good (51.5%, $n = 18/35$) in IDS-TILDA. For wheelchair users, feasibility was low in HA-ID (0%, $n = 0/15$) and moderate (26.6%, $n = 25/94$) in IDS-TILDA.

Feasibility of the ST was lowest (low feasibility) for adults with severe (HA-ID: 21.2%, $n = 7/33$; IDS-TILDA: 6.3%, $n = 4/63$) and profound (HA-ID: 15.4%, $n = 2/13$; IDS-TILDA: 4.5%, $n = 1/22$) intellectual disabilities. For adults with a walking aid,

TABLE 1 | Participant characteristics of the IDS-TILDA and HA-ID study sample.

	IDS-TILDA ($n=260$)	HA-ID ($n=180$)
Age in years, mean ± SD	61.1 ± 9.7	70.6 ± 5.9
40–49 years, *n* (%)	26 (10.0)	—
50–59 years, *n* (%)	91 (35.0)	—
60–69 years, *n* (%)	94 (36.2)	91 (50.6)
70–79 years, *n* (%)	40 (15.4)	74 (41.1)
80+ years, *n* (%)	9 (3.5)	15 (8.3)
Sex		
Female sex, *n* (%)	168 (64.6)	89 (49.4)
Level of intellectual disability, *n* (%)		
Borderline (IQ = 70–84)	—	10 (5.6)
Mild (IQ = 50–69)	45 (17.3)	32 (17.8)
Moderate (IQ = 35–49)	110 (42.3)	91 (50.6)
Severe (IQ = 20–34)	63 (24.2)	33 (18.3)
Profound (IQ < 20)	22 (8.5)	13 (7.2)
Unknown	20 (7.7)	1 (0.6)
Down syndrome, *n* (%)		
Yes	37 (14.2)	11 (6.1)
No	223 (85.8)	165 (91.7)
Unknown	—	4 (2.2)
Mobility level, *n* (%)		
Independent	131 (50.4)	70 (38.9)
Walking-aid	35 (13.5)	34 (18.9)
Wheelchair-bound	94 (36.2)	15 (8.3)
Unknown	—	61 (33.9)
Residential status, *n* (%)		
Central setting	127 (48.8)	95 (52.8)
Community based	106 (40.8)	81 (45.0)
Independent or with family	25 (9.6)	—
Independent with ambulatory support	—	1 (0.6)
Unknown	2 (0.8)	3 (1.7)

Abbreviations: IQ: intelligence quotient, *n*: number of participants, SD: standard deviation.

feasibility was good in HA-ID (64.7%, $n=22/34$) and moderate in IDS-TILDA (37.1%, $n=13/35$). For wheelchair users, feasibility was low in both HA-ID (0%, $n=0/15$) and IDS-TILDA (16.0%, $n=15/94$).

Feasibility of the FT reduced with increasing age in the IDS-TILDA sample, with low feasibility for the age groups 60–69 (17.0%, $n=16/94$), 70–79 years (20.0%, $n=8/40$) and 80+ years (0%, $n=0/9$). In HA-ID, feasibility was moderate for all age groups. Feasibility was low for adults with severe (HA-ID: 9.1%, $n=3/33$; IDS-TILDA: 4.8%, $n=3/63$) and profound (HA-ID: 7.7%, $n=1/13$; IDS-TILDA: 0%, $n=0/22$) intellectual disabilities. For adults with a walking aid, feasibility was moderate in HA-ID (44.1%, $n=15/34$) and IDS-TILDA (28.6%, $n=10/35$). For wheelchair users, feasibility was low in both HA-ID (0%, $n=0/15$) and IDS-TILDA (11.7%, $n=11/94$). Feasibility was low in adults living in a central setting (HA-ID: 18.9%, $n=18/95$; IDS-TILDA: 7.9%, $n=10/127$).

The main reasons for not performing the static balance stances according to protocol were 'difficulties understanding the instructions or task' and 'physical limitations' (Table 3).

3.1.2 | GS

The feasibility of the GS test was good in HA-ID (73.3%, $n=132/180$) and IDS-TILDA (54.6%, $n=142/260$). Feasibility was low for adults with severe intellectual disabilities in IDS-TILDA (15.9%, $n=10/63$) and moderate for HA-ID (39.4%, $n=13/33$), and low for adults with profound intellectual disabilities in both samples (HA-ID: 15.4%, $n=2/13$; IDS-TILDA: 9.1%, $n=2/22$).

The main reasons for not performing the GS according to protocol were 'difficulties understanding the instructions or task', 'physical limitations' and 'lack of motivation' (Table 3).

3.1.3 | 5xCS

The feasibility of the 5xCS was good in HA-ID (61.7%, $n=111/180$) and moderate in IDS-TILDA (32.3%, $n=84/260$). Feasibility was moderate in adults aged 60–69 years in IDS-TILDA (25.5%, $n=24/94$) and low in those aged 70+ (70–79 years: 22.5%, $n=9/40$; 80+ years: 11.1%, $n=1/9$), but good in all age categories in HA-ID (60–69 years: 61.5%, $n=56/91$; 70–79 years: 62.2%, $n=46/74$; 80+ years: 60.0%, $n=9/15$). For adults with severe intellectual disabilities, feasibility was low in IDS-TILDA (9.5%, $n=6/63$), but moderate in HA-ID (36.4%, $n=12/33$), and low for adults with profound intellectual disabilities in both samples (HA-ID: 23.1%, $n=3/13$; IDS-TILDA: 0%, $n=0/22$). Feasibility was excellent for adults with a walking aid in HA-ID (82.4%, $n=28/34$) and moderate (42.9%, $n=15/35$) for the IDS-TILDA participants, and low for wheelchair users in both HA-ID (0%, $n=0/15$) and IDS-TILDA (19.1%, $n=18/94$). For adults living in a central setting feasibility was low in IDS-TILDA (12.6%, $n=16/127$) and good in HA-ID (50.5%, $n=48/95$).

The main reasons for not performing the 5xCS according to protocol were 'difficulties understanding the instructions or task', 'physical limitations' and 'lack of motivation' (Table 3).

3.1.4 | TMST

Feasibility of the TMST was moderate in both samples (HA-ID: 49.4%, $n=89/180$; IDS-TILDA: 27.3, $n=71/260$). In HA-ID,

TABLE 2 | Feasibility results of the physical fitness tests, completion represented by percentages, for the total group and subgroups for age, sex, level of ID, presence of Down syndrome, mobility and residential status.

	SbS (%, *n*)		ST (%, *n*)		FT (%, *n*)		GS (%, *n*)		5xCS (%, *n*)		TMST (%, *n*)	
	HA-ID	IDS-TILDA	HA-ID	IDS-TILDA	HA-ID	IDS-TILDA	HA-ID	IDS-TILDA	HA-ID	IDS-TILDA	HA-ID	IDS-TILDA
Total group	63.9 (*n* = 115/180) (Good)	42.7 (*n* = 111/260) (Mod.)	55.0 (*n* = 99/180) (Good)	31.5 (*n* = 82/260) (Mod.)	34.4 (*n* = 62/180) (Mod.)	23.8 (*n* = 62/260) (Low)	73.3 (*n* = 132/180) (Good)	54.6 (*n* = 142/260) (good)	61.7 (*n* = 111/180) (Good)	32.3 (*n* = 84/260) (Mod.)	49.4 (*n* = 89/180) (Mod.)[a]	27.3 (*n* = 71/260) (Mod.)
Age (years)												
40–49	—	57.7 (15/26) (Mod.)	—	50.0 (13/26) (Mod.)	—	42.3 (11/26) (Mod.)	—	65.9 (17/26) (Good)	—	50.0 (13/26) (Mod.)	—	46.2 (12/26) (Mod.)
50–59	—	47.3 (43/91) (Mod.)	—	38.5 (35/91) (Mod.)	—	29.7 (27/91) (Mod.)	—	53.8 (49/91) (Good)	—	40.7 (37/91) (Mod.)	—	29.7 (27/91) (Mod.)
60–69	65.9 (60/91) (Good)	39.4 (37/94) (Mod.)	59.3 (54/91) (Good)	25.5 (24/94) (Mod.)	34.1 (31/91) (Mod.)	17.0 (16/94) (Low)	71.4 (65/91) (Good)	50.0 (47/94) (Mod.)	61.5 (56/91) (Good)	25.5 (24/94) (Mod.)	53.8 (49/91) (Good)	25.5 (24/94) (Mod.)
70–79	62.2 (46/74) (Good)	35.0 (14/40) (Mod.)	51.4 (38/74) (Good)	22.5 (9/40) (Low)	32.4 (24/74) (Mod.)	20.0 (8/40) (Low)	71.6 (53/74) (Good)	62.5 (25/40) (Good)	62.2 (46/74) (Good)	22.5 (9/40) (Low)	43.2 (32/74) (Mod.)	20.0 (8/40) (Low)
80+	60.0 (9/15) (Good)	22.2 (2/9) (Low)	46.7 (7/15) (Mod.)	11.1 (1/9) (Low)	46.7 (7/15) (Mod.)	0 (0/9) (Low)	93.3 (14/15) (Exc.)	44.4 (4/9) (Mod.)	60.0 (9/15) (Good)	11.1 (1/9) (low)	53.3 (8/15) (Good)	0 (0/9) (Low)
Sex												
Male	69.2 (63/91) (Good)	45.7 (42/92) (Mod.)	58.2 (53/91) (Good)	35.9 (33/92) (Mod.)	37.4 (34/91) (Mod.)	20.7 (19/92) (Low)	71.4 (65/91) (Good)	56.5 (52/92) (Good)	62.2 (57/91) (Good)	28.3 (26/92) (Mod.)	49.5 (45/91) (Mod.)	33.7 (31/92) (Mod.)
Female	58.4 (52/89) (Good)	41.1 (69/168) (Mod.)	51.7 (46/89) (Good)	29.2 (49/168) (Mod.)	31.5 (28/89) (Mod.)	25.6 (43/168) (Mod.)	75.3 (67/89) (Exc.)	53.6 (90/168) (Good)	60.7 (54/89) (Good)	34.5 (58/168) (Mod.)	49.4 (44/89) (Mod.)	23.8 (40/168) (Low)
Level of ID												
Borderline	80.0 (8/10) (Exc.)	—	80.0 (8/10) (Exc.)	—	60.0 (6/10) (Good)	—	100 (10/10) (Exc.)	—	70.0 (7/10) (Good)	—	80.0 (8/10) (Exc.)	—
Mild	87.5 (28/32) (Exc.)	80 (36/45) (Exc.)	81.3 (26/32) (Exc.)	68.9 (31/45) (Good)	62.5 (20/32) (Good)	55.6 (25/45) (Good)	93.8 (30/32) (Exc.)	93.3 (42/45) (Exc.)	78.1 (25/32) (Exc.)	66.7 (0/45) (Good)	68.8 (22/32) (Good)	53.3 (24/45) (Good)
Moderate	71.4 (65/91) (Good)	46.4 (51/110) (Mod.)	61.5 (56/91) (Good)	32.7 (36/110) (Mod.)	35.2 (32/91) (Mod.)	21.8 (20/91) (Low)	83.5 (76/91) (Exc.)	67.3 (61/91) (Good)	69.2 (63/91) (Good)	34.5 (31/91) (Mod.)	58.2 (53/91) (Good)	31.8 (29/91) (Mod.)
Severe	33.3 (11/33) (Mod.)	14.3 (9/63) (Low)	21.2 (7/33) (Low)	6.3 (4/63) (Low)	9.1 (3/33) (Low)	4.8 (3/63) (Low)	39.4 (13/33) (Mod.)	15.9 (10/63) (Low)	36.4 (12/33) (Mod.)	9.5 (6/63) (Low)	15.2 (5/33) (Low)	6.3 (4/63) (Low)

(Continues)

TABLE 2 | (Continued)

	SbS (%, *n*)		ST (%, *n*)		FT (%, *n*)		GS (%, *n*)		5xCS (%, *n*)		TMST (%, *n*)	
	HA-ID	IDS-TILDA	HA-ID	IDS-TILDA	HA-ID	IDS-TILDA	HA-ID	IDS-TILDA	HA-ID	IDS-TILDA	HA-ID	IDS-TILDA
Profound	15.4 (2/13) (Low)	18.2 (4/22) (Low)	15.4 (2/13) (Low)	4.5 (1/22) (Low)	7.7 (1/13) (Low)	0 (0/22) (Low)	15.4 (2/13) (Low)	9.1 (2/22) (Low)	23.1 (3/13) (Low)	0 (0/22) (Low)	7.7 (1/13) (Low)	4.5 (1/22) (Low)
DS												
Yes	63.6 (7/11) (Good)	43.2 (16/37) (Mod.)	63.6 (7/11) (Good)	37.8 (14/37) (Mod.)	36.4 (4/11) (Mod.)	35.1 (13/37) (Mod.)	63.6 (7/11) (Good)	51.4 (19/37) (Good)	54.5 (6/11) (Good)	32.4 (12/37) (Mod.)	54.5 (6/11) (Good)	35.1 (13/37) (Mod.)
No	63.0 (104/165) (Good)	42.6 (95/223) (Mod.)	53.3 (88/165) (Good)	30.5 (68/223) (Mod.)	33.9 (56/165) (Mod.)	22.0 (29/223) (Low)	73.3 (121/165) (Good)	55.2 (123/223) (Good)	61.8 (102/165) (Good)	32.3 (40/223) (Mod.)	48.5 (80/165) (Mod.)	26.0 (58/223) (Low.)
Mobility												
Independent	70.0 (49/70) (Good)	51.9 (68/131) (Good)	60.0 (42/70) (Good)	41.2 (54/131) (Mod.)	37.1 (26/70) (Mod.)	31.3 (41/131) (Mod.)	68.6 (48/70) (Good)	61.8 (81/131) (Good)	65.7 (46/70) (Good)	38.9 (51/131) (Mod.)	51.4 (36/70) (Good)	30.5 (40/131) (Mod.)
Walking-aid	82.4 (28/34) (Exc.)	51.5 (18/35) (Good)	64.7 (22/34) (Good)	37.1 (13/35) (Mod.)	44.1 (15/34) (Mod.)	28.6 (10/35) (Mod.)	91.2 (31/34) (Exc.)	60.0 (21/35) (Good)	82.4 (28/34) (Exc.)	42.9 (15/35) (Mod.)	67.6 (23/34) (Good)	40.0 (14/35) (Mod.)
Wheelchair	0 (0/15) (Low)	26.6 (25/94) (Mod.)	0 (0/15) (low)	16.0 (15/94) (Low)	0 (0/15) (Low)	11.7 (11/94) (Low)	53.3 (8/15) (Good)	42.6 (40/94) (Mod.)	0 (0/15) (Low)	19.1 (18/94) (low)	0 (0/15) (Low)	18.1 (17/94) (Low)
Residence												
Central	51.6 (49/95) (Good)	23.6 (30/127) (Low)	36.8 (35/95) (Mod.)	11.8 (15/127) (Low)	18.9 (18/95) (Low)	7.9 (10/127) (Low)	62.1 (59/95) (Good)	37.8 (48/127) (Mod.)	50.5 (48/95) (Good)	12.6 (16/127) (Low)	31.6 (30/95) (Mod.)	17.3 (22/127) (Low)
Community	76.5 (62/81) (Exc.)	54.7 (58/106) (Good)	74.1 (60/81) (Good)	44.3 (47/106) (Mod.)	50.6 (41/81) (Good)	34.0 (36/106) (Mod.)	85.2 (69/81) (Exc.)	67.0 (71/106) (Good)	72.8 (59/81) (Exc.)	45.3 (48/106) (Mod.)	67.9 (55/81) (Good)	28.3 (30/106) (Mod.)
Family	—	84 (21/25) (Exc.)	—	72 (18/25) (Exc.)	—	56.0 (14/25) (good)	—	84 (21/25) (Exc.)	—	76.0 (19/25) (Exc.)	—	68.0 (17/25) (Good)
Ambulatory	100 (1/1) (Exc.)	—	100 (1/1) (Exc.)	—	100 (1/1) (Exc.)	—	100 (1/1) (Exc.)	—	100 (1/1) (Exc.)	—	100 (1/1) (Exc.)	—

Note: Feasibility categories: low (≤ 25%), moderate (> 25% and ≤ 50%), good (> 50% and ≤ 75%) and excellent feasibility (> 75%).
Abbreviations: 5xCS: Five-Times Chair Stand, Ambulatory: independent with ambulatory support, Central: central setting, Community: community based, Exc.: excellent, Family: independent or with family, FT: Full-Tandem Stand, GS: grip strength, Mod.: moderate, *n*: number of participants, NR: not reported, SbS: Side-by-Side stand, ST: Semi-Tandem Stand, TMST: Two-Minute Step Test.
[a]Including eight participants who were not able to reach the required step height, adjustments were made to the step height.

TABLE 3 | Reasons for a non-successful performance per fitness test.

	SbS (%)		ST (%)		FT (%)		GS (%)		5xCS (%)		TMST (%)	
	HA-ID ($n = 65$)	IDS-TILDA ($n = 163$)	HA-ID ($n = 81$)	IDS-TILDA ($n = 192$)	HA-ID ($n = 118$)	IDS-TILDA ($N = 212$)	HA-ID ($n = 48$)	IDS-TILDA ($n = 142$)	HA-ID ($n = 69$)	IDS-TILDA ($n = 190$)	HA-ID ($n = 91$)	IDS-TILDA ($n = 201$)
Concentration difficulties	1.5	0	2.5	0	1.7	0	0	0	1.4	0	2.2	0
Difficulties understanding the task	27.7	0	35.8	0	32.2	0	62.5	11.3	24.6	23.7	41.8	36.8
Physical limitations	47.7	74.8	40.7	77.6	41.5	79.7	10.4	21.3	39.1	52.1	31.9	26.4
Lack of motivation	6.2	0	2.5	0	3.4	0	12.5	43.5	13.0	2.6	5.5	7.0
Anxiety	1.5	0	1.2	0	5.9	0	0	0.7	1.4	2.6	1.1	0
May not exert him/herself	NA	NA	NA	NA	NA	NA	NA	NA	0	0	3.3	0
Other, e.g., DNA	7.7	15.3	14.8	13.0	13.6	11.8	8.3	23.2	10.1	13.2	8.8	13.4
Unknown/missing	7.7	9.8	2.5	9.4	1.7	8.5	6.3	0	10.1	5.8	5.5	16.4

Abbreviations: 5xCS: Five-Times Chair Stand, DNA: did not attend, FT: Full-Tandem Stand, GS: grip strength, NA: not applicable, SbS: Side-by-Side stand, ST: Semi-Tandem Stand, TMST: Two-Minute Step Test.

this included eight participants (8.9%) for which step height was adjusted because they were not able to reach the required step height. Feasibility was low in adults aged 70+ in IDS-TILDA (70–79 years: 20%, $n=8/40$; 80+ years: 0%, $n=0/9$), moderate in HA-ID (70–79 years: 43.2%, $n=32/74$) and IDS-TILDA (60–69 years: 25.5%, $n=24/94$), and good in HA-ID (60–69 years: 53.8%, $n=49/91$; 80+ years: 53.3%, $n=8/15$). For adults with severe (HA-ID: 15.2%, $n=5/33$; IDS-TILDA: 6.3%, $n=4/63$) and profound intellectual disabilities (HA-ID: 7.7%, $n=1/13$; IDS-TILDA: 4.5%, $n=1/22$), feasibility was low in both samples. Feasibility was moderate for adults without Down syndrome in IDS-TILDA (26.0%, $n=58/223$) and HA-ID (48.5%, $n=80/165$). For adults using a walking aid, feasibility was good in HA-ID (67.6%, $n=23/34$), moderate in IDS-TILDA (40.0%, $n=14/35$) and low for wheelchair users in both samples (HA-ID: 0%, $n=0/15$; IDS-TILDA: 18.1%, $n=17/94$). For adults living in a central setting, feasibility was low in IDS-TILDA (17.3%, $n=22/127$) and moderate in HA-ID (31.6%, $n=30/95$).

The main reasons for not performing the TMST according to protocol were 'difficulties understanding the instructions or task', 'physical limitations' and 'lack of motivation' (Table 3).

4 | Discussion

This study assessed the feasibility of four physical fitness tests; that is, static balance stances (SbS, TS, FT), 5xCS, GS and TMST, in two large European cohort studies: IDS-TILDA and HA-ID. All fitness tests showed moderate to good feasibility, except for the FT showing low feasibility in IDS-TILDA. Feasibility was lowest in adults with more severe intellectual disabilities and in wheelchair users for tests involving the lower extremities. The IDS-TILDA sample was younger than the HA-ID sample, with more participants being independent in mobility.

Overall, the four physical fitness tests evaluated demonstrate moderate to good feasibility, with some differences across the study samples. In fact, the older HA-ID participants demonstrated better feasibility for all assessments. For the TMST both studies showed moderate feasibility. However, looking at the feasibility percentages, the feasibility of the TMST was also higher in HA-ID (49.4 vs. 26.6%). This may be partly attributed to the protocol used in HA-ID, adapting step height when participants were not able to reach the required step height, for example because of limited range of motion. This was not done in IDS-TILDA. However, step height was only adjusted in eight participants in HA-ID, therefore this does not fully explain the difference in feasibility between samples.

In both IDS-TILDA and HA-ID feasibility of the physical fitness tests was lower in adults with more severe intellectual disabilities. For all other subgroups, that is, age, sex, presence of Down syndrome, mobility and living circumstances, feasibility was also generally lower, particularly in the IDS-TILDA study despite this cohort being younger and having better mobility. Both studies used a person-centred approach with reasonable adjustments made, including modifications in supportive equipment, communication and procedures to ensure accessibility for individuals with varying levels of intellectual disabilities. A possible explanation for the differences in feasibility between the studies lies in participant characteristics not included in this study, such as high sedentary behaviour (Lynch et al. 2024), prevalence of overweight and obesity (Ryan et al. 2021) and comorbidities previously reported (Hermans and Evenhuis 2014; Ryan et al. 2023). Excess weight, increased comorbidities and lower activity levels can result in less functional capacity, which would be reflected in physical fitness assessments being less feasible. Because we were not able to combine the datasets due to legal reasons, we could not statistically compare our study samples on these outcomes.

Difficulties in understanding the instructions or the task, as well as physical limitations, posed the greatest challenges in both studies. This occured despite the use of a person-centred approach and reasonable adjustments (such as modifications in supportive equipment, communication and procedures to ensure accessibility) to make the fitness tests as accessible as possible for individuals with varying levels of intellectual and physical disabilities while still adhering to the test protocols. Some participants simply did not want to participate due to a lack of motivation, whereas others were feeling anxious. This highlights the importance of a person-centred approach as part of the standard methodology in large studies. Both teams found that the use of a total communication approach, where an individualised personal approach was used for each participant, incorporating accessible easy read and adapted to individual needs, was invaluable to support understanding; however, there remained a part of the study sample who did not gain full comprehension. Therefore, we recommend ensuring sufficient time, instigating simpler cues, providing repeated explanations and allowing for enough time to practice the tests to help adults with intellectual disabilities engage better. Using motivation and encouragement also lends itself to participant success. Although anxiety did not emerge as one of the main reasons for non-compliance, it was noted. Therefore, providing encouragement, emotional support and reassurance can improve engagement. Finally, comprehensive training of test administrators is imperative. Both studies engaged in comprehensive training for their test administrators which they found invaluable, especially in supporting the testers to manage the cognitive and physical limitations, as well as motivational issues displayed by participants and adjust their test administration accordingly (within protocol). Overall, these strategies contribute to the success of both studies and can lead to making future assessments more accessible and improve the feasibility of physical fitness assessments for adults with intellectual disabilities. Including internationally standardised physical fitness assessments, with a person-centred approach, is recommended to allow for comparability and combining of data (ref ID-fitscan). Further work needs to be conducted to assess which tests or adjustments are more suitable for adults with more severe intellectual and physical disabilities, such as wheelchair users.

Being physically fit, as well as physically active and being less sedentary, are critical for health, daily functioning and wellbeing in adults with intellectual disabilities (Lynch et al. 2022; Oppewal et al. 2014; Oppewal et al. 2015; Oppewal and Hilgenkamp 2019). Accurate physical fitness assessments are essential for understanding health effects and for the designing and evaluating effective therapies and interventions. However, challenges exist in these measurements for adults with intellectual disabilities due to cognitive and physical limitations, a shorter attention span and limited availability of reference values to interpret results (Oppewal and Hilgenkamp 2020). This study showed that the feasibility of the fitness tests was sufficient in two large cohort studies, underpinning their use in such studies to reach uniformity across studies and allow for comparability and combining data.

5 | Conclusion

We provided empirical evidence on the feasibility of four specific physical fitness tests in large cohort studies. Overall, moderate to good feasibility was observed. Difficulties understanding the instructions and task and physical limitations were the most common barriers, emphasising the need for the person-centred approach taken by both studies. Feasibility for including internationally standardised physical fitness assessments, with a person-centred approach, is recommended to allow for comparability and combining of data for more knowledge on physical fitness assessment and physical fitness levels in adults with intellectual disabilities. This would provide a wealth of information that could be directly used for physical fitness assessment in research and clinical practice, and to further study the effects of physical fitness on health, functioning and well-being of this often-overlooked group.

Acknowledgements

The authors thank the care organisations involved in the Academic Collaborative Research Center Healthy Ageing and Intellectual Disabilities (HA-ID), Abrona, Amarant and Ipse de Bruggen, for their collaboration and financial and organisational support. The IDS-TILDA authors express thanks to the International Scientific Advisory Board and the Steering Committee, who provide invaluable advice on the design, implementation and strategic objectives of IDS-TILDA and acknowledge the support provided by the Health Research Board and the Department of Health. Most importantly, both HA-ID and IDS-TILDA would like to thank all participants, their family members and staff of the participating care organisations, who gave their time so willingly to support the studies.

Funding

The Academic Collaborative Research Center Healthy Ageing and Intellectual Disabilities (HA-ID) funded the HA-ID cohort study. This consortium consists of three Dutch care organisations for people with intellectual disabilities (Abrona, Amarant and Ipse de Bruggen) in collaboration with the Department of General Practice, Intellectual Disability Medicine Research of the Erasmus MC, University Medical Center Rotterdam. The three care organisations had no involvement in the conduct of data processing, analysis or writing the manuscript. IDS-TILDA is funded by the Health Research Board and the Department of Health (IDS-TILDA-2018-1). These funders do not have access to any of the data provided for the study.

Ethics Statement

Ethical approval for the HA-ID cohort study was obtained from the Medical Ethics Review Committee of Erasmus MC, University Medical Center Rotterdam (MEC-2019-0562). The study is registered in the Dutch Trial Register (NTR number: NL8564, https://onderzoekmetmensen.nl/nl/trial/28611). Ethical approval for the IDS-TILDA cohort study was granted by the Faculty of Health Sciences at Trinity College Dublin and all the service providers participating in IDS-TILDA (181210). Both studies adhered to the guidelines of the Declaration of Helsinki (World Medical Association 2013).

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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