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Adding meaning to physical fitness test results in individuals with intellectual disabilities

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ABSTRACT

Purpose: Evaluating physical fitness in individuals with intellectual disabilities (ID) is challenging, and a multitude of different versions of tests exist. However, psychometric properties of these tests are mostly unknown, and both researchers as clinical practitioners struggle with selecting appropriate tests for individuals with ID. We aim to present a selection of field tests with satisfactory feasibility, reliability, and validity, and of which reference data are available.

Methods: Tests were selected based on (1) literature review on psychometric properties, (2) expert meetings with physiotherapists and movement experts, (3) studies on population specific psychometric properties, and (3) availability of reference data. Tests were selected if they had demonstrated sufficient feasibility, reliability, validity, and possibilities for interpretation of results.

Results: We present a basic set of physical fitness tests, the ID-fitscan, to be used in (older) adults with mild to moderate ID and some walking ability. The ID-fitscan includes tests for body composition (BMI, waist circumference), muscular strength (grip strength), muscular endurance (30 second and five times chair stand), and balance (static balance stances, comfortable gait speed).

Conclusions: The ID-fitscan can be used by researchers, physiotherapists, and other clinical practitioners to evaluate physical fitness in adults with ID. Recommendations for future research include expansion of research into psychometric properties of more fitness tests and combining physical fitness data on this population in larger datasets.

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KEYWORDS
Physical fitness; intellectual disabilities; assessment; psychometric properties; reference values; feasibility

➤ IMPLICATIONS FOR REHABILITATION

- Individuals with intellectual disabilities have low physical fitness levels, and a high risk for unnecessary functional decline and unhealthy aging.
- Physical fitness testing could help improve, adapt and evaluate exercise interventions, but is challenging in this population.
- This paper proposes a selection of tests (ID-fitscan) with sufficient feasibility, reliability, and validity in this population, and provides reference values to aid interpretation of physical fitness test outcomes in individuals with intellectual disabilities.
- The ID-fitscan can be used by researchers, physiotherapists, and other clinical practitioners to evaluate physical fitness, and thereby allowing for a better interpretation of results by using the same tests, and an increasing knowledge of the physical fitness levels of this population.

Interpretability of physical fitness test results

For decades, physical fitness testing has been an important source of information for various purposes (athletic performance, comparison of different populations, development over the lifespan), but one of the main reasons to measure physical fitness is its well-documented relationship with health and functioning [1]. Within this context, physical fitness has been an increasingly important topic for individuals with intellectual disabilities (ID) [2]. Studies have shown that individuals with ID demonstrate earlier and unhealthier aging than the general population [3–5]. This is a strong reason to evaluate physical fitness in relationship to future negative health outcomes in this specific population, and to understand any age-related decline in physical functioning [6–8]. Preventing the possible negative consequences of a loss of physical fitness, such as chronic diseases, falls, and a loss of independence, is critical for both quality of life as for reducing health care costs in this aging population [9–13].

Although the importance of physical fitness as a concept has been established, measuring physical fitness in individuals with ID in daily practice comes with specific challenges [14]. The difficulty of instructions or execution of a test is not always aligned with the physical or cognitive abilities of the individual with ID, resulting in drop-out or invalid test results [15]. Additionally, having the motivation to perform maximally, and maintaining attention to

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the task at hand are not always self-evident. These aspects have led to a wide variety of adaptations to existing physical field fitness tests and the development of ID-specific physical fitness tests, as described in recent reviews [16–18]. Although these new (versions of) tests often solve the abovementioned feasibility issues, other psychometric properties like reliability and validity are not always evaluated sufficiently [17,18]. Fortunately, recent years have shown a strong awareness amongst researchers with regards to the importance of evaluating psychometric properties in individuals with ID, resulting in a growing body of evidence [18–21].

Where psychometric properties are increasingly receiving attention, interpretability has not been granted the same focus in research just yet [22], which is another important methodological issue with this wide range of physical fitness tests available [17,18]. Interpretability can be supported in three different ways: (1) comparing individual or group results to a value or range of values that correlates with a (future) health outcome, for example cardiovascular disease, being able to walk safely, or the ability to perform daily living skills (criterion-referenced value), (2) comparing individual or group results to values based on the distribution of test results in a large group, often stratified for sex and age-categories (norm-referenced values), (3) defining clinically relevant differences based on participant experiences or reductions in health risks (i.e., with the minimal detectable change (defined as the minimal change that falls outside the measurement error in the score of an instrument used to measure a symptom) or the minimal clinically important change (defined as the minimal change in the score that is meaningful for patients)) [23]. Availability of these sources for interpretability of test results will increase the meaningfulness of physical fitness tests for both research and clinical practice, and will enable the development of detailed knowledge regarding the physical fitness of this population.

With this wide range of physical fitness tests available, and methodological issues associated with it, it is difficult for professionals like physiotherapists or physical activity instructors to select a suitable test. Due to the risk of inappropriate use of tests, invalid test scores, high dropout, and obtaining results that lack meaning for the participant, the professional is high. Additionally, using a multitude of different tests hampers comparison of test results and development of reference values.

To assist professionals and guide future research, we intended in this paper to propose a selection of physical fitness tests that have demonstrated sufficient feasibility, reliability, and validity, and to collect and present existing reference data to interpret results that will add meaning to the test results.

The specific target population in mind for this paper is (older) adults with a mild to moderate ID that are able to walk (without or with support). We focus on (older) adults because monitoring or promoting a healthy ageing process in individuals with ID is one of the most important reasons for the application of physical fitness tests in research and practice in this population. Due to the heterogeneity of the population of individuals with ID and the influence of cognitive and physical capabilities in the ability to perform physical fitness tests, we focus here on individuals with mild to moderate ID that are able to walk (without or with support).

Toward comparable fitness tests results: properties of a good physical fitness test

As mentioned, a good physical fitness test has to demonstrate sufficient feasibility, reliability, validity, and possibilities for interpretation [24]. These psychometric concepts, along with the criteria used in this paper to operationalize these concepts, are defined below:

1. *Feasibility:* Feasibility was defined as the ability to perform a test according to the test instructions. This includes understanding the purpose of the test and being able to execute the test [25]. Feasibility was expressed as the completion rate of a test in a specific target population. Due to the heterogeneity of the population of individuals with ID and the lack of consensus in the literature on standards to interpret feasibility, we used quartiles to define cutoff scores for completion rate: a completion rate of 75% and over was defined as excellent, from 50 to 75% as good, from 25 to 50% as moderate, and below 25% as a low completion rate [15].
2. *Reliability:* Reliability was defined as the degree to which a test gives consistent results each time it is employed. Test–retest reliability (intra-rater reliability) refers to consistency of results across different time points within the same test administrator. Inter-rater reliability refers to the consistency of results when different test administrators perform the same test on the same participant [24]. The intraclass correlation coefficient (ICC) is a measure of reliability, and we considered an ICC of $\geq$0.6 as acceptable and an ICC of $\geq$0.8 as good [26].
3. *Validity:* Validity is the extent to which a test accurately measures what it is supposed to measure [27]. Validity can be determined through comparison with other tests that are supposed to measure the same or a completely different construct (construct validity; convergent or divergent), by measuring the degree to which the content of a test is an adequate reflection of the construct to be measured (content validity), or through comparing the test with a gold standard (criterion validity) [22,25]. Predictive validity is a useful subtype of criterion validity in this context, since it describes how well a physical fitness test would be able to predict future health outcomes. We considered a physical fitness test valid if validity has been demonstrated in any of these three different ways, in at least the general population and preferably the population with ID.
4. *Interpretation of test results:* In addition to sufficient psychometric properties, a test has to have reference data available to allow for interpretation of test results. As mentioned before, interpretation of test results can be supported by criterion-referenced values, norm-referenced values, and clinically relevant differences [23]. Since reference values can vary across populations, it is important to take the population that was used to determine these values into account. In this paper, we considered a physical fitness test to have sufficient possibilities for interpretation of results if any of the abovementioned options were available.

ID-fitscan: recommended basic set of physical fitness tests with adequate psychometric properties

To arrive at the selection of recommended tests, we started off by using the ACSM guidelines for the operationalization of physical fitness as a combination of health-related components and skill-related components [28]. We focused on the components that are important for daily functioning of adults with ID (body composition, coordination, reaction time, balance, muscular strength, muscular endurance, flexibility, and cardiorespiratory fitness) [18].

For this recommended set, we chose applicability to older adults with ID as a starting point. As epidemiological studies in

Table 1. Health-related and skill-related components of physical fitness according to the American College of Sports Medicine, with physical fitness components covered in the ID-fitscan in bold.

Fitness components	Included tests in the ID-fitscan
Health-related components	
Body composition	Body mass index, waist circumference
Cardiorespiratory fitness	Not available yet
Muscular strength	Grip strength
Muscular endurance	30 seconds chair stand, five times chair stand
Flexibility	Not available yet
Skill-related components	
Coordination	Not available yet
Balance	Static stances, comfortable gait speed
Reaction time	Not available yet

older adults with ID are still scarce, we mainly used information of the large epidemiological Healthy Ageing and Intellectual Disability (HA-ID) study ($n = 1050$, aged ≥ 50 years) as a source for the selection of tests [29]. In this study, a test was selected for each of the abovementioned physical fitness components based on (1) an extensive literature review of previous literature and (2) expert meetings with physiotherapists and movement experts with experience in working with individuals with ID [26]. To be selected in the literature review, a test has to meet the following criteria: (1) use a functional task to measure the specific physical fitness component, (2) have at least one reference to a reliability or validity study, and (3) expected to be feasible for adults with ID, and make use of objective criteria. If more than one test for a specific physical fitness component met all three criteria, further selection was done within the expert meetings to come to a selection of tests that would be most suitable in practice. These criteria and the process of the literature review and the expert meeting are described in more detail elsewhere [18]. Next, the psychometric properties of these tests were studied [15,18,26,30].

Based on this information, we recommend a selection of physical fitness tests, from here on referred to as the "ID-fitscan". Tests were included in the ID-fitscan if they had demonstrated sufficient feasibility, reliability, validity, and possibilities for interpretation of results as defined in the previous section. Suitable tests were found for the physical fitness components, body composition, muscular strength, muscular endurance, and balance, presented in bold in Table 1. For the remaining physical fitness components, available tests were promising but were currently lacking information or did not demonstrate sufficient feasibility, reliability, or validity. The ID-fitscan is most suitable to be used in adults with mild to moderate ID, with some walking ability.

The test descriptions refer to the original versions, without making any adaptations to the execution of the tests. The selected tests are described below. The interpretation of the test results is described in the section after the description of the tests.

Body composition: body mass index and waist circumference

For body composition, the body mass index (BMI) and waist circumference were selected which are feasible to use in older adults with ID [30,31].

BMI is calculated by dividing weight in kilograms by squared height in meters. Height is measured with the participant wearing no shoes with preferably a stadiometer, accurate to the nearest centimeter. Weight is measured with the participants wearing light clothes and no shoes with a digital floor scale, accurate to the nearest 0.1 kg [28]. BMI is divided into underweight ($<$18.5 kg/m^2), normal ($<$25 kg/m^2), overweight (25–30 kg/m^2) and obese ($\geq$30 kg/m^2) [28,32].

Waist circumference is measured in standing position, with the arms at the sides, over the unclothed abdomen at the narrowest point between the costal margin and iliac crest at the end of an expiration, accurate to the nearest 0.5 cm [28]. Waist circumference can be measured underneath the clothes, but then it is important that the participant does not hold up his or her clothes because this can influence the test results.

Validity and reliability was good in the general population [28,32]. Feasibility and test–retest reliability of these measurements was also good in adults with ID, with an ICC of 0.98 (95% confidence interval (CI) 0.98–0.99, standard error of measurement (SEM) = 0.34) for BMI, and 0.97 (95% CI 0.95–0.98) for waist circumference [30,33]. However, only few studies have been conducted regarding reliability and validity of these body composition measurements in the ID population [31].

Muscle endurance: 30 s chair stand and five times chair stand

The 30 s chair stand (30sCS) and the five times chair stand ($5 \times$ CS) [34,35] were selected to measure muscle endurance. For the 30sCS, participants are instructed to stand up and sit down again as often as possible in 30 s, without using their hands. The total number of complete stances is the result of the test. For the $5 \times$ CS, participants are instructed to stand up and sit down again five times as fast as possible, without using their hands. The time needed to complete five stances is the test result, accurate to the nearest hundredth of a second. For both tests, the starting position is that the participant is sitting in the chair with the feet on the floor and the knees in a 90° angle.

In the general population, validity and reliability of both versions of the test was good [34–37]. In addition, the psychometric properties of the 30sCS were also studied in older adults with ID. Feasibility and test–retest reliability was moderate to good, with an ICC of 0.72 (95% CI 0.32–0.91) for a same-day interval and 0.65 (95% CI 0.19–0.87) for a two-week interval [15,26]. In addition, the 30sCS was predictive for a decline in the ability to perform basic and instrumental activities of daily living, and mobility over a 3-year follow-up period in older adults with ID [9,10]. The $5 \times$ CS has not been studied this extensively in adults with ID, but was added to the ID-fitscan to increase possibilities for interpretation of results, because this version of the test is used in the Healthy Athletes program of the Special Olympics and is often used in the general older population. Also, the $5 \times$ CS is the preferred test if the 30sCS is too hard to complete for an individual.

Muscle strength: grip strength

As a measure for muscle strength, grip strength (GS) was selected. Grip strength is measured with a hand dynamometer (preferably the Jamar Hand Dynamometer #5030J1, Sammons Preston Rolyan, Bolingbrook, IL) in seated position, according to the recommendations of The American Society of Hand Therapists [38]. Participants are seated in a chair with an armrest with the shoulder in 0° flexion, the elbow in 90° flexion and the wrist between pronation and supination with the hand palm in vertical position. When holding the hand dynamometer, the middle phalanges have to rest on the handle, if not, the position has to be adjusted. Participants squeeze the dynamometer with maximum force, three times with one-minute recovery between attempts [38]. This has to be done for both hands because handedness may not be self-evident [39]. The maximal produced force of the six attempts is the test result, accurate to the nearest kg. Results are only valid if the test instructor is convinced; the participant squeezes with

Table 2. Description of the type of reference values available to interpret or compare test results of the ID-fitscan.

	Norm-referenced values of the general population	Norm-referenced values of the ID population [57,58]	Criterion-referenced values ID population	Clinically relevant differences ID population
Body composition				
BMI	Rikli and Jones [34,59] 6728 community-residing, functionally independent older adults (60–94 years), 4707 females, USA Statline [60] Online database of the Dutch population based on a population health questionnaire (>20 years), The Netherlands	HA-ID study population, 671 older adults with mild to moderate ID (≥50 years), 350 females, The Netherlands	X	X
Waist circumference	Patry-Parisien et al. [61] 1732 adults (20–79 years), 908 females, Canada	HA-ID study population, 671 older adults with mild to moderate ID (≥50 years), 350 females, The Netherlands	X	X
Muscular endurance				
30 s chair stand	Rikli and Jones [34,59] 6774 community-residing, functionally independent older adults (60–94 years), 4747 females, USA	HA-ID study population, 671 older adults with mild to moderate ID (≥50 years), 350 females, The Netherlands	X	X
5× chair stand	Guralnik et al. [35] 5106 adults (71+ years), 3320 females, USA	X	X	X
Strength				
Grip strength	Bohannon et al. [62] Meta-analyses 12 studies, 3317 adults (data used for adults up to 75 years) USA, Canada, Australia, UK, Sweden Bohannon et al. [63] Meta-analyses 7 studies, 739 adults ≥75 years USA, Canada, Australia	HA-ID study population, 671 older adults with mild to moderate ID (≥50 years), 350 females, The Netherlands	X	X
Balance				
Static balance test	Side by side, semi-tandem and tandem stand: Guralnik et al. [35] 5106 adults (71+ years), 3320 females, USA One leg stand: X	Side by side stand, tandem stand and one leg stand: HA-ID study population, 671 older adults with mild to moderate ID (≥50 years), 350 females, The Netherlands Semi-tandem stand: X	X	X
Comfortable gait speed	Bohannon and Williams Andrews [64] Meta-analyses 41 studies, 23,111 adults (20–99 years) USA, Canada, Australia, UK, Sweden, The Netherlands, Germany, France, Italy, Japan, Kuwait, Israel	HA-ID study population, 671 older adults with mild to moderate ID (≥50 years), 350 females, The Netherlands	X	X

ID: intellectual disabilities; BMI: body mass index; HA-ID: Healthy Ageing and Intellectual Disability study.

maximum effort. To check that the participant squeezes with maximum effort, test instructors have to look at the contracting muscles of the arm and hand, turning white of the phalanges, facial expressions, and the consistency of the three attempts. Optionally, participants can squeeze a rubber ball first, to assure understanding of the task.

Validity and reliability in the general population was good [40,41]. In older adults with ID, feasibility was good to excellent and test–retest reliability was good, with an ICC of 0.94 (95% CI 0.87–0.97) for a same-day interval and 0.90 (95% CI 0.80–0.95) for a two-week interval [15,26]. Additionally, GS was predictive for a decline in mobility over a 3-year follow-up period in older adults with ID [9].

Balance: static and dynamic balance

To measure balance, a static balance test consisting of four stances and a dynamic balance test consisting of comfortable gait speed were selected.

The four stances are performed in order of increasing difficulty: side by side stand, semi-tandem stand, tandem stand, and one-leg stand [35,42–45]. The participant has to try to maintain each stand independently for 10 s, for both sides. If the participant succeeds, the participant continues to the next stand. Multiple attempts up to a maximum of five are allowed. Support (or manual cueing) is only allowed to help the participant obtain the correct starting position, and not during the execution of the test. The result of the test is the number of seconds the participant is able to hold the position, accurate to the nearest second, with a maximum of 10 s.

Validity and reliability in the general population was good [35,42–45]. The feasibility of the stances was good in older adults with ID [46], and test–retest reliability of the one-leg stance has been confirmed in adolescents and young adults with ID, with an ICC of 0.88 (95% CI 0.82–0.92, SEM = 1.49) [47].

Gait speed is measured at comfortable speed (CGS) over a 5-meter distance [48].

Participants walk on an 11-meter walkway, which includes 3 m for acceleration from stance to comfortable speed, a timed 5 m of comfortable walking, and 3 m to decelerate to standing still again. Participants perform the walk three times, and the test result is the average time of the three walks in m/s (accurate to the nearest hundredth of a second). To avoid influencing the speed and balance of the participants, participants have to walk without someone walking alongside or physically supporting them. Walking aids are allowed.

Validity and reliability in the general population was good [49–53]. In older adults with ID, feasibility was good to excellent, and test–retest reliability was also good, with an ICC of 0.96 (95% CI 0.90–0.98) for a same-day interval and 0.93 (95% CI 0.85–0.97) for a two-week interval [15,26]. Additionally, comfortable gait speed was predictive for a decline in the ability to perform basic and instrumental activities of daily living, and mobility over a 3-year follow-up period in older adults with ID [9,10].

Short physical performance battery (SPPB)

The SPPB score is calculated based on the tests that are included in de ID-fitscan, it can also be calculated, based on the results of the 5 × CS, three stances (side by side stand, semi-tandem stand, tandem stand), and CGS. The SPPB is a test battery that is widely used in the general population. Although not investigated in the ID population, scores are strongly related to disability, institutionalization and mortality in the general population [35,54,55], and results from the ID population can be compared to norm-referenced values of the general population.

Order and duration of test administration

The following order for test administration is advised, with regard to the load and rest periods for different parts of the body:

1. Body composition: length, weight, waist circumference (four minutes),
2. Muscular endurance: 30sCS (one minute),
3. Strength: GS (five minutes),
4. Static balance: four stances (four minutes),
5. Dynamic balance: CGS (five minutes),
6. Muscular endurance: 5 × CS (one minute).

As the order of the tests is arranged in such a way that the different muscle groups have sufficient rest between the tests, no fixed rest period between the tests is prescribed. However, a minimum rest period of 30 s is advised, and depending on the fitness level and level of fatigue of the participant this can be prolonged.

Additional data on participant characteristics to collect

Besides collecting physical fitness data, additional data on participant characteristics can be collected to improve interpretation of the results. To be able to compare the results to reference values, information on age, sex, and level of ID is needed. Additionally, one can collect information on other factors that may influence physical fitness levels in individuals with ID such as genetic syndromes, physical activity level, mobility impairments, neurological conditions, cardiovascular and respiratory condition, and medication use. Information on these factors can help in putting the physical fitness results in better perspective with regard to one's health condition.

Available data to interpret or compare test results of the ID-fitscan

Table 2 shows the type of reference values that are available for each of the tests of the ID-fitscan. Currently, only norm-referenced values are available for the general population and/or the population with ID. We added the actual norm-referenced data per test in the Supplementary Tables S1–S7 to facilitate interpretation or comparison of test results of the ID-fitscan. Scores are presented for subgroups based on sex and age, and are presented as means with standard deviations or 95% CIs, and 25th, 50th and 75th percentiles. A score at the 25th percentile indicates that 25% of the scores in that particular group would be lower and 75% of the scores would be higher.

Several aspects have to be taken into account while using the provided reference values for interpreting test results. First, the study population that is used as the basis for the reference values (Table 2) has to be taken into account when interpreting individual results with norm-referenced values. For example, the norm-referenced values for the ID population are based on the HA-ID study, and are therefore representative for older adults with mild to moderate ID who receive care (ranging from complete care and support to only minimal support in instrumental activities of daily living) from specialized ID-care organizations. Older adults with ID not receiving any form of registered care or support are not included, and older adults only receiving ambulatory support or only visit a day-activity center are underrepresented in the HA-ID study sample. Also, women are slightly overrepresented and 80–84 year-olds are also slightly underrepresented. More detailed information about the representativeness of the HA-ID study sample is published elsewhere [29]. Caution is needed when extrapolating these reference values to other ID subgroups.

Second, the provided reference values are based on group averages and their distribution of test results in large groups. With these values, one can interpret an individual's result relative to the ID population and the general population. However, cutoff (criterion-referenced values) that allow for individual interpretation for the risk of a decline in daily functioning are not yet available.

Recommendations for clinical practice

The ID-fitscan has not only shown adequate feasibility, reliability, and validity, but will also allow users to more easily interpret the obtained results based on comparison with relevant population data. The recommended tests are the original tests as used in the general population, without making adaptations in the execution of these tests. This allows for comparison of the results with the general population, but also stresses the importance of performing these tests according to the provided instructions to achieve uniformity and comparability of the results.

Currently, the recommended tests can be used (1) to determine physical fitness in a large group of individuals with a range of physical (only some walking ability required) and cognitive abilities (good feasibility for mild and moderate level of ID), (2) to start building large datasets and increase our knowledge on the physical fitness levels of individuals with ID, compared to the general population or specific other populations, (3) to define high-risk subgroups within the population with ID, and (4) to adapt interventions or daily support to adequately promote physical activity and exercise. Caution has to be taken when using these tests for individual risk profiles or individual evaluation of treatment or training programs, because at this point both cutoff values for determining risks and the responsiveness to change is unknown for all included tests, and not all the fitness components are currently covered in the ID-fitscan yet.

General recommendations for performing physical fitness tests in individuals with ID are provided in the most recent guidelines of the American College of Sports Medicine [28]. In short, they describe the need for careful health screening and checking for medication beforehand, familiarization of tests before the actual testing, providing a safe environment, and for providing simple one-step instructions and explicit and regular verbal and visual reinforcement and encouragement throughout the test (chapter 11, p. 329–331) [28]. Additional recommendations based on our personal experience are: (1) ensure a quiet and low-stimulus environment to facilitate focus on the tests, with as few other people present as possible, (2) do not rely on verbal feedback only when estimating the intensity or effort of a performance, instead observe bodily signals like redness in the face, sweating or high heart rate, and take a break where needed, (3) instead of using standardized motivation and instructions, adapt communication and motivation style to the participant to ensure maximal motivation and an optimal performance, and (4) accommodate their often short attention span with the organization of the tests and prepare the set-up and the program of the physical fitness tests beforehand to avoid unnecessary waiting time for the participant in between tests.

Setting a research agenda

Expanding the ID-fitscan

Some promising other fitness field tests have been used in individuals with ID (e.g., the 6 min walk test and the timed up and go test). In order to include these tests, or other tests for the remaining physical fitness components, more information is needed on psychometric properties (mostly validity) or reference values. This currently limits physiotherapists or physical activity experts in performing a full assessment of all components of physical fitness of the individual with ID. Future research should focus first on determining suitability of physical fitness tests for cardiorespiratory fitness, and for flexibility, coordination and reaction time second, based on their relevance for health and daily functioning. Furthermore, the proposed set is mostly feasible for adults with mild to moderate ID, with some walking ability. More research is needed to add alternative or adapted tests to make the ID-fitscan suited for other subpopulations with more severe physical or cognitive disabilities, and for children and adolescents.

Expanding information on psychometric properties

With regard to the tests in the ID-fitscan, further research is needed regarding the psychometric properties that have not been studied yet [22,24]. This includes measurement error, construct and criterion validity, and responsiveness to change. The responsiveness to change of a test is essential for the evaluation of interventions and treatments, on both group level and individual level. For the outcome of a test to be of clinical importance, a test should be sensitive enough to detect at least a clinical relevant difference, and research should focus on providing information on standard error of the measurement. Future research should focus on the responsiveness to change of the suggested tests as well.

Future research is also needed to enhance the interpretation of the tests. Further investigation of the predictive validity of the tests would provide valuable criterion-referenced values for increased risk for specific negative health outcomes, such as cardiovascular diseases and mortality. Such cutoff values are extremely valuable for assessing the urgency of interventions and policy changes to improve physical fitness.

Big datasets, bigger benefits

To be able to enhance the interpretation of the physical fitness tests, big datasets on physical fitness of adults with ID are needed, which requires uniformity in physical fitness assessment across studies and in clinical practice. Bigger datasets will give opportunities in obtaining more insight in the physical fitness of this population as a whole, for specific subgroups and locations, and in changes over time. This is not just invaluable for fitness and health professionals working with individuals with ID, but also important to decision makers to make informed choices about policies and interventions on different levels, ranging from (inter-)national politics to individual planning of support or care for individuals with ID.

As an example, the Healthy Athletes program of the Special Olympics collects data worldwide regarding health, including physical fitness, of the athletes participating in their games. This largest known international dataset has great potential in answering a wide range of existing health questions in individuals with ID. However, the Special Olympics focus on athletes with ID, with little information on the representativeness of this group compared to the total population with ID [56]. This might also influence the generalizability of the information on feasibility of the tests to the rest of the population with ID. With regard to the ID-fitscan, we have set up a database to collect the data of the ID-fitscan assessed by physiotherapists and movement experts working with individuals with ID in The Netherlands, who are currently already implementing the ID-fitscan in their clinical work and/or for research purposes.

Concluding remarks

This paper proposes a first set of psychometrically sound tests to measure physical fitness in adults with ID for wider use in research and clinical practice. The tests proposed in the ID-fitscan fulfill the predetermined criteria for feasibility, reliability, validity, and interpretation of results, and are a solid starting point for further research on psychometric properties and of physical fitness in adults with ID. Uniformity in physical fitness assessment in studies and clinical practice will result in more comparable physical fitness results, and provide opportunities in obtaining more insight in the physical fitness levels of adults with ID.

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Disclosure statement

The authors report no conflict of interest.

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