Received: 18 September 2020 | Revised: 25 June 2021 | Accepted: 15 September 2021

DOI: 10.1111/jar.12942

ORIGINAL ARTICLE

JARID bild WILEY

Factors associated with non-completion of and scores on physical capability tests in health surveys: The North Health in Intellectual Disability Study

Monica Isabel Olsen[1,2] | Marianne Berg Halvorsen[3] | Erik Søndenaa[4,5] | Bjørn Heine Strand[6,7,8] | Ellen Melbye Langballe[6,7] | Anders Årnes[9] | Henriette Michalsen[1,2] | Frode Kibsgaard Larsen[6] | Wenche Gamst[10] | Erik Bautz-Holter[11] | Audny Anke[1,2,11]

[1]Department of Rehabilitation, University Hospital of North Norway, Tromsø, Norway

[2]Faculty of Health Sciences, Department of Clinical Medicine, UiT The Arctic University of Norway, Tromsø, Norway

[3]Department of Paediatric Rehabilitation, University Hospital of North Norway, Tromsø, Norway

[4]Faculty of Medicine, Institute of Mental Health, Norwegian University of Science and Technology, Trondheim, Norway

[5]Department of Brøset, St. Olavs University Hospital, Trondheim, Norway

[6]Norwegian National Advisory Unit on Ageing and Health, Vestfold County Hospital Trust, Tønsberg, Norway

[7]Department of Geriatric Medicine, Oslo University Hospital, Oslo, Norway

[8]Department of Chronic Diseases and Ageing, Norwegian Institute of Public Health, Oslo, Norway

[9]Department of Pain, University Hospital of North Norway, Tromsø, Norway

[10]Department of Clinical Research, University Hospital of North Norway, Tromsø, Norway

[11]Faculty of Medicine, Institute of Health and Society, Research Centre for Habilitation and Rehabilitation Model and Services (CHARM), University of Oslo, Oslo, Norway

Correspondence
Monica Isabel Olsen, Department of Rehabilitation, University Hospital of North Norway, Sykehusveien 38, P.O. Box 1, 9038 Tromsø, Norway.
Email: monica.isabel.olsen@unn.no

Funding information
Institute of Health and Society, Research Centre for Habilitation Model and Services (CHARM), University of Oslo, Norway; The Norwegian Dam Foundation

Abstract

Background: This study investigated the completion rates, scores and factors associated with non-completion and low scores on physical capability tests in a health survey administered to adults with intellectual disabilities.

Method: Assessment comprised body mass index (BMI), the Short Physical Performance Battery (SPPB), the timed up-and-go (TUG) test, the one-legged stance (OLS) test; and gross motor, communication and behavioural functioning tests.

Results: The completion rates among 93 participants (aged 17–78) were 46% for the SPPB, 42% for the TUG, and 31% for the OLS. More severe intellectual disability (OR $= 3.12$, $p < .001$) and lower BMI (OR $= 0.859$, $p = .001$) were related to test non-completion. The SPPB scores were below the reference values from the general population. Lower scores were associated with older age, motor disabilities and intellectual disability severity.

Conclusions: Including physical capability tests in health surveys among adults with intellectual disabilities is important to monitor functional status and guide prevention strategies.

KEYWORDS
body mass index, intellectual disability, physical capability, Short Physical Performance Battery, timed up-and-go

1 | INTRODUCTION

Several studies have reported higher prevalence rates of conditions such as epilepsy, obesity, asthma, diabetes and hypothyroidism (Cooper et al., 2015; Folch et al., 2019; Perera et al., 2019); less preventative screening (Havercamp & Scott, 2015; Maltais et al., 2020); and higher mortality rates among adults with intellectual disabilities than among the general population (Cooper et al., 2020; Heslop et al., 2014). Adults with intellectual disabilities often present below-average physical performance (Hilgenkamp et al., 2012, 2013; Lahtinen et al., 2007). The results of physical capability tests in health surveys are important to inform health services and policy makers about current health challenges.

In older adults, a low physical fitness level has been found to be predictive of a decline in the ability to perform activities of daily living (Oppewal et al., 2015), and physical fitness components have been shown to be predictive of 5-year survival (Oppewal & Hilgenkamp, 2019b). Individuals who do not complete physical capability tests in health surveys or who achieve markedly low scores on such tests may have health challenges (Oppewal & Hilgenkamp, 2019b) and therefore be at risk of developing serious illness (Bergland et al., 2017). Physical capability tests used in the general population rely on average cognitive and physical abilities, and even short physical performance batteries used for older adults (Guralnik et al., 1994) cannot be assumed to be suitable for the population with intellectual disabilities (Hilgenkamp et al., 2013). Recently, Oppewal and Hilgenkamp (2019a) recommended a physical fitness test battery for adults with intellectual disabilities (Oppewal & Hilgenkamp, 2019a). The present study contributes knowledge from a Norwegian investigation of adults with intellectual disabilities where physical capability tests identical to those in a health survey for the general population were administered (the Tromsø Study).

Data on the completion rates of short physical capability test batteries are limited for adults with intellectual disabilities. Hilgenkamp et al. (2013) reported the feasibility of eight physical fitness tests to be moderate to good in older Dutch adults with intellectual disabilities, except those with profound intellectual disabilities (all tests), with severe intellectual disabilities (response time and Berg Balance Scale), and who used a wheelchair (all tests that involve the legs). Others have reported that clinical tests of balance and gait are feasible in adults with mild to moderate intellectual disabilities (Enkelaar et al., 2013). Sufficient feasibility and test–retest reliability in lower extremity strength tests in 29 adults with severe or moderate intellectual and visual disabilities has been reported, but behaviour or communication problems may influence the examination results (Dijkhuizen et al., 2018).

Factors associated with scores on physical performance tests may explain the variance in test results (Oppewal & Hilgenkamp, 2019a). Lahtinen et al. (2007), in a Finnish longitudinal study, found a decline in balance and manual dexterity during adulthood, with a significant relationship between balance and intellectual disability severity. In the study by Enkelaar et al. (2013) on balance and gait performance in older persons, associations with age, body mass index (BMI), and number of co-morbidities were reported. In adults with visual and intellectual disabilities, the two significant explanatory variables for scores on a modified Berg Balance Scale were the Barthel Index and the Gross Motor Function Classification Scale (GMFCS) score (Dijkhuizen et al., 2018).

Factors associated with low scores on physical capability tests used in health surveys have rarely been investigated in adults with intellectual disabilities (Oppewal & Hilgenkamp, 2019a). The Short Physical Performance Battery (SPPB) (Guralnik et al., 1994) is a well-established tool for assessment of lower extremity physical capability. It has been used in general population studies in Norway (Bergland & Strand, 2019), for elderly people living in nursing homes (Sverdrup et al., 2018), and in intervention studies involving individuals with mild to moderate intellectual disabilities (Torres-Unda et al., 2017). The primary aims of this study were to (1) assess the completion rates of physical capability measurements; (2) assess whether test completion is associated with demographics and cognitive, gross motor, communicative and behavioural functioning; and (3) identify predictors of physical capability test scores. A secondary aim in the study was to compare physical capability test result with existing reference values from the general population in the same area to document possible disparities in people with intellectual disabilities and make meaningful interpretation of physical capability (Bergland & Strand, 2019).

2 | METHODS

2.1 | Study design and setting

The North Health in Intellectual Disability (NOHID) study was a population-based study including people with intellectual disabilities who lived in five different municipalities in northern and central Norway. Data were collected between October 2017 and December 2019. This study used NOHID data from the municipality of Tromsø, which is the largest municipality in northern Norway and has 60,868 inhabitants aged 18 years or older (Statistics Norway, 2019). The prevalence of intellectual disability in adults is 0.5%–1%, and 0.45% of this population receives welfare support (Skorpen et al., 2016; Søndenaa et al., 2010); therefore, we expected that approximately 135–270 adults with intellectual disabilities received some sort of support from the municipality. The main data collection methods were questionnaires and interviews. The current study included additional clinical measurements, specified below. For data collection, the web-based instrument REDCap (Research Electronic Data Capture, Vanderbilt University, Nashville, TN) was used. The trial is registered in the Clinical Trials Registry under identification number NCT03889002.

2.2 | Participants

We included individuals with a verified diagnosis of intellectual disability according to International Classification of Diseases 10th revision (ICD-10) criteria (World Health Organization, 2019), who were aged 17 years and above, and who lived in Tromsø. According to official municipality information, a total of 170 inhabitants had a diagnosis of intellectual disability and received services from the municipality in 2017. Potential participants were identified through (1) the receipt of specialised intellectual disability services at the University Hospital of North Norway (UNN) or (2) information available from the municipality (receiving services). For the latter participant identification method, staff from the municipality contacted the individual with intellectual disability prior to researcher contact. There were no pre-defined exclusion criteria. In line with previous studies on physical fitness tests in adults with intellectual disabilities, both people with and without co-occurrence of genetic diagnoses were included (Hilgenkamp et al., 2013; Oppewal et al., 2018). Informed consent was obtained from each individual or his or her legal representative. The study was approved by the Committee for Medical Research Ethics, Health Region North (2017/811), and the data protection officer at the UNN.

2.3 | Demographics, level of intellectual disability and questionnaires

Information about age, gender and living conditions was collected from the participants. Living situation was classified as living independently in their own residence, living with family or living in a group home with care. In Tromsø municipality, group homes have individual apartments for those with intellectual disabilities in addition to shared areas. Information about intellectual disability degree and concurrent genetic syndromes or autism was confirmed in the participants' medical records. Intellectual disability degree was categorised as mild (IQ 50–69), moderate (IQ 35–49), severe (IQ 20–34) or profound (IQ <20) (World Health Organization, 2019). For eight individuals, the intellectual disability degree was unknown; it was determined considering information about adaptive functioning and consultation with specialised intellectual disability health service staff (Tassé et al., 2019).

The GMFCS classifies gross motor functioning into levels 1–5, with lower levels indicating better function. The GMFCS was developed for children with cerebral palsy (Palisano et al., 1997) and has high interrater reliability (McCormick et al., 2007). Individuals with level 1 motor function may have limitations in advanced motor skills (speed, balance) but generally walk unremarkably. Persons with level 2 motor function usually need to use railings on stairs and walk without aid but may occasionally use devices such as crutches or a wheelchair. Persons with level 3 motor function require walking aids inside and usually a wheelchair outside. Levels 4 and 5 generally indicate wheelchair use. The GMFCS has been used but not validated in studies of adults with intellectual disabilities (Dijkhuizen et al., 2018).

The Communication Function Classification System (CFCS) classifies communication function into five levels, with lower levels indicating better communication skills. Interrater reliability is high for people with cerebral palsy (Hidecker et al., 2011), but validation in adults with intellectual disabilities is lacking.

The Aberrant Behaviour Checklist-Community (ABC-C) is a rating scale with 58 items for the assessment of behavioural problems in people with intellectual disabilities (Aman & Singh, 1994, 2017). The items are grouped into five subscales: (I) Irritability (15 items), (II) Social Withdrawal (16 items), (III) Stereotypic Behaviour (7 items), (IV) Hyperactivity/Non-compliance (16 items) and (V) Inappropriate Speech (4 items). Each item is rated on a four-point scale from (0), not a problem, to (3), the problem is severe. The Norwegian version of the ABC-C was found to have satisfactory internal consistency, factor structure and divergent and convergent validity (Halvorsen et al., 2019).

2.4 | Clinical measurements and physical performance tests

BMI was calculated as weight in kilos divided by height in metres squared and was classified as follows: underweight (<18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2) and obese (≥30 kg/m^2) (Bailey & Ferro-Luzzi, 1995). Height and weight were measured on-site or, when that was not possible, were based on self-reports. Height without shoes was measured with a stadiometer (Seca 206, Hamburg, Germany). Weight without shoes and outdoor garments was measured with a mechanical floor scale (Seca 761, Hamburg, Germany). For participants who were in a wheelchair or had difficulty standing on a small plate, a wheelchair weight (Seca 675, Hamburg, Germany) was used.

The SPPB is a screening tool originally designed to assess physical performance and predict disability in the older population (Guralnik et al., 1994). The SPPB mainly measures lower extremity function and comprises three subtests. A score of 0 indicates inability to perform the subtest, while a score of 4 indicates the highest level of performance. The battery comprised the following tests: (1) static balance, tested with the feet in side-by-side, semi-tandem and tandem positions; (2) gait speed, assessed by two 4-m (13 ft) walking tests at the individual's habitual pace, with the best result of the two tests retained; and (3) lower limb strength, assessed by the ability to rise from a chair with the arms folded across the chest. The total score was the sum of the three test scores and ranged from 0 to 12 points; 0–6 points was considered a low score, 7–9 points was a moderate score and 10–12 points was a high score (Guralnik et al., 1994). In addition, raw scores on the gait speed (m/s) and chair stand (seconds) tests are provided in this study.

The validity and reliability of the SPPB have been reported for older adult populations (Guralnik et al., 1994) and for Norwegian populations (Olsen & Bergland, 2017). Norwegian reference values for the general adult population were recently established (Bergland & Strand, 2019). The SPPB has been used in people with mild and moderate intellectual disabilities (Torres-Unda et al., 2017). According to Oppewal and Hilgenkamp (2019a), the SPPB may be calculated from tests included in the fitness tests battery recommended for adults with intellectual disabilities.

The timed up-and-go (TUG) test assesses basic mobility skills (Podsiadlo & Richardson, 1991) and has been applied in people with intellectual disabilities (Enkelaar et al., 2013). The subjects were seated and instructed to stand up, walk 3 m, turn around, return to the chair and sit down. The task was to be performed at an ordinary walking speed. The TUG time was measured in seconds (Podsiadlo & Richardson, 1991).

The one-legged stance (OLS) test is a simple tool to measure static aspects of balance (Springer et al., 2007). The subjects were instructed to choose one foot to stand on for as long as possible for a maximum of 30 s without moving the standing foot. They were allowed to move the upper body and the raised foot. Timing was stopped if the participants moved their standing foot or put their raised foot on the floor. If participants managed to keep their balance and felt safe, they were instructed to do the same with closed eyes. The OLS has been found to have excellent interrater reliability in the general population (Springer et al., 2007) and good reliability, with an intraclass correlation coefficient of 0.88, in individuals with mild and moderate intellectual disabilities (Blomqvist et al., 2012).

To complete the SPPB, TUG and OLS, the participants had to be able to follow a basic set of instructions and to stand and walk independently. Walking aids, such as walkers or canes, could be used if necessary.

We defined non-completers as participants who either did not attend the test appointment or failed to perform the tests but completed the questionnaires.

2.5 | Procedure

The tests were administered by an experienced intellectual disability nurse (first author) or study nurses at the research unit. 'Intellectual disability nurse' is the international title used for professionals with a Norwegian 3-year university education for care and services for individuals with intellectual disabilities. The test administrators received training in administering the tests from a research technician (physiotherapist) (author AÅ) who had carried out the same tests in the population-based Tromsø Study (Jacobsen et al., 2012). The following adjustments to the test procedures were made in advance based on experiences in previous studies in the general population and the researchers' clinical knowledge regarding individuals with intellectual disabilities: (1) the participant and next of kin were greeted in a friendly manner in the sitting area to help the participant relax and feel safe; (2) information about the study and the task to be performed was provided; (3) the instructions for each test were simplified and concretized; and (4) the researcher demonstrated the task. The clinical measurements and physical performance tests were carried out in a fixed order, in a calm atmosphere and with necessary breaks.

2.6 | Data analyses

Statistical analysis was performed using IBM SPSS Statistics for Windows version 26.0. The data set was checked for normal distribution. Descriptive statistics including the frequency, mean, standard deviation (SD), median and range were used to describe population characteristics.

To assess the rate of completion of measurements and physical capability tests, numbers and frequencies in relation to the total study population were used.

Relationships of the variables with the completion/non-completion of the SPPB test were investigated with cross tabulations for nominal variables and with independent *t*-tests for continuous variables. For ordinal scales (GMFCS, CFCS) and non-normally distributed scales with low sample sizes (ABC-C subscales), comparisons were made with non-parametric statistics (Mann–Whitney *U*-test). Then, confounder-adjusted logistic regression analysis was performed to determine which variables were associated with the completion of the SPPB. A logistic regression analysis with the 'enter' method was performed with backward, stepwise removal of non-significant variables. The independent variables entered in the regression analysis were age, gender and variables with *p*-values <.10 in the univariate analysis (intellectual disability degree, BMI, GMFCS and CFCS levels, and hyperactivity and inappropriate speech scores). The results are presented as adjusted odds ratios (ORs). Model fit was investigated using the Hosmer–Lemeshow test. The amount of explained variance in the outcome was investigated using Nagelkerke's R^2.

Mean test scores were later compared with published normative mean values for the SPPB, TUG and OLS. To identify factors associated with physical capability test scores, ANOVA, and when appropriate, a post hoc least significant difference (LSD) test, was used. *p*-values <.05 were regarded as statistically significant, and when Bonferroni correction was applied, *p*-values <.01 were considered significant.

3 | RESULTS

3.1 | Participant characteristics

In total, 93 of 182 eligible individuals with intellectual disabilities, representing 51% of the identified intellectual disability population in the municipality of Tromsø, participated. A flowchart of the recruitment process is shown in Figure 1. Due to Norwegian ethical rules, only information on age and gender was available for the 89 individuals who did not participate in the current study. Non-participants, with a mean age of 42 years (SD = 16 years), were significantly older than participants, with a mean age of 34 years (SD = 14 years) ($p < .001$). The gender distribution was similar between the two groups.

Population characteristics are presented in Table 1; 58% were men, and 42% were women. There were 7 (8%) participants aged less than 20 years, 57 (61%) aged between 20 and 39 years, 23 (25%) aged between 40 and 60 and 6 (6%) aged more than 60years.

3.2 | Test completion

Table 2 shows the number of participants who completed each measurement and physical capability test. Fifty-three (57%) of the 93 participants completed one or more of the measurements or tests. Weight and height were the most frequently completed (57%) measurements. The completion rates were 46% for one or more subtests of the SPPB, 42% for the TUG, 35% for the OLS with eyes open and 20% for the OLS with eyes closed. Six of 26 participants (23%) with severe intellectual disability completed the walking test of the SPPB (23%). One of the participants could not follow the instructions for the balance tests in the SPPB, and another participant refused to continue after the walking test in

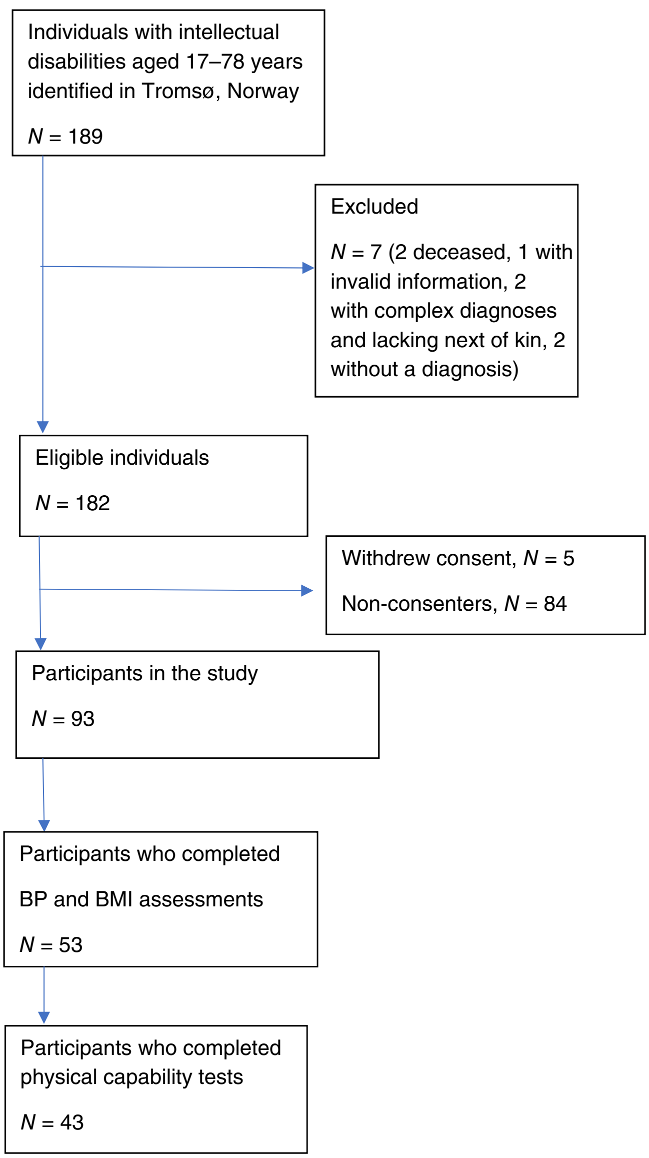

FIGURE 1 Flowchart of the study population selection

TABLE 1 Population characteristics ($N = 93$)

Characteristics	Total, $N = 93$
Gender, *n* (%)	
Men	54 (58)
Women	39 (42)
Age (year)	
Mean (SD)	34.2 (13.9)
Median (range)	30 (17–78)
Level of ID, *n* (%)	
Mild	31 (33)
Moderate	22 (24)
Severe	26 (28)
Profound	13 (14)
Unknown	1 (1)
Lives independently	14 (15)
Lives with family	25 (27)
Lives in a group home with care	53 (57)
Other	1 (2)
Work status, *n* (%)	
Regular paid work	1 (1)
Work with support	18 (26)
Day centre work	14 (19)
Day centre activity	17 (24)
Other	20 (28)
GMFCS[a], *n* (%)	
Level 1	45 (48)
Level 2	32 (34)
Level 3	5 (5)
Level 4–5	12 (12)
CFCS[b], *n* (%)	
Level 1	19 (20)
Level 2	15 (16)
Level 3	29 (31)
Level 4	23 (25)
Level 5	7 (7)

[a]Gross Motor Function Classification System, where level 1 is the highest level.
[b]Communication Function Classification System, where level 1 is the highest level.

TABLE 2 Participant completion rates for measurements and physical performance tests ($N = 93$)

	N	Height *N* (%)	Weight *N* (%)	Waist measurement *N* (%)	BP 1 *N* (%)	Balance SPPB *N* (%)	Walking SPPB *N* (%)	STS SPPB *N* (%)	Total SPPB *N* (%)	TUG *N* (%)	OLS1 *N* (%)	OLS2 *N* (%)
Total	93	50	51	51	49	41	43	39	43	39	29	19
Men	54 (58)	30 (60)	31 (61)	30 (59)	29 (59)	23 (56)	25 (58)	22 (56)	25 (58)	21 (54)	17 (59)	13 (68)
Women	39 (42)	20 (40)	20 (39)	21 (41)	20 (41)	18 (44)	18 (42)	17 (44)	18 (42)	18 (46)	12 (41)	6 (32)
Level of ID												
Mild	31 (33)	25 (50)	25 (49)	25 (49)	25 (51)	23 (56)	23 (53)	22 (56)	23 (53)	23 (59)	18 (62)	12 (63)
Moderate	22 (24)	14 (28)	14 (27)	14 (27)	14 (29)	13 (32)	14 (33)	13 (33)	14 (33)	12 (31)	11 (38)	7 (37)
Severe	26 (28)	10 (20)	10 (20)	10 (20)	7 (14)	5 (12)	6 (14)	4 (10)	6 (14)	4 (10)	0	0
Profound	13 (14)	1 (2)	2 (4)	2 (4)	3 (6)	0	0	0	0	0	0	0
GMFCS												
Level 1	45 (48)	27 (54)	27 (53)	27 (53)	26 (53)	26 (63)	26 (60)	26 (67)	26 (60)	25 (64)	21 (72)	15 (79)
Level 2	32 (34)	20 (40)	20 (39)	20 (39)	18 (37)	15 (37)	16 (37)	13 (33)	16 (37)	14 (36)	8 (28)	4 (21)
Level 3	5 (5)	1 (2)	1 (2)	1 (2)	1 (2)	0	1 (2)	0	1 (2)	0	0	0
Level 4–5	11 (12)	2 (4)	3 (6)	3 (6)	4 (8)	0	0	0	0	0	0	0
CFCS												
Level 1	19 (20)	14 (28)	13 (26)	14 (27)	14 (29)	13 (32)	13 (30)	12 (31)	13 (30)	13 (33)	10 (34)	7 (37)
Level 2	15 (16)	13 (26)	13 (26)	13 (25)	13 (26)	12 (29)	12 (28)	12 (31)	12 (28)	11 (28)	7 (24)	5 (26)
Level 3	29 (31)	15 (30)	16 (31)	15 (29)	14 (29)	12 (29)	14 (33)	12 (31)	14 (33)	12 (31)	9 (31)	6 (32)
Level 4–5	30 (32)	8 (16)	8 (16)	9 (18)	8 (16)	4 (10)	4 (9)	3 (8)	4 (9)	3 (8)	3 (10)	1 (5)

Note: In total 53 individuals completed one or more measurement or test. Numbers and percentages of participants in each subgroup with completed assessments are given.
Abbreviations: BP, blood pressure; CFCS, Communication Function Classification System; GMFCS, Gross Motor Function Classification Scale; ID, intellectual disability; OLS1, one-leg stance with eyes open; OLS2, one-leg stance with eyes closed; SPPB, Short Physical Performance Battery; STS, sit to stand; TUG, timed up-and-go.

the SPPB. The completion rate of the SPBB for people with mild to moderate intellectual disabilities was 70%. Except for one person, all participants with GMFCS levels 1 and 2 completed the physical capability tests. Four participants with the lowest communication function (CFCS levels 4–5) completed one or more physical capability tests. Twelve participants did not complete the OLS, mostly because the instructor or the participant regarded it as unsafe.

TABLE 3 Demographic and clinical characteristics of completers and non-completers of SPPB tests

Characteristics	Total, *N* = 93	SPPB completers, *n* = 43	SPPB non-completers, *n* = 50	*p*-Value
Gender, *n* (%)				
Men		25 (58)	29 (58)	.989
Women		18 (42)	21 (42)	
Age (year)				
Mean (SD)		34 (14.0)	34 (13.8)	.864
Level of ID, *n* (%)				
Mild*		23 (53)	8 (16)	.001
Moderate		14 (33)	8 (16)	
Severe		6 (14)	20 (40)	
Profound		0	13 (26)	
Unknown		0	1 (2)	
Down syndrome		14 (33)	9 (18)	.046
Weight*				
Mean (SD)	70.6 (21.6)	80.2 (21.7)	61.7 (17.4)	.001
Range	32.4–145.0	34.0–145.0	32.4–105.0	
Body mass index (BMI)*				
Mean (SD)	26.7 (6.7)	30.0 (6.6)	23.5 (5.1)	.001
Range	14.5–45.0	16.2–45.0	14.5–39.2	
≤18.5, underweight*, *n* (%)	9 (10)	1 (2)	8 (17)	.001
18.5–25, normal, *n* (%)	32 (36)	10 (23)	22 (48)	
26–29, overweight, *n* (%)	20 (23)	11 (26)	9 (20)	
≥30, obesity, *n* (%)	28 (31)	21 (49)	7 (15)	
GMFCS, *n* (%)				
Level 1	45 (48)	26 (60)	19 (38)	.01
Level 2	32 (34)	16 (37)	16 (32)	
Level 3	5 (5)	1 (2)	4 (8)	
Level 4–5	11 (13)	0	11 (22)	
CFCS, *n* (%)				
Level 1*	19 (20)	13 (30)	6 (12)	.001
Level 2	15 (16)	12 (28)	3 (6)	
Level 3	29 (31)	14 (33)	15 (30)	
Level 4	23 (25)	4 (9)	19 (38)	
Level 5	7 (7)	0	7 (14)	
ABC-C, mean (SD)	(*n* = 91)	(*n* = 42)	(*n* = 49)	
Irritability	4.5 (6.0)	3.7 (5.7)	5.2 (6.3)	.149
Social withdrawal	3.0 (3.6)	2.6 (3.4)	3.3 (3.8)	.246
Stereotypic behaviour	1.0 (1.9)	0.9 (1.6)	1.1 (2.2)	.304
Hyperactivity/non-compliance	5.3 (6.7)	4.0 (5.8)	6.5 (7.3)	.090
Inappropriate speech	1.8 (2.5)	2.2 (2.7)	1.4 (2.2)	.048

Note: Level of ID: chi-square test with three categories, with severe and profound ID collapsed into one category. BMI categories: chi-square test with three categories, with underweight and normal weight collapsed into one category.
**p*-Values < .01 after Bonferroni correction.

3.3 | Predictors of SPPB completion

As shown in Table 3, SPPB completers had a higher proportion of mild to moderate intellectual disability than non-completers ($p < .001$). SPPB completers had a higher BMI than non-completers, and 75% were overweight (26%) or obese (49%). In contrast, non-completers had a significantly higher proportion of underweight, at 17% compared to 2% ($\chi^2 = 15.92$, $p < .001$).

Multiple logistic regression analysis suggested a final model with two variables that predicted completion of the SPPB: higher cognitive function (level of intellectual disability) (OR 3.12, 95% CI 1.172–5.66, $p < .001$) and higher BMI (OR 0.86, 95% CI 0.78–0.94, $p = .001$). The Hosmer–Lemeshow test indicated a good model fit (χ^2: 3.09, df = 8 and $p = .929$). Nagelkerke's R^2 was 0.498.

3.4 | Physical capability test scores and score predictors among participants

The results of the SPPB and the three subtests are presented by gender and age in Table 4. The mean total SPPB score was 8.1 (range 0–12). The proportion of participants with a high score (11–12) was approximately 25%, indicating a ceiling effect. Younger participants performed better than older participants ($p = .040$). Higher total SPPB scores were predicted by younger age (<40 years) and less-severe intellectual disability. Regarding motor functioning, only participants with the two highest levels according to the GMFCS were compared, and there were significant differences in the SPPB total score (9.4 vs. 6.2, $p < .001$), walking speed (0.9 vs. 0.7 m/s, $p = .10$), and sit-to-stand results (12.8 vs. 18.7 s, $p < .01$). Participants with a normal BMI walked faster (1.0 m/s) than obese individuals (0.7 m/s, $p = .04$).

Fewer participants completed the TUG and OLS, and fewer significant associations were found, but the raw results yielded convergent findings.

3.5 | Physical capability test scores among participants compared to reference values in the general population

Considering the recently published normative mean values for the general Tromsø population (Bergland & Strand, 2019), the participants' scores were lower than those for both men and women aged more than 85 years (Table 4). Compared with the normative walking speed in the general population from the Tromsø Study, the participants had the same 4-m walking speed (m/s) as 85-year-old men in the general population (0.9 m/s), and women walked even more slowly (0.8 m/s).

As presented in Table 5, the total mean TUG score of the 39 participants was 12.1. There was a significant male bias in the study sample. Compared to the normative mean values for the general Norwegian population reported by Svinøy et al. (2020), the

TABLE 4 Means and confidence intervals of the SPPB ($n = 43$) scores for participants with ID and the normative mean values from a reference population

	Total SPPB score *M* (95% CI)	4 m walking speed (m/s) *M* (95% CI)	Sit to stand (s) *M* (95% CI)
Total	8.12 (7.26–8.98)	0.82 (0.74–0.91)	14.7 (12.8–16.7)
Gender			
Men	8.3 (6.97–9.59)	0.9 (0.74–0.97)	13.8 (11.95–15.72)
Women	7.9 (6.78–8.99)	0.8 (0.65–0.90)	15.9 (11.85–19.91)
Age			
<40 years	8.6 (7.71–9.54)*	0.9 (0.77–0.96)	13.7 (12.16–15.25)
≥40 years	6.6 (4.57–8.70)	0.7 (0.52–0.85)	18.1 (10.60–25.69)
Level of ID			
Mild	9.26 (8.22–10.30)**	0.91 (0.80–1.03)	12.6 (10.8–14.4)*
Moderate	7.29 (5.79–8.78)*	0.70 (0.56–0.85)	17.6 (12.6–22.5)*
Severe	5.67 (2.72–8.61)**	0.76 (0.50–1.02)	17.2 (11.8–22.7)
Normative mean values[a]			
Men age 40 years	11.99	1.32	7.4
Men age 80 years	10.41	0.99	11.4
Men age 85 years	9.80	0.90	12.4
Women age 40 years	11.88	1.31	7.9
Women age 80 years	9.75	0.96	12.3
Women age 85 years	9.06	0.89	12.9

Note: SPPB total score and 4 m walking speed: Higher scores indicate better functioning. Sit to stand in seconds: Fewer seconds indicate better functioning.
[a]Normative mean values from Bergland and Strand (2019).
*$p < .05$; **$p < .01$.

TABLE 5 Test results for participants in the TUG test and OLS test with eyes open (OLS1) and eyes closed (OLS2) and the normative mean values from a reference population

	TUG (s) Mean (95% CI), $n = 39$	OLS1 (s) Mean (95% CI), $n = 29$	OLS2 (s) Mean (95% CI), $n = 19$
Total	12.1 (11.05–13.07)	16.9 (12.52–21.22)	11.01 (6.39–15.63)
Gender			
Male	11.1 (9.76–12.37)*	18.5 (12.94–24.08)	9.6 (4.80–14.49)
Female	13.2 (11.69–14.75)	14.5 (6.72–22.37)	14.0 (0.65–27.29)
Age groups, years			
<40	11.7 (10.60–12.88)	17.7 (13.07–22.33)	11.5 (6.32–16.63)
≥40	13.1 (10.57–15.67)	11.7 (9.10–32.46)	7.0 (22.46–36.61)
Level of ID			
Mild	11.1 (9.77–12.53)	19.3 (13.71–24.97)	11.6 (5.66–17.48)
Moderate	13.2 (11.61–14.78)	12.8 (5.51–20.16)	10.0 (0.12–19.96)
Severe	13.9 (8.82–18.95)	–	–
Normative mean values[a]			
Men aged 40–49	–	40.1	7.3
Men aged 60/60–69	8.2	28.7	3.1
Men aged 80/80–99	10.4	5.6	1.3
Men aged 84 years	11.2	–	
Women aged 40–49	–	40.4	7.4
Women aged 60/60–69	7.8	25.1	2.5
Women aged 80/80–99	11.0	7.4	1.4
Women aged 84 years	12.0	–	–

[a]The normative values for TUG scores are from Svinøy et al. (2020), and those for the OLS scores are from Springer et al. (2007). The OLS scores used are for the age groups 40–49, 60–69 and 80–99 years.
$^{*}p < .05$.

mean scores in the present study sample were lower than those for both men and women aged more than 80 years. The scores of women in the study sample were lower than the normative values for both men and women aged more than 84 years (Svinøy et al., 2020).

Additionally, scores on the OLS with eyes open, performed by 29 participants, and the OLS with eyes closed, performed by 19 participants, were lower than the reference values published by Springer et al. (2007).

4 | DISCUSSION

The completion rates for the SPPB, TUG and OLS were 46%, 42% and 31%, respectively. The SPPB had good feasibility for individuals with mild and moderate intellectual disability and low feasibility for individuals with severe intellectual disability, in accordance with a study by Oppewal and Hilgenkamp (2019a). The most important independent explanatory factors for non-completion were a more severe degree of intellectual disability and lower BMI. Compared to the normative reference values from the general Norwegian population, the participants' physical capability results were significantly worse than those of older adults.

4.1 | Test completion

Epidemiological studies on physical test performance in adults with intellectual disabilities are scarce (Oppewal & Hilgenkamp, 2019a). Half of the participants who completed questionnaires did not complete the physical capability tests, a result in line with the large Healthy Ageing and Intellectual Disability (HA-ID) study ($n = 10{,}150$, aged 50 years and above) in the Netherlands (Hilgenkamp et al., 2013). Inclusion criteria will be crucial for the degree of test completion. The HA-ID study had broader inclusion criteria than our study, as people with borderline intellectual disabilities were also included. In our study, the SPPB, for which participants obtained a score even if just one subtest was completed, had a higher completion rate than the TUG and OLS. No participants with severe intellectual disability completed the OLS, mainly because the instructor or the participant considered it to be unsafe. Therefore, it was not possible to conclude if the instructions were too complex or the participant was being asked for perform a skill they typically do not perform. However, one of the participants could not follow the instructions for the balance test in the SPPB, and another participant refused to continue with testing after the walking test in the SPPB.

The simple walking test, which is the first subtest in the SPPB, had the highest completion rate. The finding of good feasibility of the walking test has also been reported by others (Enkelaar et al., 2013; Hilgenkamp et al., 2013). The good feasibility of the TUG is in accordance with the findings of Enkelaar et al. (2013). The sit-to-stand SPPB subtest has similarities to the 30-second chair stand test used by Dijkhuizen et al. (2018) in 29 individuals with moderate to severe intellectual and visual disabilities. They reported better feasibility than that in the present study. The divergent findings may emphasise the importance of detailed sample descriptions and the uniformity of tests.

In addition to disabilities, reasons for not completing tests may include difficulties with attending the examination due to lack of transport, support persons or desire to perform tests (Brooker et al., 2014). These proposed reasons are in line with our experiences. Research involving people with intellectual disabilities often meets practical challenges, such as recruiting participants by engaging caretakers and ensuring that the participants understand the assessment tasks and can follow instructions (Brooker et al., 2014; Feldman et al., 2014; Mulhall et al., 2018).

A more pedagogical approach to testing may lead to better success in testing, even for individuals with more severe intellectual disabilities (Dijkhuizen et al., 2018). Motivational issues of importance in physical activity participation could be of importance in test participation (Michalsen et al., 2020).

4.2 | Characteristics of the SPPB test completers

Increased occurrence of both overweight and underweight among adults with intellectual disabilities has been observed in several studies (Folch et al., 2019; Oppewal & Hilgenkamp, 2018; Torres-Unda et al., 2017). We found that completers had higher rates of overweight and obesity than non-completers, who had a higher rate of underweight. These findings call for special attention to adults with intellectual disabilities who do not attend or complete tests in health surveys, as they could be at high risk for poor general health. Consistent with other studies, the second main explanatory factor for SPPB completion was less-severe intellectual disability (Hilgenkamp et al., 2013). The other significantly associated factors in the univariate analysis, namely, gross motor and communication function and hyperactivity, were not significant in the final multiple logistic regression model.

4.3 | Physical capability test result compared to reference values from the general population

Physical capability results for the SPPB and the TUG were on average markedly poorer than recently published reference values for the Norwegian general population (Bergland & Strand, 2019; Svinøy et al., 2020). The participants had a mean age of 34 years but had, on average, poorer performance on the SPPB than 85-year-olds in the general population of the same city (Bergland & Strand, 2019), and TUG scores were lower than the reference values for 80-year-olds (Svinøy et al., 2020). The test results were comparable to those in a somewhat older population with intellectual disabilities (mean age 48.9) reported by Torres-Unda et al. (2017). Even poorer TUG test results than in the present study were found in other studies of individuals with intellectual disabilities (Enkelaar et al., 2013; Hakim et al., 2017). Fewer participants completed the OLS than the SPPB and TUG. The OLS with eyes open was also used in a study by Enkelaar et al. (2013) in older persons with mild to moderate intellectual disabilities, in which the mean scores were far lower than those in the present study. The finding of a ceiling effect on the SPPB indicates that the SPPB should not be used as the only physical capability test in a screening battery. The test battery proposed by Oppewal and Hilgenkamp (2019a) involves tests that were selected based on feasibility, reliability, validity and possibility for interpretation of the results. The OLS is included in this battery, but it requires holding the position for a maximum of 10 s, which is in contrast with our procedure that required holding the position for a maximum of 30 s. A ceiling effect was found for the OLS in young people with mild to moderate intellectual disabilities in the study by Blomqvist et al. (2012), but this result was not found in the present study. Correlation analysis was not performed between the physical capability tests used in this study. Validation analysis of tests could be relevant for future research, as well as validation of physical capability tests against measures of activities of daily living. Developing and exploring physical capability tests for individuals with more severe intellectual disability should be a research focus, as it is now a neglected research area.

A strength of this study is the municipality-based design as part of a health indicator study. As in a previous Norwegian prevalence study (Søndenaa et al., 2010), the study sample was mainly restricted to individuals with intellectual disabilities receiving some sort of municipality-based services. Recruitment of approximately 50% of the eligible individuals in the municipality is regarded as a satisfactory result compared to those in other studies in people with intellectual disabilities (Hilgenkamp et al., 2013) and in the Tromsø Study in the general population in the same city (The Tromsø Study, 2020). Standardised physical capability tests used in population-based studies allowed the comparison of the results with reference values from the general population in the same geographic area. Except in the Netherlands, little research has been conducted on this important topic in adults with intellectual disabilities.

The generalizability of the results is limited by the small sample size and the younger mean age in participants than in non-participants. In line with another study (Lahtinen et al., 2007), we found higher test scores in younger than older adult individuals with intellectual disabilities. Therefore, it is possible that if the participation rate had been higher, the physical capability test results would have been even poorer. Since not all participants' heights and weights were measured at the study site, we had to rely on self-reports for non-attenders. This could have affected the precision of the reported BMI values.

A lack of validation of the GMFCS and CFCS tools, as well as physical capability tests in adults with intellectual disabilities is another limitation in this study.

5 | CONCLUSIONS

The well-established SPPB and TUG tests had good feasibility for people with mild and moderate intellectual disability. Completion rates in those with severe intellectual disability were low. Participants' test scores were well below normative reference values, which calls for increased attention to physical activity support for individuals with intellectual disabilities of all ages and the identification of physical capability tests that can be applied in a wider population with intellectual disabilities. Last, individuals who fail to attend health surveys could be at risk of health conditions associated with underweight.

ACKNOWLEDGEMENTS

The authors want to thank the individuals with intellectual disabilities who participated, their families and the services involved in the municipality of Tromsø. From the University Hospital of North Norway, we thank Brita Lena Hansen and Inger Sperstad at the research unit and Christian Sørensen at the Department of Habilitation for contributions to data collection and Per Wilhelmsen for administrative support. We also thank Anita Tymi from the Norwegian Association for Persons with Intellectual Disabilities (NFU) for her contribution. Initial parts of this project were made possible by funding from the Institute of Health and Society, Research Centre for Habilitation Model and Services (CHARM), University of Oslo, Norway, and the main funding of a Ph.D. student was from the Norwegian Dam foundation.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author, (MIO). The data are not publicly available due to restrictions (their containing information that could compromise the privacy or research participants).

ORCID

Monica Isabel Olsen https://orcid.org/0000-0002-4955-2231

REFERENCES

Aman, M. G., & Singh, N. N. (1994). *Aberrant behavior checklist-community supplementary manual*. East Aurora, NY: Slosson Educational Publications.

Aman, M. G., & Singh, N. N. (2017). *Aberrant behavior checklist manual*. 2nd edn. East Aurora, NY: Slosson Educational Publications.

Bailey, K. V., & Ferro-Luzzi, A. (1995). Use of body mass index of adults in assessing individual and community nutritional status. *Bulletin of the World Health Organization*, *73*(5), 673–680.

Bergland, A., Jørgensen, L., Emaus, N., & Strand, B. H. (2017). Mobility as a predictor of all-cause mortality in older men and women: 11.8 year follow-up in the Tromsø study. *BMC Health Services Research*, *17*(1), 22. https://doi.org/10.1186/s12913-016-1950-0

Bergland, A., & Strand, B. H. (2019). Norwegian reference values for the Short Physical Performance Battery (SPPB): The Tromsø study. *BMC Geriatrics*, *19*(1), 216. https://doi.org/10.1186/s12877-019-1234-8

Blomqvist, S., Wester, A., Sundelin, G., & Rehn, B. (2012). Test–retest reliability, smallest real difference and concurrent validity of six different balance tests on young people with mild to moderate intellectual disability. *Physiotherapy*, *98*(4), 313–319. https://doi.org/10.1016/j.physio.2011.05.006

Brooker, K., Van Dooren, K., Tseng, C. H., McPherson, L., Lennox, N., & Ware, R. (2014). Out of sight, out of mind? The inclusion and identification of people with intellectual disability in public health research. *Perspectives in Public Health*, *135*(4), 204–211. https://doi.org/10.1177/1757913914552583

Cooper, S. A., Allan, L., Greenlaw, N., McSkimming, P., Jasilek, A., Henderson, A., McCowan, C., Kinnear, D., & Melville, C. (2020). Rates, causes, place and predictors of mortality in adults with intellectual disabilities with and without down syndrome: Cohort study with record linkage. *BMJ Open*, *10*(5), e036465. https://doi.org/10.1136/bmjopen-2019-036465

Cooper, S. A., McLean, G., Guthrie, B., McConnachie, A., Mercer, S., Sullivan, F., & Morrison, J. (2015). Multiple physical and mental health comorbidity in adults with intellectual disabilities: Population-based cross-sectional analysis. *BMC Family Practice*, *16*(1), 110. https://doi.org/10.1186/s12875-015-0329-3

Dijkhuizen, A., Douma, R. K., Krijnen, W. P., Van der Schans, C. P., & Waninge, A. (2018). Measuring quadriceps strength in adults with severe or moderate intellectual and visual disabilities: Feasibility and reliability. *Journal of Applied Research in Intellectual Disabilities*, *31*(6), 1083–1090. https://doi.org/10.1111/jar.12468

Enkelaar, L., Smulders, E., Lantman-de Valk, H. V. S., Weerdesteyn, V., & Geurts, A. C. H. (2013). Clinical measures are feasible and sensitive to assess balance and gait capacities in older persons with mild to moderate intellectual disabilities. *Research in Developmental Disabilities*, *34*(1), 276–285. https://doi.org/10.1016/j.ridd.2012.08.014

Feldman, M. A., Bosett, J., Collet, C., & Burnham-Riosa, P. (2014). Where are persons with intellectual disabilities in medical research? A survey of published clinical trials. *Journal of Intellectual Disability Research*, *58*(9), 800–809. https://doi.org/10.1111/jir.12091

Folch, A., Salvador-Carulla, L., Vicens, P., Cortés, M. J., Irazábal, M., Muñoz, S., Rovira, L., Orejuela, C., González, J. A., & Martínez-Leal, R. (2019). Health indicators in intellectual developmental disorders: The key findings of the POMONA-ESP project. *Journal of Applied Research in Intellectual Disabilities*, *32*(1), 23–34. https://doi.org/10.1111/jar.12498

Guralnik, J. M., Simonsick, E. M., & Ferrucci, L. (1994). A Short Physical Performance Battery assessing lower extremity function: Association with self-reported disability and prediction of mortality and nursing home admission. *Journal of Gerontology*, *49*(2), 85–94. https://doi.org/10.1093/geronj/49.2.M85

Hakim, R., Ross, M., Runco, W., & Kane, M. (2017). A community-based aquatic exercise program to improve endurance and mobility in adults with mild to moderate intellectual disability. *Journal of Exercise Rehabilitation*, *13*(1), 89–94. doi:10.12965/jer.1732838.419

Halvorsen, M., Aman, M. G., Mathiassen, B., Brøndbo, P. H., Steinsvik, O. O., & Martinussen, M. (2019). Psychometric properties of the norwegian aberrant behavior checklist and diagnostic relationships in a neuro-pediatric sample. *Journal of Mental Health Research in Intellectual Disabilities*, *12*, 234–255. https://doi.org/10.1080/19315864.2019.1630872

Havercamp, S. M., & Scott, H. M. (2015). National health surveillance of adults with disabilities, adults with intellectual and developmental disabilities, and adults with no disabilities. *Disability and Health Journal*, *8*(2), 165–172. https://doi.org/10.1016/j.dhjo.2014.11.002

Heslop, P., Blair, P. S., Fleming, P., Hoghton, M., Marriott, A., & Russ, L. (2014). The confidential inquiry into premature deaths of people with intellectual disabilities in the UK: A population-based study. *The Lancet*, *383*(9920), 889–895. https://doi.org/10.1016/S0140-6736(13)62026-7

Hidecker, M. J. C., Paneth, N., Rosenbaum, P. L., Kent, R. D., Lillie, J., Eulenberg, J. B., Chester, K., Johnson, B., Michalsen, L., Evatt, M., & Taylor, K. (2011). Developing and validating the Communication Function Classification System for individuals with cerebral palsy. *Developmental Medicine & Child Neurology*, *53*(8), 704–710. https://doi.org/10.1111/j.1469-8749.2011.03996.x

Hilgenkamp, T. I. M., Van Wijck, R., & Evenhuis, H. M. (2012). Low physical fitness levels in older adults with ID: Results of the HA-ID study. *Research in Developmental Disabilities*, *33*(4), 1048–1058. https://doi.org/10.1016/j.ridd.2012.01.013

Hilgenkamp, T. I. M., Van Wijck, R., & Evenhuis, H. M. (2013). Feasibility of eight physical fitness tests in 1,050 older adults with intellectual disability: Results of the healthy ageing with intellectual disabilities study. *Intellectual and Developmental Disabilities*, *51*(1), 33–47. https://doi.org/10.1352/1934-9556-51.01.033

Jacobsen, B. K., Eggen, A. E., Mathiesen, E. B., Wilsgaard, T., & Njølstad, I. (2012). Cohort profile: The Tromsø study. *Journal of International Epidemiologi*, *41*(4), 961–967. https://doi.org/10.1093/ije/dyr049

Lahtinen, U., Rintala, P., & Malin, A. (2007). Physical performance of individuals with intellectual disability: A 30-year follow-up. *Adapted Physical Activity Quarterly*, *24*(2), 125–143. https://doi.org/10.1123/apaq.24.2.125

Maltais, J., Morin, D., & Tassé, M. J. (2020). Healthcare services utilization among people with intellectual disability and comparison with the general population. *Journal of Applied Research in Intellectual Disabilities*, *33*(3), 552–564. https://doi.org/10.1111/jar.12698

McCormick, A., Brien, M., Plourde, J., Wood, E., Rosenbaum, P., & McLean, J. (2007). Stability of the gross motor function classification system in adults with cerebral palsy. *Developmental Medicine & Child Neurology*, *49*(4), 265–269. https://doi.org/10.1111/j.1469-8749.2007.00265.x

Michalsen, H., Wangberg, S. C., Anke, A., Hartvigsen, G., Jaccheri, L., & Arntzen, C. (2020). Family members and health care workers' perspectives on motivational factors of participation in physical activity for people with intellectual disability: A qualitative study. *Journal of Intellectual Disability Research*, *64*(4), 259–270. https://doi.org/10.1111/jir.12716

Mulhall, P., Taggart, L., Coates, V., McAloon, T., & Hassiotis, A. (2018). A systematic review of the methodological and practical challenges of undertaking randomised-controlled trials with cognitive disability populations. *Social Science & Medicine*, *200*, 114–128. https://doi.org/10.1016/j.socscimed.2018.01.032

Olsen, C. F., & Bergland, A. (2017). Reliability of the Norwegian version of the short physical performance battery in older people with and without dementia. *BMC Geriatrics*, *17*(1), 124. https://doi.org/10.1186/s12877-017-0514-4

Oppewal, A., Festen, D. A. M., & Hilgenkamp, T. I. M. (2018). Gait characteristics of adults with intellectual disability. *American Journal on Intellectual and Developmental Disabilities*, *123*(3), 283–299. https://doi.org/10.1352/1944-7558-123.3.283

Oppewal, A., & Hilgenkamp, T. I. M. (2018). The association between gait and physical fitness in adults with intellectual disabilities. *Journal of Intellectual Disability Research*, *62*(5), 454–466. https://doi.org/10.1111/jir.12484

Oppewal, A., & Hilgenkamp, T. I. M. (2019a). Adding meaning to physical fitness test results in individuals with intellectual disabilities. *Disability and Rehabilitation*, *42*, 1406–1413. https://doi.org/10.1080/09638288.2018.1527399

Oppewal, A., & Hilgenkamp, T. I. M. (2019b). Physical fitness is predictive for 5-year survival in older adults with intellectual disabilities. *Journal of Applied Research in Intellectual Disabilities*, *32*(4), 958–966. https://doi.org/10.1111/jar.12589

Oppewal, A., Hilgenkamp, T. I. M., Van Wijck, R., Schoufour, J. D., & Evenhuis, H. M. (2015). Physical fitness is predictive for a decline in the ability to perform instrumental activities of daily living in older adults with intellectual disabilities: Results of the HA-ID study. *Research in Developmental Disabilities*, *41-42*, 76–85. https://doi.org/10.1016/j.ridd.2015.05.002

Palisano, R., Rosenbaum, P., Walter, S., Russell, D., Wood, E., & Galuppi, B. (1997). Development and reliability of a system to classify gross motor function in children with cerebral palsy. *Developmental Medicine & Child Neurology*, *39*(4), 214–223. https://doi.org/10.1111/j.1469-8749.1997.tb07414.x

Perera, B., Audi, S., Solomou, S., Courtenay, K., & Ramsay, H. (2019). Mental and physical health conditions in people with intellectual disabilities: Comparing local and national data. *British Journal of Learning Disabilities*, *48*(1), 19–27. https://doi.org/10.1111/bld.12304

Podsiadlo, D., & Richardson, S. (1991). The timed "up & go": A test of basic functional mobility for frail elderly persons. *Journal of the American Geriatrics Society*, *39*(2), 142–148. https://doi.org/10.1111/j.1532-5415.1991.tb01616.x

Skorpen, S., Nicolaisen, M., & Langballe, E. M. (2016). Hospitalisation in adults with intellectual disabilities compared with the general population in Norway. *Journal of Intellectual Disability Research*, *60*(4), 365–377. https://doi.org/10.1111/jir.12255

Søndenaa, E., Rasmussen, K., Nøttestad, J. A., & Lauvrud, C. (2010). Prevalence of intellectual disabilities in Norway: Domestic variance. *Journal of Intellectual Disability Research*, *54*(2), 161–167. https://doi.org/10.1111/j.1365-2788.2009.01230.x

Springer, B. A., Marin, R., Cyhan, T., Roberts, H., & Gill, N. W. (2007). Normative values for the unipedal stance test with eyes open and closed. *Journal of Geriatric Physical Therapy*, *30*(1), 8–15. https://doi.org/10.1519/00139143-200704000-00003

Statistics Norway. (2019). Statistikkbanken. https://www.ssb.no/statbank/

Sverdrup, K., Bergh, S., Selbæk, G., Røen, I., Kirkevold, Ø., & Tangen, G. G. (2018). Mobility and cognition at admission to the nursing home – A cross-sectional study. *BMC Geriatrics*, *18*(1), 30. https://doi.org/10.1186/s12877-018-0724-4

Svinøy, O. E., Hilde, G., Bergland, A., & Strand, B. (2020). Timed up and go reference values for older adults with and without noncommunicable diseases and arthritis. *Osteoarthritis and Cartilage*, *28*, S361–S362. https://doi.org/10.1016/j.joca.2020.02.564

Tassé, M. J., Balboni, G., Navas, P., Luckasson, R., Nygren, M. A., Belacchi, C., Bonichini, S., Reed, G. M., & Kogan, C. S. (2019). Developing behavioural indicators for intellectual functioning and adaptive behaviour for ICD-11 disorders of intellectual development. *Journal of Intellectual Disability Research*, *63*(5), 386–407. https://doi.org/10.1111/jir.12582

The Tromsø Study. (2020). UiT norges arktiske universitet. https://www.uit.no/forskning/forskningsgrupper/sub?p_document_id=36727&sub_id=503778

Torres-Unda, J., Polo, V., Dunabeitia, I., Bidaurrazaga-Letona, I., García-Gil, M., Rodriguez-Larrad, A., & Irazusta, J. (2017). The Feldenkrais method improves functioning and body balance in people with intellectual disability in supported employment: A randomized clinical trial. *Research in Developmental Disabilities*, *70*(C), 104–112. https://doi.org/10.1016/j.ridd.2017.08.012

World Health Organization. (2019). *International statistical classification of diseases and related health problems*. 10th revision, Geneva, Switzerland: World Health Organization.

How to cite this article: Olsen, M. I., Halvorsen, M. B., Søndenaa, E., Strand, B. H., Langballe, E. M., Årnes, A., Michalsen, H., Larsen, F. K., Gamst, W., Bautz-Holter, E., & Anke, A. (2021). Factors associated with non-completion of and scores on physical capability tests in health surveys: The North Health in Intellectual Disability Study. *Journal of Applied Research in Intellectual Disabilities*, *35*(1), 231–242. https://doi.org/10.1111/jar.12942