Journal of Physical Activity and Health, 2013, 10, 1048-1056

JOURNAL OF
Physical Activity & Health
Official Journal of ISPAH
www.JPAH-Journal.com
ORIGINAL RESEARCH

Physical Activity in a Large Sample of Adults With Intellectual Disabilities

Timothy L. Barnes, Erin K. Howie, Suzanne McDermott, and Joshua R. Mann

***Background*:** Few studies have documented physical activity (PA) and overweight and obesity in adults with intellectual disabilities (ID) using both self-report and objective methods. We sought to characterize PA in adults with ID and examine the associations between self-reported activity types, objectively-measured PA, and objectively-measured body mass index (BMI). ***Methods*:** Self-reported PA and BMI were measured on 294 adults with ID. Accelerometry was collected on 131 of those participants. Differences in BMI and accelerometry by demographic factors and activity types were examined. ***Results*:** Among the participants, 79.6% were overweight or obese and 23.7% met recommended PA guidelines. The mean amount of moderate-to-vigorous PA (MVPA) per week was 108.6 minutes. The most common activities reported were walking (53.7%) and inside chores (42.5%). Twenty-six percent reported no activity. Biking and jogging/running was associated with lower BMI. Self reports of playing basketball, softball, and outside chores were associated with increased MVPA. ***Conclusion*:** In this sample of adults with ID, most participants were overweight or obese and PA levels were below national averages. Select self-reported activities and greater objectively measured PA were associated with lower BMI.

***Keywords*:** accelerometers, BMI

One of the overarching goals of Healthy People 2020 is to reduce health disparities and improve health among all population subgroups.[1] Adults with disabilities are the largest minority population in the United States, with 1 in 5 adults reporting a disability and 1 in 14 adults over 15 years of age reporting an intellectual disability.[2] Intellectual disabilities (ID) are characterized by significant limitations both in intellectual functioning and in adaptive behavior, which covers many everyday social and practical skills.[3,4] Causal factors for ID can be genetic (chromosomal or hereditary disorders/factors), such as in Down syndrome, acquired (congenital and developmental) in fetal alcohol syndrome and infection, or a cluster of contributing social factors, such as poverty.[3]

Physical activity (PA) is an important factor in improving health outcomes and associated with reduced risk of heart disease, stroke, hypertension, cancer, diabetes, and obesity.[5] According to current National Physical Activity Guidelines, all adults should receive 150 minutes of moderate-to-vigorous PA (MVPA) per week.[1] However, the 2009 Behavioral Risk Factor Surveillance Survey (BRFSS) reports that 49% of adults in the general U.S. population do not meet these recommended guidelines.[6] In the majority of studies that have examined physical activity in adults with ID, PA guidelines have also not been met.[7,11–13] Furthermore, in a review of 14 articles, Temple and colleagues reported a range of only 17.5%–33% adults with ID meet the recommended amount of PA.[11] Variations in the study methods to measure PA, including self-report, proxy-report, pedometers, and accelerometers, account for this range.[11] In addition, the lack of appropriately powered representative samples, validated PA questionnaires, and the accuracy of responses have also contributed to substantial variation and potential bias in the characterization of PA in adults with ID.[11]

Obesity risk and prevalence has been linked with a lack of physical activity (PA) in both the general population and in individuals with ID.[12] Studies have shown lower BMI among individuals with higher levels of PA and fitness.[5,13] Data from the National Health Interview Survey (1985–2000) revealed that 35% of adults with ID are obese and an additional 29% are overweight compared with 20% and 34% in adults without ID, respectively.[8] In other studies, adults with ID were more likely to be obese when compared with nondisabled adults.[9,14]

Given the complexity of characterizing PA, many tools, subjective and objective, have been developed to measure PA in populations. Studies in adults with ID have used many of these methods including self-report and proxy reports,[15–18] direct observation,[19] pedometers[20–22] and accelerometers.[10,19,23] The use of self-report

Barnes is with the Dept of Epidemiology and Biostatistics, University of South Carolina, Columbia, SC. Howie is with the Dept of Exercise Science, University of South Carolina, Columbia, SC. McDermott and Mann and with the Dept of Family and Preventive Medicine, School of Medicine, University of South Carolina, Columbia, SC.

and proxy report questionnaires to capture PA in adults with ID has been used more than any other method.[11] Self-report provides contextual information such as the type and location of activities that may be important for promoting physical activity. However, the use of questionnaires in this population presents many issues related to comprehension and recall by the participants and possibly overestimation of activity by proxy (ie, care providers).[11,24] In addition, most questionnaires used to measure PA in adults with ID, have not been properly validated in this population group.[11,25] In contrast, accelerometry has provided a multidimensional, objective measure of PA compared with self-report or proxy surveys and other methods. However, the studies using accelerometers in this population have had small sample sizes, making generalizations to larger ID populations difficult. For example, Frey is one of the only studies[13] to use accelerometry in adults with ID. With a small sample size of 22 individuals with ID and 26 controls (individuals without ID), Frey found that adults with ID averaged 20 minutes of MVPA per day compared with 56 minutes in active adults without ID.[10] Two other studies by Temple and colleagues have also used accelerometry to characterize PA in adults with ID with small sample sizes of 6 and 37, respectively.[19,23]

Given the options, it has been suggested that a combination of subjective and objective measures is best to describe PA, however, only a small number of studies have used multiple measures adults with ID.[19–21,26]

The purpose of this study is to describe physical activity using 2 methods, accelerometry and a self-report questionnaire, along with objectively measured BMI in a large sample of adults with ID. Our primary hypothesis is adults with less physical activity, either self-report or accelerometry, will have greater BMI. In addition, we hypothesized that, consistent with other studies in the literature,[7,15,18,27] older adults with ID and those individuals living with family or alone, will have lower levels of PA and higher BMI compared with younger adults and individuals living in supervised homes, respectively. It is also expected that adults with ID who self-report participating in physical activities will have lower BMI and higher levels of objectively measured PA (MVPA). However, due to limited project and staffing resources we did not attempt to cross-validate self-report physical activities and PA measured by accelerometry because PA data by the 2 methods was not collected concurrently.

Methods

This study received full Board approval by the University of South Carolina Institutional Review Board. The participants were adults with ID, age 18–65 years, recruited through a network of community disability agencies in South Carolina, North Carolina, and Georgia between January 2007 and August 2009. Local disability agencies provide residential, day services, including supported employment, and family support services to individuals with ID and their families. Staff members of the agencies asked individuals with ID who lived in the community if they were interested in participating in a health education program that included PA and nutrition instruction. Individuals were eligible for participation if they were 18–65 years of age, have agency staff report mild to moderate ID, were ambulatory, were not underweight (BMI < 18.5), and did not have any serious medical conditions, were able to comprehend and communicate verbally, and were able to give informed consent.

Study participants were classified as having ID by criteria established by the state agencies. These criteria included tests of adaptive functioning and intelligence testing, administered by a licensed psychologist. Once individuals agreed to be recruited and were considered eligible for participation the informed consent process was initiated. The local disability agency staff knew which eligible individuals had legal guardians and all legal guardians were asked to participate in the consent process. If the individual did not have a legal guardian they were able to sign the informed consent, however family members and staff active in the individual's circle of support were notified that the individual chose to participate in the study.

Since data collection involved asking each participant questions regarding demographic characteristics and self reported activities each individual was administered the Short Portable Mental Status Questionnaire (SPMSQ) to determine their ability to comprehend the interview questions and the content of the intervention. The SPMSQ was developed to be a brief, clinically useful tool to assess cognitive function and consists of 10 questions that assess the individual's orientation, memory and cognitive function.[28] The SPMSQ has a test-retest reliability of (0.82) at 4 weeks.[28] Participants were eligible if they were able to answer at least 3 of 10 questions correctly. The SPMSQ was used as an assessment of cognitive ability because no other brief, easily usable scale was found in the literature.

A cutoff of 7 errors on the SPMSQ was selected based on Pfeiffer's original development of the SPMSQ as the cutoff identifying those with severe mental impairment. Studies with dementia patients have used more conservative criteria of 6 errors. The cutoff of 7 wrong answers allowed us to capture the majority of people who live in group homes for adults with ID. During pretesting we determined the dementia standard would eliminate adults with ID who were verbal and able to learn through demonstration and repetition. We found 3 correct responses were a more specific criteria for our target group. A total of 602 individuals were screened and 140 (23.3%) were not eligible due to low scores on the SPMSQ. An additional 19 individuals decided to not participate in the study beyond this point.

Measurement assessments were obtained from 443 individuals in whom 426 individuals met inclusion criterion. Seventeen individuals had serious medical conditions, including physician diagnosed heart and/or respiratory conditions, which prevented intense activity, and thus these individuals were excluded. For the purpose

of this analysis, the number of participants was further reduced to 294 individuals with complete BMI and self reported activity data. For the objectively measured PA we only included a subset of 131 with complete accelerometry data.

Trained research staff obtained demographic information from local agency staff and verified this information with the participants. All questionnaires were administered verbally to the participants to accommodate literacy limitations or misinterpretations. Research staff training included reading, individual discussion about challenges and solutions, hands-on experience using paid actors with ID, and supervised field training. Assessments were completed in duplicate, discrepancies were discussed and training sessions continued until interrater reliability reached at least 80%.

Demographic and Anthropometric Measures

Demographic information included age, sex, race, and housing type. Weight was measured to the nearest 0.5 kg with participants dressed in lightweight clothing without shoes using a Seca 880 model scale. Height was measured to the nearest 0.5 cm using a portable Shorr heightboard. All measurements were taken in duplicate, and if the measurements differed by more than 1 kg or 1 cm, respectively, the measurements were repeated. BMI (kg/m^2) was calculated and categorized using National Institutes of Health guidelines from the mean height and weight recorded.[29]

Physical Activity Measurements

Physical activity was objectively measured over 7 days using Actigraph accelerometers (Actigraph Inc, Shalimar, FL) worn at the waist. Participants were given accelerometers at an initial visit and instructed to wear them at the waist daily when awake. Accelerometers were collected at a second visit that occurred 7 or more days later. Accelerometer data were downloaded using software provided by Actigraph. Participants were excluded if they did not have 4 days of valid wear time, including at least 1 weekend day, for at least 8 hours per day[30–32] during the first 7 days of possessing the accelerometer. Counts of minutes of moderate-intensity physical activity were calculated using modified Freedson cut-points.[33,34]

At the second visit, accelerometers were collected and trained staff administered the Physical Activity Checklist Interview (PACI). The PACI is an interview-administered instrument to assess the previous day recall of 24 activities related to PA and has been shown to be correlated with heart rate index (r = .51) and accelerometry (r = .33).[35] We intended to use the questionnaire was to use the PACI questions as a proxy of PA, not to quantify physical activity levels. The self report activity and accelerometry were not recorded concurrently. For the activities of walking, jogging, or running, research staff emphasized to participants that these activities were only included if they were for sustained periods during exercise and/or play. During training, assessments were repeated until interrater reliabilities of the research staff was at least 80%.

Statistical Analysis

Demographic (age, sex, race, BMI, and housing status) and self-report activity data were complete and available for all 294 adults participating in the study. Of the 294 participants, only 131 individuals had complete accelerometry data. One hundred sixty-three individuals had incomplete data based on established criteria.

Differences in BMI and objectively PA by demographic factors and activity types were tested using t and Chi-square tests. A series of linear regression models and analysis of covariance (ANCOVA), were used to evaluate the effect each individual activity had on BMI and accelerometer measured PA (MVPA) before and after adjustment for age and sex. All statistical analyses were performed using SAS 9.2 (Cary, NC).

Results

Demographic characteristics did not significantly differ between the total sample (n = 294), those with complete accelerometer data (n = 131), or those individuals with incomplete accelerometer data as shown in Table 1. Using the total sample, the mean age was 37.8 years. The majority of participants were non-Hispanic Black (58.8%), approximately half were female (51.7%), and 41.8% lived in group homes. The mean BMI was 33.0 kg/m^2 (SD = 8.8) and 79.6% of individuals were overweight or obese. Females had significantly higher BMI and lower PA levels than males and younger participants had higher levels of PA (P = 0.0047; Table 2). There were no other significant differences in BMI or MVPA by other demographic characteristics. The inverse correlation between MVPA and BMI was small and nonsignificant (r = –0.15, P = 0.1125).

Self-Reported Physical Activities

On average, individuals reported participating in 1.6 (SD = 1.5) activities in the previous 24 hours. Using the total sample, the most common activity reported was walking (53.7%) followed by inside chores (42.5%). In our results we only present activities that were nonzero responses (ie, activities in which there were actually participants that had a "yes" response). All nonzero activity types are listed in Table 3. Twenty-six percent of participants reported no activities in the past 24 hours. No significant difference in activity was observed when comparing individuals with complete and incomplete accelerometry.

There were significant differences in BMI (n = 294) by activity reported in the past 24 hours in unadjusted or adjusted models. Specifically, those individuals that

Table 1 Demographic Characteristics

Variable		Mean (SD)		
		Total (N = 294)	Complete accelerometry (N = 131)	Incomplete accelerometry (N = 163)
Age (years)		37.8 (11.9)	37.5 (11.8)	38.0
BMI (kg/m^2)		33 (8.8)	33.2 (8.7)	32.8
MVPA (minutes/week)		–	108.6 (114.4)	–
Variable		**Percentage**		
		Total (N = 294)	**Complete accelerometry (N = 131)**	**Incomplete accelerometry (N = 163)**
Age	18–24 years	17	17.6	16.6
	25–34 years	26.2	26	26.4
	35–44 years	24.8	23.7	25.8
	45–54 years	22.8	25.2	20.9
	55+ years	9.2	7.6	10.4
Sex	Male	48.3	53.4	49.7
	Female	51.7	46.6	50.3
Race	Non-Hispanic White	40.1	39.7	40.5
	Non-Hispanic Black	58.8	58	59.5
	Hispanic	0.7	1.5	0
	Other	0.3	0.8	0
BMI	< 25 (Nonoverweight/ Obese)	20.4	19.9	20.9
	25+ (Overweight/Obese)	79.6	80.2	79.1
Housing	Group home	41.8	42.8	41.1
	Live with family	49.7	50.4	49.1
	Live in own apartment	2.7	1.5	3.7
	Live in supervised apartment	5.8	5.3	6.1

Note. Data are presented as mean (SD) for continuous variables and percentage for categorical variables.

Abbreviations: SD, standard deviation.

reported participating in biking, jogging/running, basketball, and outside chores had significantly lower BMI compared with those who did not report these activities in unadjusted models. However, basketball and outside chores are not significantly associated with BMI when adjusting for age and sex (Table 4).

Accelerometry

Based on accelerometry, 23.7% of participants (n = 131) met current PA recommendations of 150 minutes of MVPA per week. However, the mean for all participants with complete accelerometry was 108.6 (SD = 114.4) minutes of MVPA per week. Overweight or obese individuals had significantly lower weekly MVPA (P = 0.0256) and averaged 97.6 (SD = 81.5) minutes of weekly MVPA compared with 153.3 (SD = 194.5) minutes in nonoverweight/obese participants.

The number of activities reported had a small but significant correlation with accelerometry (r = .28, P = 0.001) and inversely with BMI (r = –0.15, P = 0.008). As for accelerometry, those who reported exercise, basketball, softball, and outside chores had significantly more minutes of MVPA than those who did not report these activities in separate unadjusted ANCOVA analyses. When adjusting for the covariates age and sex, exercise was no longer significant with MVPA (Table 5).

Discussion

While obesity is a major health concern, physical inactivity is a separate risk factor and some research argues it has more significant health consequences.[36] The overweight and obese participants in this sample were less physically active than their normal BMI weight peers, further adding

Table 2 BMI and MPA by Demographic Characteristics

		Mean BMI (SD; kg/m^2)		Mean MVPA (SD; minutes/week)	
Variable		**N = 294**	***P*-value***	**N = 131**	***P*-value***
Age	18–24 years	31.6 (9.1)	0.6362	176.7 (185.8)	0.0047
	25–34 years	32.7 (8.6)		119 (119.6)	
	35–44 years	34.2 (9.5)		106.2 (75.3)	
	45–54 years	33.1 (8.6)		66.7 (53.5)	
	55+ years	32.5 (7.4)		62.6 (44.9)	
Sex	Male	31.1 (7.8)	0.0003	134.9 (138.9)	0.0135
	Female	34.7 (9.3)		85.7 (82)	
Race	Non-Hispanic White	33.4 (8)	0.3416	87.1 (72.3)	0.2825
	Non-Hispanic Black	32.7 (9.3)		125 (135.8)	
	Hispanic	38.7 (6.8)		58 (42.4)	
	Other	20.2 (-)		84 (–)	
BMI	< 25 (Nonoverweight/Obese)	–	–	153.3 (194.5)	0.0256
	25+ (Overweight/Obese)	–		97.6 (81.5)	
Housing	Group home	32.9 (8.2)	0.8256	92.6 (74.1)	0.5181
	Live with family	33.2 (9.4)		122.7 (144.7)	
	Live in own apartment	30.8 (8.2)		73.5 (14.9)	
	Live in supervised apartment	31.8 (8.8)		113.4 (35.7)	

Note. Data are presented as mean (SD). *t* tests and Chi-square tests used to evaluate differences between groups.

* *P*-value < 0.05 indicates significance.

Abbreviations: SD, standard deviation; MVPA, moderate-to-vigorous physical activity.

Table 3 Percentage of Activity Types Performed During the Previous Day

	Percentage		
Activity performed during the previous day	**Total (N = 294)**	**Complete accelerometry (N = 131)**	**Incomplete accelerometry (N = 163)**
Walking	53.7	60.3	48.5
Biking	8.2	5.3	10.4
Exercise: jumping jacks, sit ups, pushups	15.3	16	14.7
Jogging/running	7.1	9.2	5.5
Weight lifting	2	2.3	1.8
Aerobics	1.4	1.5	1.2
Basketball	7.8	9.2	6.8
Softball/baseball	4.4	5.3	3.7
Outside chores	17.7	19.1	16.6
Inside chores	42.5	40.5	44.2

Note. Data are presented as percentage.

to their health risks. This sample of adults with ID had a prevalence of overweight and obesity of 79.6%. This percentage is higher than the reported 63.5% found in a national sample of community-dwelling adults with ID in 2005.[8] This may be due to changes over time, with the increasing proportion of people who are overweight and obese, but most likely it is due to selection bias in which fewer low weight individuals enrolled in our study. Thus, we may not have a representative sample of adults with ID when it comes to obesity status. It should be pointed out that we excluded only 3 people who were underweight, so this exclusion in itself should not have substantially impact the prevalence of overweight and obesity.

Less than a quarter of participants met current physical activity recommendations of 150 minutes per week, which is less than the recent 43.5% of adults

Table 4 Association Between Mean BMI and Activity Types

	Mean BMI (kg/m^2) (N = 294)				ANCOVA
Activity performed during the previous day	Yes	n (%)	No	n (%)	*P*-value*
Walking	32.7	158 (53.7)	33.1	136 (46.3)	0.6953
Biking	29.4	24 (8.2)	33.2	270 (91.8)	0.0370
Exercise: jumping jacks, sit ups, pushups	32.8	45 (15.3)	32.9	249 (84.7)	0.9547
Jogging/running	28.7	21 (7.1)	33.2	273 (92.9)	0.0208
Weight lifting	33.6	6 (2.0)	32.9	288 (98.0)	0.8477
Aerobics	33.7	4 (1.4)	32.9	290 (98.6)	0.8533
Basketball	30.7	23 (7.8)	33.1	271 (92.2)	0.2132
Softball/baseball	31.1	13 (4.4)	33	281 (95.6)	0.4519
Outside chores	31.5	52 (17.7)	33.2	242 (82.3)	0.2001
Inside chores	32.4	125 (42.5)	33.3	169 (57.5)	0.3511

Note. Descriptive data are presented as mean, n, and percentage. ANCOVA accounts for each activity type separately adjusted for age and sex.

* *P*-value < 0.05 indicates significance.

Table 5 Association Between Mean MVPA and Activity Types

	Mean MVPA (minutes/week) N = 131				ANCOVA
Activity performed during the previous day	Yes	n (%)	No	n (%)	*P*-value*
Walking	116.2	79 (60.3)	100.4	52 (39.7)	0.4130
Biking	106.1	7 (5.3)	110.2	124 (94.7)	0.9220
Exercise: jumping jacks, sit ups, pushups	140.2	21 (16.0)	103.9	110 (84.0)	0.1773
Jogging/running	95.7	12 (9.2)	111.5	119 (90.8)	0.6318
Weight lifting	175.4	3 (2.3)	108.3	128 (97.7)	0.2946
Aerobics	95.1	2 (1.5)	110.2	129 (98.5)	0.8445
Basketball	179.2	12 (9.2)	102.5	119 (90.8)	0.0244
Softball/baseball	209.6	7 (5.3)	104	124 (94.7)	0.0147
Outside chores	158.7	25 (19.1)	98.1	106 (80.9)	0.0133
Inside chores	111.8	53 (40.5)	108.7	78 (59.5)	0.8740

Note. Descriptive data are presented as mean, n, and percentage. ANCOVA accounts for each activity type separately adjusted for age and sex.

* *P*-value < 0.05 indicates significance.

Abbreviations: MVPA, moderate-to-vigorous physical activity.

self-reporting meeting these recommendations in another study.[37] Previous studies with accelerometers in adults with intellectual disabilities have had samples too small to make valid population estimates, however, in their review, Temple and colleagues found that the proportion of adults with ID with at least 30 minutes of MVPA for at least 5 days a week ranged from 17.5%–33% among studies.[11] Using pedometers, Peterson et al found 14.1% of adults with ID to meet recommendations of 10,000 steps per day.[20] Our findings are consistent with these previous studies.

Adults living with ID may experience unique barriers to physical activity that are necessary to consider when interpreting these results. Barriers include financial constraints, limited geographical access (ie, transport to activities), community or home environment, and lack of facilities or equipment.[38] In addition, lack of knowledge concerning the importance of PA as it relates to health can be an issue. In this paper, we did not specifically address barriers to PA; however, our analyses of PA by demographic characteristics may provide some context in which to interpret our findings. In our analyses, we found a significant relationship between age and MVPA with older individuals having a much lower mean MVPA compared with younger adults. Previous studies have found that females with ID are more than twice as likely to be obese than are males.[27] We also found a significant difference in BMI between women and men for our population with females having a BMI higher than men. As for MVPA, males had a significant higher MVPA than females. There was no significant difference between BMI or MVPA when comparing individuals by housing

status. This is a different from Rimmer and colleagues, who found that the obesity prevalence increases with less restrictive living arrangements.[27] In addition, it has been reported that individuals living with family or in supported living arrangements are less physically active when compared with their peers in more restrictive settings.[7,15,18]

In our study, a quarter of participants reported no physical activities in the past 24 hours. It is of particular concern that not even light activities (chores or walking) were reported by some of the participants. Walking was the most common PA reported by adults with ID consistent with previous findings.[9,10,17] In the literature, major types of physical activities most reported by individuals with ID include walking, cycling, chores and work, dancing, and Special Olympics.[25]

As expected, those who reported participation in activities in the past 24 hours had higher MVPA, but after adjustment, only those reporting basketball, softball, and outside chores had significantly higher MVPA levels. While this association does not necessarily indicate a causal relationship, these activities could be considered to promote PA and a healthy weight.

A major strength of this study is that it is one of the largest samples to use accelerometry to measure physical activity in adults with ID. The additional use of self-report provided additional contextual information and a more complete description of the construct of physical activity in this population.

Given these strengths, there are also limitations. This study started with a sample of 294 individuals with completed self-report activity, however only 131 individuals had complete accelerometry data. While attrition is expected, the large amount of incomplete data is evidence of the unique difficulty of measuring PA in this population without additional resources (ie, staffing, equipment, incentives, etc). We learned that many adults with ID were not persuaded when staff attempted to explain that the information we learn could help others in the future. A number of participants felt the accelerometers were cumbersome and were not motivated to wear them consistently. And a $5.00 incentive provided appeared to be insufficient to adequately promote accelerometer wear. There was also significant variation in accelerometer wear time, for those who agreed to wear an accelerometer. To account for large interindividual variation in wear-time, a MVPA rate was considered. A calculated PA rate improved our ability to retain data, however, the rate was highly correlated with total minutes of MVPA ($r = .88$). We decided to use MVPA (minutes/week) as our measure since this has been the standard practice in PA research. In addition, we wanted to focus on recommended PA guidelines, which are based on minutes of MVPA per week.

Other measurement concerns in this population include the lack of specific, valid accelerometry cut-points.[39] We used cut-points validated in general population adults, consistent with previous studies in adults with ID.[10,19] Recent evidence, however, suggests that adults with ID may have higher energy expenditure during exercise.[35] Future studies using accelerometry with adults with ID should establish appropriate validation criteria.

Self-report is a limitation with all studies; however it is not known whether individuals with ID are more likely to under or over-report health behaviors. Research using self-report about health and emotional issues indicate self-report by adults with ID is usually reliable when it is compared with caregiver report. In addition, when a variety of standardized instruments were used to measure self-report of stress and anxiety for adults with mild and moderate ID the internal consistency, test-retest reliability, sensitivity, and specificity were high.[40–42] As pointed out by Finlay and Lyons, validity of self-report questionnaires clearly is needed to combat specific problems that arise with respect to item content, question phrasing, response format, and other psychometric properties.[24]

Participants in this study had elected to participate in a future health promotion study. This may have led to selection bias resulting from health conscious or overweight adults agreeing to participate. Individuals who were underweight (BMI < 18.5) as well as those who are less health conscious were possibly excluded. Therefore, it is not valid to compare prevalence of obesity and overweight in our sample to the reported 63.5% in a national sample of community-dwelling adults with ID.[8]

The inclusion of 2 types of PA measures was not intended to validate the self-report measure in this population, as PA from the self-report was not quantified and the time frame for self-reported PA and accelerometry did not necessarily overlap. Due to the time and logistical demands of traveling throughout the study areas to collect accelerometers and obtain self reported information from participants about PA, we were unable to ensure that the timing of completion of the PACI overlapped with the time frame for accelerometer data collection. Future studies are needed to concurrently validate these measures in this population. Despite the lack of consistently overlapping time frames for accelerometer wear and PACI completion, we did find that participants who reported more activities had higher objectively measured MVPA, though the correlation was fairly weak.

The PACI was limited to a 24 hour recall which may not accurately capture regular participation in sports activities. Research staff reported anecdotally that some participants recalled participating in sports more than 24 hours ago, but this participation was not included due to our a priori decision to use the 24 hour recall measure. During data collection, interviewers noted a large percentage of the population participates in weekly, organized Special Olympics activities that usually occur on Saturdays, and that these activities were not captured because the interviews occurred on weekdays. Thus, many activities had zero "yes" responses. Zero response activities included bowling, golf, fishing, volleyball, horseback riding, martial arts, skating/skiing, stair stepper, and soccer.

A limit to the generalizability of our study is that we recruited participants with mild and moderate ID and those with severe and profound ID were excluded. Obesity levels may be greater in adults with mild ID[43] and PA levels are expected to be lower as ID severity increases.[11] Therefore, our findings should not be generalized to individuals with severe or profound ID. A final limitation in our study is the issue of unmeasured confounding. BMI is composed of several behaviors in addition to PA that were not measured, including dietary intake. It has been found that individuals with ID tend to consume diets that are high in fat and low in fruit and vegetables.[44–46]

In summary, we found that PA was below national averages and overweight and obesity were highly prevalent in this sample of adults with ID. Adaptive PA interventions are needed to increase the health and quality of life in this population. Moreover, supports for adults with ID should include sustainable, low cost PA programs that minimize barriers of cost, transportation, and complexity whether individuals are living at home or in a supervised residential setting.[47] Besides limiting barriers, they must also have social support of family or staff to maintain a physically active lifestyle.[38]

Acknowledgments

The authors would like to thank all the participants, their families and caregivers, and agencies involved in this research. We would also like to acknowledge the work of Marlo Thomas-Koger and John Clarkson in their data collection efforts. The data provided in this manuscript was supported by Grant/Cooperative Agreement Number 5R01DD000111-03 from the Centers for Disease Control and Prevention (CDC). The contents are solely the responsibility of the authors and do not necessarily represent the official views of CDC. Erin K. Howie and Timothy L. Barnes's participation in this research was supported in part by research training grant T32-GM081740 from the National Institutes of Health, National Institute of General Medical Sciences.

References

1. U.S. Department of Health and Human Services. Phase I Report Recommendations for the Framework and Format of Healthy People 2020. 2008 Oct 28. Available from: http://www.healthypeople.gov/hp2020/advisory/PhaseI/PhaseI.pdf.
2. Brault M. Americans with disabilities: 2005, current population reports. Washington, DC: US Census Bureau 2008, P70 – 117.
3. Katz G, Lazcano-Ponce E. Intellectual disability: definition, etiological factors, classification, diagnosis, treatment and prognosis. *Salud Publica Mex*. 2008;50(Suppl 2):S132–S141. PubMed doi:10.1590/S0036-36342008000800005
4. American Association on Intellectual and Developmental Disabilities (AAIDD). *Intellectual disability: definition, classification, and systems of supports*. 11th ed. Washington, DC: AAIDD Publications; 2010.
5. United States Department of Health and Human Services. *Physical activity and health: a report of the Surgeon General*. Atlanta, GA: United States Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion; 1996.
6. Centers for Disease Control and Prevention (CDC). *Prevalence and trends data, South Carolina, 2009. Behavioral Risk Factor Surveillance System survey data*. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2011.
7. Beange H, McElduff A, Baker W. Medical disorders of adults with mental retardation: a population study. *Am J Ment Retard*. 1995;99(6):595–604. PubMed
8. Yamaki K. Body weight status among adults with intellectual disability in the community. *Ment Retard*. 2005;43(1):1–10. PubMed doi:10.1352/0047-6765(2005)43<1:BWSAAW>2.0.CO;2
9. Rimmer JH, Wang E. Obesity prevalence among a group of Chicago residents with disabilities. *Arch Phys Med Rehabil*. 2005;86:1461–1464. PubMed doi:10.1016/j.apmr.2004.10.038
10. Frey GC. Comparison of physical activity levels between adults with and without mental retardation. *J Phys Act Health*. 2004;1:235–245.
11. Temple VA, Frey GC, Stanish HI. Physical activity of adults with mental retardation: review and research needs. *Am J Health Promot*. 2006;21(1):2–12. PubMed doi:10.4278/0890-1171-21.1.2
12. Saunders RR, Saunders MD, Donnelly JE, et al. Evaluation of an approach to weight loss in adults with intellectual or developmental disabilities. *Intellect Dev Disabil*. 2011;49(2):103–112. PubMed doi:10.1352/1934-9556-49.2.103
13. Pate RR, Pratt M, Blair SN, et al. Physical activity and public health: a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA*. 1995;273:402–407. PubMed doi:10.1001/jama.1995.03520290054029
14. Melville CA, Hamilton S, Hankey CR, Miller S, Boyle S. The prevalence and determinants of obesity in adults with intellectual disabilities. *Obes Rev*. 2007;8:223–230. PubMed doi:10.1111/j.1467-789X.2006.00296.x
15. Rimmer JH. Health characteristics and behaviors of adults with mental retardation residing in three living arrangements. *Res Dev Disabil*. 1995;16:489–499. PubMed doi:10.1016/0891-4222(95)00033-X
16. Messent PR, Cooke CB. Daily physical activity in adults with mild and moderate learning disabilities: Is there enough? *Disabil Rehabil*. 1998;20:424–427. PubMed doi:10.3109/09638289809166104
17. Robertson J, Emerson E, Gregory N, et al. Lifestyle related risk factors for poor health in residential settings for people with intellectual disabilities. *Res Dev Disabil*. 2000;21(6):469–486. PubMed doi:10.1016/S0891-4222(00)00053-6
18. Draheim CC, Williams DP, McCubbin JA. Prevalence of physical inactivity and recommended physical activity in community-based adults with mental retardation. *Ment Retard*. 2002;40:436–444. PubMed doi:10.1352/0047-6765(2002)040<0436:POPIAR>2.0.CO;2
19. Temple VA, Anderson JW, Walkley JW. Physical activity levels of individuals living in a group

home. *J Intellect Dev Disabil*. 2000;25:327–341. doi:10.1080/13668250020019601

20. Peterson JJ, Janz KF, Lowe JB. Physical activity among adults with intellectual disabilities living in community settings. *Prev Med*. 2008;47:101–106. PubMed doi:10.1016/j.ypmed.2008.01.007
21. Stanish HI, Draheim CC. Assessment of walking activity using a pedometer and survey in adults with mental retardation. *Adap Phys Act Qu*. 2005;22:136–145.
22. Temple VA, Stanish HI. Pedometer-measured physical activity of adults with intellectual disability: predicting weekly step counts. *American Journal on Intellectual Developmental Disabilities*. 2009;114(1):15–22. PubMed doi:10.1352/2009.114:15-22
23. Temple VA, Walkley JW. Physical activity of adults with intellectual disability. *J Intellect Dev Disabil*. 2003;28(4):323–334. PubMed doi:10.1080/13668250310001616380
24. Finlay WM, Lyons E. Methodological issues in interviewing and using self-report questionnaires with people with mental retardation. *Psychol Assess*. 2001;13(3):319–335. PubMed doi:10.1037/1040-3590.13.3.319
25. Stanish HI, Temple VA, Frey GC. Health-promoting physical activity of adults with mental retardation. *Ment Retard Dev Disabil Res Rev*. 2006;12(1):13–21. PubMed doi:10.1002/mrdd.20090
26. Matthews L, Hankey C, Penpraze V, et al. Agreement of accelerometer and a physical activity questionnaire in adults with intellectual disabilities. *Prev Med*. 2011;52:361–364. PubMed doi:10.1016/j.ypmed.2011.02.001
27. Rimmer JH, Braddock D, Fujiura G. Prevalence of obesity in adults with mental retardation: implications for health promotion and disease prevention. *Ment Retard*. 1993;31:105–110. PubMed
28. Pfeiffer E. A short portable mental status questionnaire for the assessment of organic brain deficit in elderly patients. *J Am Geriatr Soc*. 1975;23:433–441. PubMed
29. National Institute of Health. NHLBI Obesity Education Initiative Expert Panel. Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults. The Evidence Report. NIH Publication No. 98-4083, 1998.
30. Esliger D, Copeland J, Barnes J, Tremblay M. Standardizing and optimizing the use of accelerometer data for free-living physical activity monitoring. *J Phys Act Health*. 2005;3:366–383.
31. Masse LC, Fuemmeler BF, Anderson CB, et al. Accelerometer data reduction: a comparison of four reduction algorithms on select outcome variables. *Med Sci Sports Exerc*. 2005;37(Suppl 11):S544–S554. PubMed doi:10.1249/01.mss.0000185674.09066.8a
32. Colley R, Gorber SC, Tremblay MS. Quality control and data reduction procedures for accelerometry-derived measures of physical activity. Statistics Canada, Catalogue no. 82-003-XPE. *Health Rep*. 2010;21(1):63–69. PubMed
33. Freedson PS, Melanson E, Sirard J. Calibration of the Computer Science and Applications, Inc. accelerometer. *Med Sci Sports Exerc*. 1998;30(5):777–781. PubMed doi:10.1097/00005768-199805000-00021
34. Matthews CE, Ainsworth BE, Thompson RW, Bassett DR. Sources of variance in daily physical activity levels as measured by an accelerometer. *Med Sci Sports Exerc*. 2002;34:1376–1381. PubMed doi:10.1097/00005768-200208000-00021
35. Sallis JF, Strikmiller PK, Harsha DW, et al. Validation of interviewer- and self-administered physical activity checklists for fifth grade students. *Med Sci Sports Exerc*. 1996;28(7):840–851. PubMed doi:10.1097/00005768-199607000-00011
36. Blair SN, Kannel WB, Kohl HW, Goodyear N, Wilson PW. Surrogate measures of physical activity and physical fitness. Evidence for sedentary traits of resting tachycardia, obesity, and low vital capacity. *Am J Epidemiol*. 1989;129(6):1145–1156. PubMed
37. Carlson SA, Fulton JE, Schoenborn CA, Loustalot F. Trend and prevalence estimates based on the 2008 physical activity guidelines for Americans. *Am J Prev Med*. 2010;39:305–313. PubMed doi:10.1016/j.amepre.2010.06.006
38. Messent PR, Cooke CB, Long J. Primary and secondary barriers to physically active healthy lifestyles for adults with learning disabilities. *Disabil Rehabil*. 1999;21(9):409–419. PubMed doi:10.1080/096382899297396
39. Cervantes CM, Porretta DL. Physical activity measurement among individuals with disabilities: a literature review. *Adap Phys Act Qu*. 2010;27:173–190. PubMed
40. Hermans H, van der Pas FH, Evenhuis HM. Instruments assessing anxiety in adults with intellectual disabilities: a systematic review. *Res Dev Disabil*. 2011;32(3):861–870. PubMed doi:10.1016/j.ridd.2011.01.034
41. Lunsky Y, Bramston P. A preliminary study of perceived stress in adult with intellectual disabilities according to self-report and informant ratings. *J Intellect Dev Disabil*. 2006;31(1):20–27. PubMed doi:10.1080/13668250500488660
42. McCarron M, Gill M, Lawlor B, Beagly C. A pilot study of the reliability and validity of the Caregiver Activity Survey—Intellectual Disability (CAS-ID). *J Intellect Disabil Res*. 2002;46(Pt 8):605–612. PubMed doi:10.1046/j.1365-2788.2002.00437.x
43. Hove O. Weight survey on adult persons with mental retardation living in the community. *Res Dev Disabil*. 2004;25:9–17. PubMed doi:10.1016/j.ridd.2003.04.004
44. Braunschweig C, Gomez S, Sheean P, Tomey K, Rimmer J, Heller T. Nutritional status and risk factors for chronic disease in urban-dwelling adults with Down syndrome. *Am J Ment Retard*. 2004;109:186–193. PubMed doi:10.1352/0895-8017(2004)109<186:NSARFF>2.0.CO;2
45. Draheim CC, Stanish HI, Williams DP, McCubbin JA. Dietary intake of adults with mental retardation who reside in community settings. *Am J Ment Retard*. 2007;112:392–400. PubMed doi:10.1352/0895-8017(2007)112[0392:DIOAWM]2.0.CO;2
46. Heller T, McCubbin JA, Drum C, Peterson J. Physical activity and nutrition health promotion interventions: what is working for people with intellectual disabilities? *Intellect Dev Disabil*. 2011;49(1):26–36. PubMed doi:10.1352/1934-9556-49.1.26
47. Lante KA, Walkley JW, Gamble M, Vassos MV. An initial evaluation of a long-term, sustainable, intergraded community-based physical activity program for adults with intellectual disability. *J Intellect Dev Disabil*. 2011;36(3):197–206. PubMed doi:10.3109/13668250.2011.593163