Physical Activity of Youth With Intellectual Disability: Review and Research Agenda

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This review characterizes physical activity behavior in youth with intellectual disability (ID) and identifies limitations in the published research. Keyword searches were used to identify articles from MEDLINE, EBSCOhost Research Databases, Psych Articles, Health Source, and SPORT Discus, and ProQuest Dissertations and Theses up to June 2007. Data were extracted from each study using a template of key items that included participant population, study design, data source, and outcome measure. Nineteen manuscripts met the inclusion criteria. Findings were mixed, with various studies indicating that youth with ID have lower, similar, and higher physical activity levels than peers without disabilities. Only two studies provided enough information to determine that some youth with ID were meeting minimum physical activity standards. Significant methodological limitations prohibit clear conclusions regarding physical activity in youth with ID.

It is recommended that all children accumulate at least 30–60 min of physical activity on all or most days of the week, including 10–15 min of continuous, moderate to vigorous activity. Adolescents should also be active daily or almost daily and engage in ≥ 20 min of continuous, moderate to vigorous activity at least three times per week (U.S. Department of Health and Human Services, USDHHS, 2000a). The data suggest that youth are generally not meeting these basic physical activity guidelines, and this is a likely contributor to the precipitous rise in childhood obesity over the last 20 years (USDHHS, 2000a). While there is extensive research on the physical activity behaviors, patterns, and determinants in youth without disabilities, similar data on those with intellectual disability (ID) are lacking. Fernhall and Unnithan (2002) conducted a review of physical activity research in youth with ID and concluded that the majority of work in this area addresses physical work capacity (i.e., fitness) and there is scant information on physical activity. The presence of health disparities in adults with ID is well documented (Sutherland,

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Couch, & Iacono, 2002; U.S. Public Health Service, 2001) but relatively little is known about preventive health, including physical activity, in youth with ID. Research on youth with other disabling conditions such as physical disabilities and autism, indicates that these individuals are less active than peers primarily due to few activity opportunities (Longmuir & Bar-Or, 2000; Pan & Frey, 2005), but it is unclear if this is also true for youth with ID.

Conclusions regarding the physical activity behavior of youth with ID are largely based on fitness research, which consistently demonstrates lower levels of cardiovascular fitness, muscular strength, and higher levels of obesity than peers without ID (Fernhall, 1993; Gillespie, 2003; MacDonncha, Watson, McSweeney, & O’Donovan, 1999), although it is documented that youth with ID can achieve acceptable levels of fitness (Pitetti, Millar, & Fernhall, 2000). The relationship between physical fitness (typically cardiovascular fitness) and physical activity in youth without disabilities ranges from weak to high (.16–.80) (Dennison, Strauss, Mellits, & Charney, 1988; Katzmarzyk, Malina, Song, & Bouchard, 1998; Morrow & Freedson, 1994; Pate, Dowda, & Ross, 1990), and Katzmarzyk et al. (1998) found that between 80–90% of the variance in fitness was not accounted for by physical activity. Further, longitudinal studies on youth without disabilities have shown that regular physical activity contributes little to physical fitness over time periods of four (Baquet, Twisk, Kemper, van Praagh, & Berthoin, 2006) and 15 years (Kemper, Twisk, Koppes, van Mechelen, & Post, 2001). Malina and Katzmarzyk (2006) attribute the inconsistent association between physical activity and physical fitness in youth without disabilities to a variety of factors, such as imperfect measures of fitness and activity and the impact of growth and maturation on these variables. Riddoch and Boreham (1995) suggest that fitness in youth without disabilities is due to sporadic activity rather than regular physical activity, and although there is an association between these variables, cause and effect cannot be implied in this age group. Therefore, caution is warranted when making judgments about physical activity behavior based on fitness outcomes in youth without disabilities (Baquet et al., 2006). No similar data exist on the relationship between fitness and physical activity in youth with ID, but it is reasonable to assume that the aforementioned factors affecting this association in nondisabled youth would also apply to youth with ID.

As such, physical fitness and physical activity are often viewed as independent health indicators (Baquet et al., 2006; Bouchard, Shephard, Stephens, Sutton, & McPherson, 1990; Caspersen, 1989; Malina & Katzmarzyk, 2006). While the importance of physical fitness for everyone is well accepted (USDHHS, 2000b), the primary impetus of federal and professional organizations has been to increase physical activity as a health behavior among youth (Centers for Disease Control and Prevention, 1997; Corbin & Pangrazi, 1998; USDHHS, 2000a, 2000b). Youth with disabilities are mentioned in some of these documents (USDHHS 2000a, 2000b) and it is generally assumed that physical activity recommendations apply to all youth, regardless of diagnosis; however, there are few studies documenting whether youth with ID are meeting these established physical activity guidelines. The majority of studies related to this topic addresses test validation and describes physical fitness levels, and there is relatively less information on physical activity. The physical and psychological benefits of physical activity behavior are widely accepted and strongly promoted for all youth, including those with ID (USDHHS,
Physical Activity and Youth With Intellectual Disability

2000b). Therefore, attempts must be made to better understand physical activity behavior in youth with ID and this can be initially achieved through a comprehensive review of available literature.

The purpose of this review is to critically analyze the existing research on physical activity and youth with ID in an attempt to address the following questions: (a) What are the physical activity patterns of youth with ID? (b) To what extent do youth with ID meet the recommended physical activity guidelines? (c) Is physical activity behavior comparable in youth with and without ID? (d) What are the methodological limitations that restrict inferences regarding physical activity and youth with ID? and (e) How can future research in this area be improved and advanced? It must be noted that this review is modeled after a similar paper on physical activity in adults with ID (Temple, Frey, & Stanish, 2006). Due to the small number of studies and significant variability in samples, measurement techniques, and procedures, we opted to prepare a narrative discussion of the literature instead of conducting statistical analyses to integrate the findings of the published work.

Method

Inclusion Criteria

The inclusion criteria for this review were (a) physical activity, and not exercise or fitness, was clearly stated as an outcome variable of interest; (b) physical activity was quantified as a direct measure; (c) study participants consisted primarily of youth with ID ages 0–18 years, whether explicitly or implicitly stated; and (d) studies were complete papers written in English. The following definition of intellectual disability was used: “...a disability characterized by significant limitations both in intellectual functioning and in adaptive behavior as expressed in conceptual, social, and practical adaptive skills. This disability originates before age 18” (American Association on Mental Retardation, 2002, p. 8). Terminology for ID varies among regions and cultures, so each paper using a descriptor other than ID (e.g., learning disability) was carefully assessed for potential inclusion. Several retrieved studies were based on individuals with etiologies associated with ID and these were also assessed for inclusion. Another point of clarification is that exercise was used as a search term because this term and physical activity are often used interchangeably even though the definition of each is different (Bouchard et al., 1990; Caspersen, 1989). Papers that measured exercise were collected and evaluated to determine if the term exercise was used but that physical activity was the actual variable of interest. A critical appraisal to determine study validity is typically involved in the systematic review process (Khan, Popay, & Kleijnen, 2001). The purpose of this paper, however, was to review the research on physical activity in youth with ID so no studies were excluded based on methodological considerations.

Data Sources

and Theses (1861-) up until June 1, 2007. The keywords used to identify articles on the population of interest were *mental retardation, intellectual disability, learning disability, developmental disability,* and *child or adolescent.* Each of the population search terms was combined with *physical activity* and *exercise* to identify articles on the topic of interest for this review. This produced a total of 387 citations. An examination of the reference sections of retrieved papers was conducted to identify additional articles that may have been overlooked; ten additional articles were retrieved, producing a total of 397 citations.

**Exclusion**

The inclusion criteria were applied to the 397 citations and abstracts to determine eligibility by one author and a research assistant independently. Where disagreement occurred, all authors reviewed and discussed the paper until consensus was achieved. Of the 397 citations and abstracts reviewed, 16 articles and 3 theses fulfilled our primary selection criteria. Excluded were 378 citations for the following reasons: 34 citations were duplicates within the databases searched, 118 citations were not empirical studies, 197 studies did not quantitatively measure physical activity, 4 citations from conference proceedings were not published as complete articles in proceedings or journals, 24 studies were not published in English, and 1 study involved adults with ID only.

**Data Extraction**

Following verification of a study’s eligibility for inclusion into the review, general information, specific study characteristic information, and results were extracted using a data extraction form (Khan & Kleijnen, 2001) and were independently evaluated by three experienced researchers in the area of physical activity and persons with ID. General information regarding the study’s title, authors, journal, and publication details were extracted. Specific study characteristic information about recruitment procedures, characteristics of participants (age, sex, ID classification, and living circumstance), design of the study (including whether youth without ID were included), outcome measures (what was measured, how was it measured, who carried out the measurement, when it was measured, and whether the measurement tools were validated), and methods of analyses were extracted. Quantitative findings of percentage of participants meeting each study’s physical activity criterion and where possible inferential statistics examining group differences were extracted. Descriptions that qualified these physical activity data were also extracted.

**Results**

Nineteen studies were identified as meeting the criteria for inclusion in this review and Table 1 summarizes the participants, design, data source(s), outcome measures, results, and comments by the reviewers. Three of the studies are unpublished theses (Foley, 2006; Kim, 2006; Kochersperger, 2005) that were included in this review in an effort to fully describe and summarize the research that has been conducted on this topic. Table 1 presents the reviewed studies in chronological order according to publication date. Eight studies were classified as quasi-experimental, one as experimental, and the remaining were descriptive. Sixteen studies used an objective
measure of physical activity such as accelerometry, pedometry, direct observation, heart rate, or doubly-labeled water and four of these used multiple measures, which is recommended when assessing this variable in youth (Kohl, Fulton, & Caspersen, 2000; Welk, Corbin, & Dale, 2000). Three studies used parent proxy reports to evaluate youth physical activity, which have also been employed in samples of youth without ID (Kohl et al., 2000; Sallis, 1991). Fourteen papers reported all day physical activity and the other five restricted findings to specific school periods, typically recess and/or physical education. Five papers were based on youth with Prader-Willi syndrome and four on youth with Down syndrome. These studies were included in the review because intellectual disability is associated with both conditions (Batshaw, 2002). Thirteen studies used a cross-sectional design that included both children (age ≤ 12 years) and adolescents (age = >13 years). One of these employed participants ages 3–22 years and since this represented the legal school-age population in that area, the study was retained for review (Suzuki et al., 1991). Another study involved two participants ages 21 and 25 years, but this represented only 28% of the data pool, so this study was also incorporated in the analysis (Kozub, 2003). Males and females were included in all participant samples and gender was an independent variable in three studies (Lorenzi, Horvat, & Pellegrini, 2000; Sharav & Bowman, 1992; Suzuki et al., 1991). Twelve papers used a comparison group of age, gender, and/or anthropomorphic matched youth without ID.

**Discussion**

The paucity of studies on this topic clarify that this is a neglected research area similar to that observed in the review on adults with ID (Temple et al., 2006). However, contrary to findings on adults with ID, the studies reviewed revealed no clear patterns regarding physical activity behavior in youth with ID. Youth with ID are often purported to be inactive based on evidence that this group has low fitness levels (Fernhall, 1993), yet this contention is not uniformly supported by studies that directly assessed physical activity and reported it as an outcome measure. As previously stated, clear conclusions regarding physical activity in youth with ID cannot be drawn from the studies reviewed that represent all identified published research on this topic. As a result, it appears that little is actually known about physical activity behavior in youth with ID. A summary of these findings is organized according to the aforementioned review objectives.

**What Are the Physical Activity Patterns of Youth With ID?**

Research in youth without disabilities indicates that physical activity varies according to time of day (during school, after school), day of week (weekday v. weekend), age (children v. adolescents), and gender (male v. female; Gavarry, Giacomoni, Bernard, Seymat, & Falgairette, 2003; Mota, Santos, Guerra, Ribeiro, & Duarte, 2003; Trost, Pate, Freedson, Sallis, & Taylor, 2000), but similar data in youth with ID are lacking. While several studies examined physical activity over several days, only Kozub (2003) specifically addressed patterns in this behavior and found that youth with ID were primarily active in the afternoon. Other studies presented total physical activity values during specific, short time periods as part of the school day, such as physical education and recess (Faison-Hodge & Porretta, 2004; Horvat & Franklin, 2001; Lorenzi et al., 2000). Since it is known that youth physical activity
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<td>Massey et al. (1971)</td>
<td>33 youth with ID (21 M, 12 F) ages 6–15 y living in institutions. IQ scores ranged from 33 to 78.</td>
<td>D, CS</td>
<td>Actometer (Timex motion recorder, No. 32) worn on the dominant wrist during a 45 min language development class for 10 days over 2 weeks.</td>
<td>Activity scores, but not units of measure, were reported.</td>
<td>Older youth were less active than younger peers, but there were no associations between PA and gender or IQ.</td>
<td>Study was focused on hyperactive behavior, which prohibits inferences regarding PA behavior.</td>
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<td>Nardella et al. (1983)</td>
<td>12 youth with Prader-Willi syndrome (10 M, 2 F) ages 11–22 y attending a 2-week specialized camp. 13 youth without Prader-Willi syndrome (8M, 5F) ages 11–15 y served as a comparison group.</td>
<td>D, CS</td>
<td>Actometer (Timex Model 32) and pedometer (Precise Model 25235), both worn at waist daily for 14 days. Weight loss and dietary intake were also measured daily in youth with Prader-Willi syndrome.</td>
<td>Actometer = hours/week; pedometer = km/week.</td>
<td>Variability in activity was higher among youth with Prader-Willi syndrome compared with non-disabled controls. There was no association between physical activity and weight loss.</td>
<td>No data regarding activity duration or intensity were provided. Cross sectional data limits interpretation of findings. No IQ values were reported, but the sample was referred to as having ID.</td>
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<td>Schoeller et al. (1988)</td>
<td>10 participants with Prader-Willi syndrome (5M, 5F) age 15 y and 10 obese controls without Prader-Willi syndrome (5M, 5F) age 16 y.</td>
<td>QE</td>
<td>Doubly-labeled water using a 7-day period with samples collected on days 1 and 7.</td>
<td>Calculation of energy expenditure due to PA was not clearly specified, but it was reported in Kcal/day.</td>
<td>Youth with Prader-Willi syndrome expended significantly less energy in PA than the obese comparison group (650 Kcal/day v. 1940 Kcal/day).</td>
<td>More information is needed on how energy expenditure from PA was determined. No data on frequency, intensity, or duration of activity.</td>
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Levinson & Reid (1991) 105 youth (72 M, 33 F) with mild ID and co-occurring conditions (e.g., autism, emotional disturbance, neurological impairments) ages 4–21 y living in segregated schools.

D, CS Parent proxy of home PA, using a questionnaire modified from the Canada Fitness Survey. Eight questions were used: PA levels, common activities, companions, location, barriers, and facilitators.

PA ranked as active (>3 hrs/wk, >9 mos), moderate (<3 h/w, >9 mos or >3 hrs/wk, <9 mos), sedentary (<3 h/w, <9 mos), stagnant (<1 h/w, <9 mos) over past year. Reliability estimates obtained from small subsample.

Survey return rate = 49.3%.

75% of children ages 4–10 y considered active similar to youth without ID, compared with 56% of children ages 11–21 y. Most frequent activities were walking, swimming, biking, jogging/running, and skating, usually with family in a home environment. Test-retest agreement ranged from 66 to 88%.

Activity criteria do not meet guidelines. Although the study was completed before current PA recommendations, 3 hr per week is a low minimum criterion of youth PA. It was not clear what constituted PA or how this was explained in the questionnaire.

Suzuki et al. (1991) 217 (136 M, 81 F) or 80 (47 M, 33 F) with ID 585 with other disabilities (Deaf, blind, physical impairments) ages 3–22 y living in segregated schools. Disability severity was not specified.

QE, CS Pedometers (AM-5 Yamasatokei Co., Tokyo) worn on waist for 24 during regular school day. Also reported that 80 youth with ID wore the devices for 6 successive days.

Counts/d Males with ID were more active than females and youth with ID were more active than those with physical disabilities (p < .05), but less active than deaf youth (p < .05). There were no differences between youth with ID and visual impairments.

Methodology was confusing with initial reports of 217 participants with ID, but another reported 80 participants with ID. Therefore, it is unclear if some participants wore the pedometers for 1 or 6 days.

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<td>Sharav &amp; Bowman (1992)</td>
<td>30 youth with Down syndrome, 30 sibling pairs (28 F, 32 M) ages 2–14 y. Disability severity was not specified.</td>
<td>QE, CS</td>
<td>Parent proxy reports of home physical activity using a questionnaire based on scaled developed for Finnish youth by Telama &amp; Yang (2000)</td>
<td>1. movement ranked on a scale of 1–5. 2. time (h) spent inside/outside per season (winter/summer). 3. number of structured activities.</td>
<td>Youth with Down syndrome were less active than siblings (p &lt; .007). There was a significant difference between groups in time spent outdoors (summer Down syndrome = 4.4 ± 2.0 h v. sibling = 5.5 ± 1.7 h, p &lt; .04; winter Down syndrome = 1.0 ± 0.8 h v. sibling = 1.4 ± 0.8 h, p &lt; .03). Children with Down syndrome played in organized PA at least once per week.</td>
<td>Parent proxy questionnaire was not validated for population. Conclusion that youth with Down syndrome spent more time indoors, which predisposes them to inactivity, is spurious because (a) actual time differences between groups were minimal, and (b) many other factors may have influenced time spent indoors (e.g., overprotection).</td>
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<td>Davies &amp; Joughin (1993)</td>
<td>10 youth with (5 M, 5 F) and 60 without Prader-Willi syndrome ages 6–18 y. Disability severity was not specified.</td>
<td>QE, CS</td>
<td>Doubly-labeled water, but sampling period was not reported.</td>
<td>Total energy expenditure/resting metabolic rate = physical activity energy expenditure.</td>
<td>Physical activity energy expenditure was lower in youth with Prader-Willi syndrome after adjusting for age.</td>
<td>More details regarding methodology are needed before clear data interpretation can occur.</td>
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<td>Luke et al. (1994)</td>
<td>12 youth with Down syndrome (6 M, 6 F)</td>
<td>Doubly-labeled water using an 8 day period with samples collected 6 hr after dosage and on days 5 and 8.</td>
<td>Nonresting metabolic rate energy expenditure = PA and the thermic effect of food in Kcal/day.</td>
<td>No significant difference between groups (ID = 751 ± 212; non-ID = 733 ± 314 kcal/day). Results did not change when normalized for body weight.</td>
<td>Sampling period was rather short and there were no data on activity patterns.</td>
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<td>10 without ID (5 M, 5 F) ages 5–11 y matched according to BMI. Disability severity was not reported.</td>
<td>Nonresting metabolic rate energy expenditure = PA and the thermic effect of food in Kcal/day.</td>
<td>No significant difference between groups (ID = 751 ± 212; non-ID = 733 ± 314 kcal/day). Results did not change when normalized for body weight.</td>
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<td>Lorenzi et al. (2000)</td>
<td>17 youth with mild ID (10 M, 7 F), 17 without ID (10 M, 7 F) ages 5–12 y attending regular schools. Disability severity was not specified.</td>
<td>PA measured using direct observation (SOAL; Eaton et al., 1987), heart rate monitor (Polar Vantage XL, Polar CIC Inc., Port Washington, NY) and accelerometry (Caltrac, Muscle Dynamics, Torrance, CA) over 2, 16 min recess sessions.</td>
<td>Direct observation in activity level/min (scores range from 1.9 to 75), heart rate in beats/min, and accelerometry in total activity counts.</td>
<td>Gender differences were observed for all measures with males more active than females, except heart rates were higher for females compared with males with ID. Youth with ID were more active than peers using accelerometry and heart rate, but not direct observation.</td>
<td>Heart rate values seemed low (range = 33–63 beats/min).</td>
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<td>van Mil et al. (2000)</td>
<td>17 youth with Prader-Willi (10 F, 7 M) and 17 obese controls without Prader-Willi syndrome (10 F, 7 M) ages 6–20 y. Disability severity was not reported.</td>
<td>QE, CS</td>
<td>Doubly-labeled water over 14 days with samples taken days 1, 8, and 14.</td>
<td>PA reported as (a) activity energy expenditure (AEE) = 0.9 average daily metabolic rate – basal metabolic rate correcting for 10% thermic effect of food in MJ/day; (b) weight bearing correction AEE/kg = AEE/total body weight in kJ/kg day; (c) physical activity level (PAL) = average daily metabolic rate/basal metabolic rate.</td>
<td>Youth with Prader-Willi syndrome demonstrated lower AEE (1.07 v. 2.56 MJ/day), AEE/kg (23.11 v. 46.09 kJ/kg/day), and PAL (1.33 v. 1.55) compared with obese youth without Prader-Willi syndrome.</td>
<td>The cross-sectional sample limits data interpretation.</td>
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<td>Horvat &amp; Franklin (2001)</td>
<td>23 youth with mild ID, ages 6–12 y. Number of males and females and disability severity were not specified.</td>
<td>D</td>
<td>PA measured using heart rate monitors (Polar Vantage XL), accelerometer (Trirac, Stay-healthy, Inc.), and direct observation (SOAL; Eaton et al., 1987) for 16 min one time in 3 settings: segregated recess, inclusive recess, and the classroom.</td>
<td>Heart rate in beats/min, direct observation in activity level/min (scores ranged from 1.9 to 75), accelerometer in activity counts/vector magnitude</td>
<td>No significant difference in activity levels between recess sites according to each measure.</td>
<td>Data were analyzed as environment × gender, but gender data were not provided. Recess settings were reportedly consistent, but no information was provided regarding number of children on the playground as well as impact of age. Recess play of 12-year-olds and 6-year-olds is likely different and may have impacted findings.</td>
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Eiholzer et al. (2003) 17 youth with Prader-Willi syndrome (8 F, 9 M) and 18 without Prader-Willi syndrome (10 M, 8 F) ages 4–19 y. The comparison group was primarily comprised of siblings. Disability severity was not reported.

E, CS PA was measured using pedometry (Mechanical Pedometer, Eschenbach, Germany) and parent proxy reports using a non-validated scale. PA was assessed 3 days prior to and post intervention. Intervention consisted of 3-month training program. Participants performed 36 toe raises each day (sets of 12 with 1-min rest).

1. Kilometers walked.
2. Activity points from parent scale: 1 = lying, 2 = sitting, 3 = walking, 4 = running. Possible scores ranged from 144 to 574 points.

Youth with Prader-Willi were less active than controls before and after training. Walking distance significantly improved from 11.1 to 17.4 km in those with Prader-Willi syndrome, but activity scores from parent reports did not change. PA in the control group did not improve according to either measure.

Standard training principles were not used and there was no true control group (i.e., youth with Prader-Willi syndrome not receiving training), thus increases in walking distance cannot be attributed to the intervention. Observed changes may have been due to reactivity or perhaps a floor effect (i.e., youth with Prader-Willi syndrome so unfit that any minimal exercise would lead to improvements).

Kozub (2003) 7 youth with mild ID (4 M, 3 F) ages 13–25 y, 5 were under the age of 18. IQ scores reported for 5 participants, range = 45–68.

D, CS PA measured for 7 consecutive days using accelerometry (RT3, Stayhealthy, Inc., Monrovia, CA).

PA reported as moderate activity bouts and moderate activity time (> 4.5 METs).

Participants accumulated 14–55 min of MPA per day and continuous PA ranged from 2 to 6 min. MPA occurred sporadically about 6–18 times per day, primarily after 3:00 pm. There was a decline in PA levels with age.

Although the data are limited, there is some evidence that youth with ID are not meeting PA recommendations.

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Faison-Hodge & Porretta (2004) | 8 youth with mild ID. IQ range = 45–70. Two comparison groups: (a) 19 youth without ID, low fitness and (b) 19 youth without ID, high fitness based on PACER scores. 25 M and 21 F in the total sample. All attended regular school and were in 3rd, 4th, or 5th grade. | QE | Direct observation using SOFIT (McKenzie, 2002). Participants videotaped during physical education and recess for 4 weeks. An average of 7, 30 min physical education and 2, 15 min recess observations per subject. | Percent time spent in MVPA | All participants spent more time in MVPA during recess (range 65–72%) compared with physical education (range 21–28%). No significant differences in MVPA between groups. | Low subject numbers likely influenced findings.

Table 1 (continued)
Kocher-Sperger (2005) 36 youth with a disability were recruited (ID 55.5%, Autism 17%, learning disability 5.5%, health impaired 11%, speech/language disability 11%). Comparison = 36 gender and grade matched peers. No student used an assistive device to ambulate. Ages 5–18 y

D, CS PA measured using SOFIT (McKenzie, 2002). Minimum of 319 observation points (21min) in PE across 5 weeks.

Total SOFIT scores across observations. Students with a disability were significantly less active in physical education than students without a disability (978.43 ± 90.53, 1038.57 ± 83.71, respectively).

Incomplete data on 6 matched pairs, therefore final sample = 30 for each group. No details of which students with disabilities were removed from the final sample.

Foley (2006) 9 students with mild intellectual disability and comparison group (classmates) of 37 youth without physical or cognitive disability ages 7–12 y. BMI: Non-ID = 20.3 ± 5.1; ID = 18.4 ± 3.6.

D, CS PA measured for 7 consecutive days using accelerometry (Actiwatch AW, Mini Mitter Bend, OR))

PA reported as counts for recess, physical education, after school, and weekend. Participants with ID were significantly less active than youth without ID. Percent less active was the following: recess, 53%; physical education, 133%; after school, 52%; and weekend, 33%.

There is evidence that children with mild ID are significantly less active than classmates without ID.

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<td>Whitt-Glover et al. (2006)</td>
<td>28 youth with Down syndrome (13 M, 15 F) and comparison group of 30 siblings (16 M, 14 F) ages 3–10 y. BMI between 5th and 95th percentile for age and gender. Disability severity was not reported.</td>
<td>D, CS</td>
<td>PA measured for 7 consecutive days using accelerometry (Actitrac, IM Systems, Baltimore, MD).</td>
<td>PA reported as total daily low, moderate, and vigorous intensity activity time and bout lengths of moderate and high intensity activity.</td>
<td>Participants accumulated 2.5 hr per day in MPA and 59 min in VPA. Youth with Down syndrome engaged in less VPA than siblings and in shorter bouts (2.5 min vs. 5.1 min) but were similar in MPA and low intensity PA.</td>
<td>There is evidence that children with Down syndrome are meeting the guidelines for PA although bouts of VPA were not sustained.</td>
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<td>Kim (2006)</td>
<td>16 youth with developmental disabilities (9 with ID, 2 with Down syndrome, 2 with autism, 1 with traumatic brain injury, 2 with developmental delay). None had physical disabilities. Ages 11–20 y.</td>
<td>D, CS</td>
<td>PA measured for 11 days (7 weekdays, 4 weekend days) using pedometers (Omron HJ-112, Omron Healthcare Inc., Bannockburn, IL) and accelerometers (Actiwatch, Mini Mitter Bend, OR). First two weekdays were familiarization.</td>
<td>PA reported as average steps per day and average activity counts for weekdays, weekends, and all days combined. Daily variance in steps and activity counts were the major outcome variables.</td>
<td>Participants accumulated 8,299 steps and 502,744 counts on weekdays, 5,858 steps and 437,097 counts on weekend days, and 7,106 steps and 473,567 counts on all days combined. Person × Day interaction accounted for 52.1% of the variance in steps per day and 37.1% of the variance in counts when all days were combined.</td>
<td>There is evidence that secondary students with developmental disability are less active on the weekends than during the week. However some youth had consistently high or low levels of physical activity whereas participation by other youth fluctuated daily. Although 4 youth were over 18 years, average age was 16.7 years and all were in high school.</td>
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<td>Jobling &amp; Cuskelley (2006)</td>
<td>38 youth with Down syndrome (21 M, 17 F) living at home. Mean language equivalent was 5 years and 7 months. BMI = 25.5 ± 5.7 (50% were obese). Ages 11–18 y.</td>
<td>Semistructured interview, 14 questions on exercise knowledge and behavior. Participants and parents interviewed separately. Participants selected picture cards that represented physical activities they participated in. Internal consistency for the subscales of the test ranged from .75–.85.</td>
<td>Frequency of participation (per week) in activities selected from picture cards (e.g., cycling, swimming). Only 2 youth reported physical activity &gt; 3/week. Swimming as the most frequent form of exercise (69%) with walking the next most popular. 90% of parents reported that their family engaged in some weekly exercise.</td>
<td>Limited utility in quantifying physical activity, however suggestive of low levels of physical activity.</td>
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*Note.* PA, physical activity; MVPA, moderate-vigorous physical activity; MPA, moderate physical activity; VPA, vigorous physical activity; ID, intellectual disability; QE, quasi-experimental; CS, cross-sectional; D, descriptive; E, experimental.
varies throughout the day, it is important to assess activity multiple times during a
day for several days to achieve a reliable representation (Trost et al., 2000).

There have been no attempts to qualify activity in this population. Sharav and
Bowman (1992) briefly addressed participation in extracurricular activities without
discussing how this contributed to overall physical activity. Several authors exam-
ined “play” during recess but did not assess the context of this activity (Faison-
Hodge & Porretta, 2004; Horvat & Franklin, 2001; Lorenzi et al., 2000). Specifically,
it is generally unknown how youth with ID are acquiring their physical activity. Play
with peers is considered one of the most natural ways for children to be physically
active (Rippe, Weisberg, & Seefeldt, 1993) yet little is known about play behaviors
in youth with ID and how these behaviors contribute to activity (Rosenbaum, 1998).
The context of physical activity in this population becomes more critical with age
due to the likely decline in physical activity during adolescence, which is well-
documented among youth without ID, particularly in females (USDHHS, 2000a).
The increase in inactivity with age among youth without ID has been attributed to
a variety of factors, including a decrease in community sport participation (Kann,
Warren, & Harris, 1995), as well as gradually reduced or eliminated recess and
physical education opportunities. Less is known about activity opportunities for
youth with ID. Simeonsson, Carlson, Huntington, McMillen, and Brent (2001)
conducted a national survey of special education teachers to assess involvement of
youth with disabilities in school activities. Only 17.5% and 13.6% of youth with
disabilities participated in after-school programs and organized sport, respectively,
but it is important to note that only 30% of students on whom teachers reported were
identified with ID. In addition, Pan and Frey (2005) found that activity opportuni-
ties decreased during adolescence in youth with autism spectrum disorders. Firm
conclusions cannot be drawn about physical activity opportunities for youth with
ID from these findings; however, there is potential cause for concern that options
may be limited for this population compared with those without disabilities and
may become more limited with age as recess and requirements for physical educa-
tion are reduced. Changes to engage in physical activity may also be hindered due
to the many social, cognitive, motor, and behavioral factors associated with the
presence of an ID. This prompts a need to not only assess the quantity of physical
activity, but also the opportunities for activity among youth with ID.

Two studies examined the impact of gender on physical activity and reported
that females with ID were less active than were males (Lorenzi et al., 2000; Suzuki
et al., 1991), which coincides with the majority of findings in youth without ID
(Sallis, Prochaska, & Taylor, 2000). Levinson and Reid (1991) and Massey, Lieber-
man, and Batarseh (1971) specifically addressed age as a factor in physical activity
and, similar to the typically developing youth, adolescents with ID were less active
than children with ID. A dearth in the quality and quantity of research, however,
limit the ability to understand or discern physical activity patterns in youth with
ID according to pertinent factors such as time of day, day of week, gender, and
age. These topics have not been fully explored in this population and additional
research is needed before further conclusions are drawn.
To What Extent Do Youth With ID Meet the Recommended Physical Activity Guidelines?

Few studies included frequency, intensity, and duration of physical activity as outcome measures. Whitt-Glover and colleagues (2006) addressed these factors and reported that children with Down syndrome were accumulating approximately 2.5 hr of moderate physical activity per day which exceeds the guideline (i.e., 30 min daily). The children also accumulated almost 1 hr of vigorous physical activity per day and the average bout of vigorous activity was 2.5 min. Kozub (2003) provided enough descriptive data to determine that some youth with ID were accumulating sufficient amounts of moderate-vigorous activity, but none were continuously active for more than 15 min. Intensity and duration were also reported to some degree in the Faison-Hodge and Porretta (2004) study, although continuous activity was not discussed. Children in this study were not moderately active for the majority of physical education instruction as recommended (USDHHS, 2000a) but spent over 65% of recess time engaged in moderate activity, indicating this as a better activity outlet than physical education.

The majority of findings from studies using doubly-labeled water generally found youth with ID expend less energy in physical activity than those without ID (Davies & Joughin, 1993; Schoeller, Levitsky, Bandini, Dietz, & Walczak, 1988; van Mil et al., 2000). These differences were sometimes attenuated when corrected for body composition, but overall youth with ID were deemed less active than comparison groups, many of which were comprised of participants with non syndrome-related obesity. In contrast, Luke, Roizen, Sutton, and Schoeller (1994) observed that nonresting metabolic rate energy expenditure, which included physical activity and the thermic effect of food, was comparable between youth with and without Down syndrome. It is important to note that participants with Down syndrome in this study had lower resting metabolic rates than peers, and the authors acknowledged that their findings were contrary to the rest of the literature. While doubly-labeled water is considered a gold standard measure of physical activity, the method is limited because it provides no information about the frequency, intensity, and duration of activity (Welk, 2002). Thus, it is difficult to determine if youth with ID are meeting physical activity guidelines based on this measure. Findings from these studies are also limited because all were conducted on youth with Prader-Willi or Down syndrome and both of these populations exhibit syndrome specific alterations in metabolism due to factors such as hypotonia and hypothyroidism. As such, data derived from these studies cannot be generalized to the youth with nonsyndrome forms of ID.

In general, whether youth with ID meet the minimum guidelines for health-related activity cannot be determined from the studies reviewed. The majority of existing research does not include a description of physical activity patterns in this group, including a differentiation among moderate and vigorous physical activity. Therefore, statements that this population is inactive should be discontinued until
more clear and comprehensive data based on physical activity participation, not fitness outcomes, are available.

Is Physical Activity Behavior Comparable in Youth With and Without ID?

Most of the studies reviewed employed some type of comparison group and youth with ID were typically less active than peers without ID, although this observation is not conclusive. Eight studies reported that youth with ID were less active than peers (Davies & Joughin, 1993; Foley, 2006; Kochersperger, 2005; Nardella, Sulzbacher, & Worthington-Roberts, 1983; Schoeller et al., 1988; Sharav & Bowman, 1992; Suzuki et al., 1991; van Mil et al., 2000), one that those with ID were more active than peers (Lorenzi et al., 2000), two found no differences between youth with and without ID (Faison-Hodge & Porretta, 2004; Luke et al., 1994), and one found differences in vigorous activity levels among children with Down syndrome and their siblings but no differences in low and moderate activity (Whitt-Glover et al., 2006). Only two studies provided enough data to determine that some participants were meeting the minimum physical activity recommendations (Kozub, 2003; Whitt-Glover et al., 2006). More research is needed to draw conclusions about differences and/or similarities in physical activity among youth with and without ID.

What Are the Methodological Limitations That Limit Inferences Regarding Physical Activity and Youth With ID?

Many methodological limitations have been discussed within the context of other subheadings; however, there were several, general issues of concern common to the studies reviewed. First, the failure of authors to sufficiently describe sample populations made it extremely difficult to interpret findings. Several studies focused on a diagnostic category (e.g., Down syndrome, Prader-Willi syndrome), but other reports made no effort to identify participants with specific conditions. While many may dispute the importance of this issue, certain genetic conditions impact physiologic, anatomic, and performance variables that could influence the ability to engage in physical activity. For example, research is consistent that individuals with Down syndrome are less physically fit than are peers with ID not related to Down syndrome, and this is partially attributed to neurological complications associated with the condition (Fernhall & Otterstetter, 2003). In addition, few studies provided a sufficient description of ID severity, and there is evidence that youth with severe ID have lower motor and fitness performance compared with peers with mild ID (Eichstaedt & Lavay, 1992).

Second, many of the studies that employed a cross-sectional design with no attempt to discuss differences in physical activity with age or gender, which is well documented in youth without ID but appears to vary according to diagnosis in youth with disabilities. For example, youth with visual impairments or physical disabilities do not become less active with age, presumably due to initially low activity levels (Longmuir & Bar-Or, 2000), while adolescents with autism spectrum disorders are less active than children due to fewer activity opportunities (e.g., physical education or recess; Pan & Frey, 2005). Six studies employed a matched group design and only two papers examined gender as a separate variable. In the
latter two studies, females were less active than males were, which suggests that combined gender groups may obscure unique physical activity patterns associated with this determinant.

**Recommendations for Future Research**

Based on the information presented in this review, there are several areas that need to be addressed before a reasonable understanding of physical activity behavior in youth with ID can be developed. Two design problems significantly limit current findings: failure to define or describe the sample population and identifying clear outcome measures to allow adequate assessment of physical activity. Future studies need to clearly characterize participants according to disability severity, gender, etiology, co-occurring conditions, school placement, and age. In addition, frequency, intensity, and duration must be measured as factors of interest, which will provide the ability to determine if youth with ID are meeting the guidelines for health-related physical activity.

Objective measures of physical activity such as pedometry, accelerometry, direct observation, and doubly-labeled water may not need to be revalidated for youth with ID, unless there are co-occurring physical or sensory conditions that could impede or interfere with movement, such as morbid obesity or obvious gait disturbances. Motion sensors are typically sensitive enough to detect a large range of human movement. Caution is recommended, however, with regard to using energy expenditure regression equations or predicted intensity levels associated with noninvasive measures (e.g., accelerometry, direct observation) in this population. These equations are usually developed using specific activities and sample populations that may not adequately represent the potential movement and metabolic variability that exists among people with ID. Depending on the purpose of the study, it may be better to use raw measures, such as posture (e.g., standing, sitting) in direct observation or accelerometer counts as the outcome variable (Freedson, Pober, & Janz, 2005). It is important that the limitations of the measurement tool be considered and addressed, and findings interpreted accordingly. For example, pedometers are only an assessment of walking behavior, which is a component of daily activity, not a global measure of physical activity.

Youth physical activity is typically sporadic, intermittent, and difficult to measure, so multiple measures (i.e., at least two) are recommended to more accurately quantify and qualify this behavior (Kohl et al., 2000; Welk et al., 2000). Self-report surveys and accelerometry are often used as compatible assessment tools to examine physical activity in youth without ID, although the applicability of self-report surveys in youth with ID is obviously questionable. Proxy-reports could be used to better qualify physical activity in this population, but significant training is required to ensure that the reports are more reflective of actual rather than perceived behavior. It must be emphasized that the validity and reliability of proxy reports to assess youth physical activity in general are not well established (Kohl et al., 2000) and this method requires further scrutiny before it is widely used.

In summary, this review highlights that there is a dearth in the quality and quantity of research on physical activity and youth with ID, and both poor study design and insufficient information prohibit the ability to develop conclusions regarding this issue. Essentially, physical activity research in youth with ID is in
its infancy and lags several years behind similar inquiry in youth without ID. As a result, there is a need for basic study on topics such as, but not limited to, seasonal and time variations, determinants of physical activity (e.g., parent influence, fitness, motivation), and relationships between physical activity and health indicators. Future research in this area would benefit from large collaborative efforts among professionals who can combine expertise in health, physical activity, and intellectual disability fields, as well as the ability to access multiple resources from which to recruit sufficient participant numbers. Such an approach would help generate the quantity and quality of research needed to better promote healthy lifestyles in youth with ID.

References


