AN ABSTRACT OF THE DISSERTATION OF

John Thomas Foley for the degree of Doctor of Philosophy in Exercise and Sport Science presented on June 20, 2005.
Title: Exploring the Physical Activity Levels of Students with Mental Retardation and Students without Disabilities in Both School and After-School Environments.

Abstract Approved:

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Jeffrey A. McCubbin

The focus of this research was to gain an understanding of physical activity in elementary school-aged children with mental retardation (MR). The primary purpose of the first study was to investigate physical activity levels of children with and without MR in both school and out of school environments. The secondary purpose of the first study was to determine if there is a relationship between physical activity and motor skills in children with MR. Physical activity levels of 9 children with MR and 37 without were recorded over 7 days using an accelerometer. Motor skills were assessed using the Movement Assessment Battery for Children. Physical activity levels for children with MR were significantly lower during the school day. Children without MR were 53% more active during recess and 133% more active during physical education

than children with MR. The disparity in physical activity continued outside of school where children without MR were 52% more active after school and 33% more active on the weekend than children with MR. There were no significant correlations between physical activity times and motor skills in either group. These findings indicate that interventions to increase physical activity in individuals with MR should to begin in the elementary school years. The primary purpose of the second study was to investigate if children with MR spend more time watching TV or on the computer than children without disabilities. The secondary purpose of study was to determine if total screen time correlates with physical activity levels. Parents of the participants recorded TV time and computer time over four days. Physical activity levels of the children were recorded with accelerometers. There was no difference in TV time or computer time in children with MR and children without MR. The correlation between after school physical activity and screen time was moderate in children with MR (r=.69 and low for children without MR (r=-.32). These results of this research suggest that there might be different patterns in the development of sedentary behaviors between children with and without MR, indicating that unique interventions may be needed for individuals with MR.

Exploring the Physical Activity Levels of Students with Mental Retardation and Students without Disabilities in Both School and After-School Environments

by
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John Thomas Foley, Author

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CONTRIBUTION OF AUTHORS

Dr. Jeffrey McCubbin was involved in the design and writing of both manuscripts. Rebecca R. Bryan and Kristin Sweeney were involved in the data collection for both studies.

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John T. Foley

Background

The National Center for Health Statistics estimates that 15 percent of children and teens ages 6 to 19 are overweight (Centers for Disease Control and Prevention, 2003b). This number has more than tripled in the last 20 years and continues to rise (CDC, 2003b; Ogden, Flegal, Carroll, & Johnson, 2002). Health officials are expressing concern because overweight children tend to have higher risks of diabetes, increased cholesterol and greater chances of being overweight as adults (Goran, Ball, & Cruz, 2003; Magarey, Daniels, Boulton, & Cockington, 2003). According to Healthy People 2010 (2000), the obesity rate in individuals with disabilities is 32 percent greater than in individuals without disabilities. One of the most important ways to combat this trend toward obesity is to increase children's physical activity levels (President's Council on Physical Activity and Sports, 1994).

However, individuals with disabilities tend to be less physically active than individuals without disabilities; 65 percent of the adult population with disabilities engages in no leisure-time physical activity compared to less than 25 percent of the population without disabilities (CDC, 2004; HP 2010, 2000). The 1996 Paralympic Congress, in a consensus statement on physical activity and health among people with disabilities, identified children with disabilities as a future research priority (Cooper et al., 1999). While research investigating the daily physical activity levels of children in the general population exists, little work has been done to examine the physical activity levels of children

with disabilities (Fernhall & Unnithan, 2002). One subset of individuals with disabilities for which this is particularly important is individuals with mental retardation, who have been shown to have high rates of physical inactivity, obesity, and cardiac disease risk (Draheim, Williams, & McCubbin, 2002a; Moran et al., 2005; Robertson et al., 2000). As adults, individuals with mental retardation who participate in regular physical activity have lower incidences of hyperinsulinemia and abdominal obesity compared to those who are less active (Draheim, Williams, & McCubbin, 2002b).

Many studies that examine physical activity in elementary school-aged children look at two distinct parts of the day, the school day and the after-school day (McKenzie, Marshall, Sallis, & Conway, 2000; Mota, Santos, Guerra, Ribeiro, & Duarte, 2003; Trost, Pate, Freedson, Sallis, & Taylor, 2000). In the school setting, physical activity primarily takes place during the following three distinct times: recess, a time for unstructured play where children make choices on ways to be active (NASPE, 2001b); physical education, which provides a structured opportunity for children to participate in physical activity and improve related skills and knowledge (NASPE, 2001a); and the classroom, which provides only limited opportunity for physical activity.

It has been suggested that physical education in the schools may be effective in reducing the onset of obesity in elementary school-aged children (Datar & Sturm, 2004). Among schools in the US that have students with disabilities, about 85 percent of those students participate in the regular

physical education curriculum and about 38 percent participate in both the regular education and adapted physical education (Burgeson, Wechsler, Brener, Young, & Spain, 2001). It is the position of the American Alliance for Health, Physical Education, Recreation, and Dance that students with disabilities be included to the fullest extent in the general physical education curriculum (American Association for Active Lifestyles and Fitness, 2004).

Faison-Hodge and Porretta (2004) found that children with MR had similar physical activity levels to children with low cardiovascular fitness levels. However, it has also been suggested by Tilinger and Lejcarova (2003) that poor performance in cardiovascular fitness may be the product of low motor skills. Previous studies have also provided evidence to indicate that children who are less physically active tend to have lower motor skills (Kim, Matsuura, Tanaka, & Inagaki, 1993; Rosa, Rodriguez, & Marquez, 1996). As one would expect, adolescents who participate in greater amounts of organized physical activity have been shown to have higher motor skills (Okely, Booth, & Patterson, 2001). It has also been shown that children who scored poorly on motor development tests had a higher propensity to be overweight (Graf et al., 2004). And, children with MR generally have lower motor skills than their peers without disabilities (Drowatzky & Geiger, 1993).

Opportunities for children to be active after school are vary. Children who spend time engaged in after-school activities or outdoor play are more physically active overall (Sallis, Prochaska, Taylor, Hill, & Geraci, 1999). It is

also known that 65 percent of children do not participate in any organized physical activity and 22 percent do not participate in any free-time physical activity during their non-school hours (CDC, 2003a). There is evidence to suggest that youth who spend longer hours engaged in sedentary behaviors, such as watching television (TV) or on the computer, tend to be less physically active overall (Arluk, Branch, Swain, & Dowling, 2003; Pate, Heath, Dowda, & Trost, 1996). Pate and colleagues (1997) found that time spent watching TV was correlated to lower activity levels. It has also been shown that an increase in TV time is associated with an increased prevalence of being overweight in children (Andersen, Crespo, Bartlett, Cheskin, & Pratt, 1998; Crespo et al., 2001).

Unlike TV time, computer time has an unclear relationship to obesity. Stettler (2004) found an association between obesity and electronic games while Hernandez et al.(1999) and Foley (2005) did not. Ford and colleagues (2005) indicated that the combination of computer time and TV time increased the prevalence of metabolic syndrome which is commonly related with obesity (Weiss et al., 2004). The time spent on a computer is not only associated with metabolic syndrome and obesity but is also considered a relevant factor in the displacement of physical activity (Brodersen, Steptoe, Williamson, & Wardle, 2005). TV and computer time are so closely linked to the displacement of physical activity that researchers often combined them into a single measure

that is referred to as total screen time (Gordon-Larsen, Nelson, & Popkin, 2004).

While there is a general understanding of physical activity levels in the school and after-school environments for children without disabilities, there is little information about activity levels in children with mental retardation. Studies of children with Prader-Willi syndrome and Down syndrome have shown that children with certain developmental disabilities have lower physical activity levels than their peers without disability (Davies & Joughin, 1993; Nardella, Sulzbacher, & Worthington-Roberts, 1983; Sharav & Bowman, 1992). However, Lorenzi, Horvat & Pellegrini (2000) found that children with MR were as active (females) or more active (males) than their peers without disabilities.

There is limited research on children with mental retardation in the inclusive classroom setting and how their physical activity levels compare to their classmates' during physical education and recess. The few studies that have been done have provided conflicting results (Faison-Hodge & Porretta, 2004; Lorenzi et al., 2000). This gap of knowledge continues into the after-school environment where little is known about physical activity levels and sedentary behaviors. The deficit of information on physical activity levels in children with mental retardation and the differences between in-school and after-school environments makes it difficult to develop strategies to increase their physical activity levels, which could reduce secondary health concerns.

Purpose statement

By understanding during which part of the day children with mental retardation have higher rates of physical inactivity compared to their peers, strategies can be developed to increase their activity levels, thereby reducing health conditions related to physical inactivity. Therefore, the primary purpose of the first study is to investigate the physical activity levels of elementary school-aged children with and without MR in both the school and after-school environments. The secondary purpose of the first study is to investigate the relationship between physical activity levels and individual motor skills in elementary school-aged children with and without MR. The primary purpose of the second study is to investigate if children with mild/moderate MR spend more time watching TV and on the computer than their peers without disabilities. The secondary purpose of the second study is to find if total screen time displaces physical activity.

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Chapter 2: Daily physical activity levels of elementary school-aged children with and without mental retardation.

John T. Foley

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Jeffrey A. McCubbin

Abstract

The primary purpose of this study was to investigate the disparity in physical activity levels of elementary school-aged children with mental retardation (MR) in both school (physical education & recess) and out of school environments (after-school and weekend) compared to their peers without disabilities. The secondary purpose of this study was to determine if there is a relationship between physical activity and gross motor skills in children both with and without MR. Physical activity levels of 46 children, 9 with mild MR and 37 without, were recorded for 7 continuous days using an accelerometer, sampling every 15 seconds. Following the physical activity data collection, the balance and ball skill subsections of the Movement Assessment Battery for Children were assessed. Independent t-tests revealed that physical activity counts were significantly lower during recess for children with MR ($\bar{X}$ = 187.3) than children without MR ($\bar{X}$ =287.3) (P>.01). During inclusive physical education, children with MR ($\bar{X}$ = 188.1) still had significantly lower physical activity levels than children without MR ($\bar{X}$ =438.7) (P>.001). This disparity was also evident in the out of school environment where children with MR ($\bar{X}$ = 135.3) were engaged in less physical activity after school than children without MR ($\bar{X}$ =205.7) (P>.001) and where physical activity counts on weekends for children with MR ($\bar{X}$ = 135.3) were lower than children without MR ($\bar{X}$ =180.5) (P>.05). There were no significant correlations between physical activity and motor ability in children with MR and without. The findings

of this study indicate that interventions to increase physical activity in individuals with MR need to begin as early as the elementary school years and be comprehensive to address multiple settings such as school, home and community based programs.

Introduction

The Centers for Disease Control and Prevention (CDC) and the World Health Organization have indicated that childhood obesity has reached epidemic proportions (Cole, Bellizzi, Flegal, & Dietz, 2000). The National Center for Health Statistics estimates that 15 percent of children and teens ages 6 to 19 are overweight (CDC, 2003). This number has more than tripled in the last 20 years and continues to rise (CDC, 2003; Ogden, Flegal, Carroll, & Johnson, 2002). Health officials are expressing concern because overweight children tend to have higher risks of diabetes, increased cholesterol and greater chances of being overweight as adults (Goran, Ball, & Cruz, 2003; Magarey, Daniels, Boulton, & Cockington, 2003). According to Healthy People 2010 (2000), the obesity rate in individuals with disabilities is 32 percent greater than in individuals without disabilities.

It is estimated that individuals with mental retardation (MR) have an average lifetime economic cost of $1,014,000 per person; which is the highest per person cost of any category of individuals with developmental disabilities (CDC, 2004a). It has been suggested that by increasing physical activity in individuals with developmental disabilities, secondary health conditions can be lowered thereby reducing overall health care costs and improving quality of life (Traci, Seekins, Szalda-Petree, & Ravesloot, 2002). While there is a general understanding that a disparity in physical activity levels of adults with MR exists, there is little information about at what age this divergence begins.

Childhood has been identified by the Institute of Medicine (2004) as a critical time for interventions to prevent obesity. It is during this time that excess subcutaneous fat is often deposited. Preventing excess fat from accumulating is recommended as a more efficient strategy in keeping children at a healthy weight than trying to reduce fat stores after they have accumulated (Hill & Peters, 1998). One of the most important ways to combat obesity is to increase children's physical activity levels (President's Council on Physical Activity and Sports, 1994). However, while there is research investigating the daily physical activity levels of children in the general population, little work has been done to examine the physical activity levels of children with disabilities (Fernhall & Unnithan, 2002).

It is known that adults with disabilities tend to be less physically active than individuals without disabilities; 65 percent of the adult population with disabilities engages in no leisure-time physical activity compared to less than 25 percent of the population without disabilities (CDC, 2004b; HP 2010, 2000). One subset of individuals with disabilities for which this is particularly important is individuals with MR, who have been shown to have high rates of physical inactivity, obesity, and cardiac disease risk (Draheim, McCubbin, & Williams, 2002; Robertson et al., 2000). As adults, individuals with MR who participate in regular physical activity have lower incidences of hyperinsulinemia and abdominal obesity compared to those who are less active (Draheim, Williams, & McCubbin, 2002).

Opportunities for children to be physically active usually occur during school, after-school, and on the weekend (McKenzie, Marshall, Sallis, & Conway, 2000; Mota, Santos, Guerra, Ribeiro, & Duarte, 2003; Trost, Pate, Freedson, Sallis, & Taylor, 2000). In the school setting, physical activity takes place during the following two distinct times: recess, a time for unstructured play where children make choices on ways to be active (NASPE, 2001b), and physical education, which provides a structured opportunity for children to participate in physical activity and improve related skills and knowledge (NASPE, 2001a). While a number of studies have examined physical activity both in school and outside of school, there is limited and inconclusive research on children with MR in the inclusive classroom setting and in particular, how their physical activity levels compare to their classmates' during physical education (PE) and recess.

Research by Faison-Hodge & Porretta (2004) showed that children with MR had physical activity levels during PE and recess similar to students with low fitness levels and significantly different from those who had higher fitness levels. However, Lorenzi, Horvat & Pellegrini (2000) found that there was no difference in physical activity levels during recess when measured by direct observation, but that male students with MR had higher levels of physical activity when measured by accelerometers and heartrate monitors. This gap of knowledge continues into the after school and weekend environments where little is known about physical activity levels in children with MR. A parental

survey by Levinson & Reid (1991) found that the majority of activity in children with MR took place in the home with less activity occurring in parks. The biggest reported barriers to participation in physical activity were the perceived lack of skills.

Other studies of children with varying developmental disabilities have shown that they were less physically active than their non-disabled peers. Children with Prader-Willi syndrome have lower physical activity levels than their peers without disability (Davies & Joughin, 1993; Nardella, Sulzbacher, & Worthington-Roberts, 1983). A study of twins in which one sibling had Down syndrome and the other did not, found that individuals with Down syndrome engaged in less physical activity than their siblings (Sharav & Bowman, 1992).

Studies by Faison-Hodge & Porretta (2004) and Gillespie (2003) have shown a relationship between cardiovascular fitness and physical activity levels in children with MR. However, it has also been suggested by Tilinger & Lejcarova (2003) that poor performance in cardiovascular fitness tests may be the product of low motor skills. Poor motor skills have been associated with lower physical activity levels in individuals without disabilities (Okely, Booth, & Patterson, 2001). Children with MR often have motor skills that are a few years behind their typically developing peers (Drowatzky & Geiger, 1993). Levinson & Reid (1991) reported that children with developmental disabilities face a barrier to participation in physical activities due to lack of motor skills.

Thus, it would be reasonable to expect an association between physical activity levels and motor skills in children with MR.

The deficit of information on physical activity levels in children with MR in both the school and after-school environments makes it difficult to develop strategies to increase their physical activity levels, thereby reducing secondary health concerns. By understanding during which part of the school day children with MR have highest rates of physical inactivity compared to their peers, school-based strategies can be developed to increase their activity levels. Therefore, the primary purpose of this study was to investigate the physical activity levels of elementary school-aged children with and without MR in both the school and after-school environments. The secondary purpose of this study was to investigate the relationship between physical activity levels and individual motor skills in elementary school-aged children with and without MR.

Methods

Participants: The participants in this study, ages 7 to 12, were 9 students with mental retardation and 45 students without physical or cognitive disability. Of the 45 students without disability, 8 were dropped from the analysis for incomplete data, leaving 37 participants without MR. The reasons for incomplete data are as follows: one student lost the accelerometer; one student took an extended weekend for vacation and missed a watch exchange; two dropped because of discomfort with the watch band; and four

were sick during part of the data collection. Descriptive statistics of the participants included in the final analyses are provided in Table 1.1.

Students with MR were recruited for this study based upon the three following criteria: 1) have mild mental retardation, 2) participate in the school's general physical education program 100 percent of the time, and 3) participate in the inclusive classroom setting at least 50 percent of the school day. Eligible students were identified by the school district's special education administrator and based on the school's current evaluation used in the formulation of the student's Individual Education Program and qualification under Individuals with Disabilities Education Act (P. L.105-17, 1997). Invitations to participate in the study were sent out by the school district to maintain the confidentiality of students receiving special education services. Once students with MR were recruited, their classmates in the inclusive classrooms were recruited to participate with only the knowledge that this was a physical activity study of elementary school-aged children. They were blinded to the fact that their results would be compared to their classmate(s) with MR. All consent forms and documents were approved by the University Institutional Review Board.

Table 1.1 Physical characteristics of participants

	Non-MR (n=37)		MR (n=9)	
	Mean	SD	Mean	SD
Age (yrs)	9.27	1.15	9.78	1.56
Wt (kg)	40.34	12.68	30.99	7.48
Ht (cm)	140.16	10.44	129.72	10.69
BMI	20.33	5.11	18.44	3.58

Measurements & Procedures:

Physical activity: Physical activity was measured by the Actiwatch AW 16 accelerometer (Mini-Mitter, Bend, OR) which has been shown to be an appropriate measure of physical activity in children (Puyau, Adolph, Vohra, & Butte, 2002). Accelerometery has also been shown to provide an effective measurement of physical activity in the school environment in children with mental retardation (Horvat & Franklin, 2001). The Actiwatch is an omni-directional accelerometer with a piezo-electric sensor that detects changes in acceleration. The signal is amplified and filtered by analog circuitry then passed into an analog to digital converter to create a digital value. This is repeated 32 times per second and a peak value is identified. These peak values are summed together to generate an activity count every 15 seconds

Students wore an accelerometer attached to the wrist of their non-dominant hand for seven consecutive days (Chen et al., 2003). Baxter, Nichols, Sallis, & Calfas (1998) determined this placement to be an accurate measure of physical activity. A trained assistant used non-removable plastic wrist bands, similar to hospital bands, to attach the accelerometers to the children on Monday mornings and replaced them with a different watch on Wednesday and Friday mornings in order to reduce measurement error. Data from the watches were downloaded every two days, except on weekends, and reported in raw movement counts to avoid any errors associated with energy expenditure estimations (Welk, Corbin, & Dale, 2000).

Periods of physical activity were divided into four different time categories. The first, recess, usually included morning and afternoon breaks lasting from 15-20 minutes, and lunch time lasting 45 minutes. The second, inclusive physical education, was 30 minutes in length and taught by certified physical education teachers with class sizes ranging from 18-25 students with out disabilities and 1-2 students with disabilities. The third, after school, went from Monday to Friday from the time school ended at 2:35 pm to 7:30 pm. And, the fourth, weekend, was from 9:00 am until 7:30 pm.

Anthropometric measurements: Height and weight were measured within two weeks of the physical activity monitoring. Participants removed shoes and jewelry before being measured. Standing height was measured with a portable stadiometer (GPM, Switzerland) and recorded to the nearest .01cm. Weight was measured on a portable electronic digital strain gauge scale (Health O Meter, Bridgeview IL) and recorded to the nearest .1kg. The scale was calibrated before each data collection session. Two measures were averaged and used to calculate body mass index for descriptive purposes; according to the CDC, body mass index compares well to laboratory measures of body fat in children (2002).

Classroom logs: Classroom teachers kept a daily time log of when the students went to physical education, recess, and lunch. Teachers were also asked to record if a child was excused from participating in physical education or recess for a particular day.

Motor skills: Participants were assessed on the balance & ball skills components of the Movement Assessment Battery for Children (MABC) (Henderson & Sugden, 1992). The MABC is a standardized test that is used to identify movement and coordination disorders in children, including those with developmental disabilities (Barnett & Henderson, 1998). The results from both subsections of the test were summed together to provide a motor impairment score. The MABC has shown high test-retest and inter-rater reliability with novice test administrators (Chow, Chan, Chan, & Lau, 2002; Croce, Horvat, & McCarthy, 2001). Data collection occurred within two weeks of physical activity monitoring. Test administrators were instructed in administration of the MABC and had to show proficiency of inter-rater reliability of $r>.90$. The inter-rater reliability on 21 test measures was high with an intraclass correlation coefficient of $r = .95$.

Data Analysis: All data analysis was performed on STATA V8.2 for Windows (Stata Corporation, TX). To determine if gender differences in both groups existed in the sample a series of t-tests were employed. No significant differences between gender in either group was found, therefore the gender variable was collapsed. A t-test was also employed to determine if a significant difference in BMI existed between the two groups. No difference was found between the two groups. A series of independent two-sample t-tests with equal variances were used to determine statistical significance between individuals with and without MR during different time periods of the day. Alpha

was set < .05 for all tests. To adjust for multiple significance tests, a Holm's Sequential Bonferroni procedure was used (Holm, 1979). A Pearson product-moment correlation was used to look at the relationship between physical activity and motor skills during different time periods.

Results

Physical activity levels for children with MR were significantly lower during both recess and physical education. During recess children with MR ($\bar{X}$ = 187.3 15/sec) were less active than those children without MR ($\bar{X}$ = 287.3 15/sec) ($t(44)= 3.35$, $p<.01$, $d=1.25$). Children without MR had 53% higher activity levels than children with MR, a difference of 100 counts per 15/sec (95% CI: 39.9-160.1). During inclusive physical education, activity levels in children with MR ($\bar{X}$ = 188.1) were, again, significantly lower than in children without MR ($\bar{X}$ = 438.7) ($t(44)= 6.17$,$p<.001$, $d=2.29$). Children without MR were 133% more physically active than children with MR, a difference of 250.6 counts per 15/sec (95% CI: 168.7-332.6).

The disparity in physical activity counts continued outside school time. Physical activity levels for children with MR ($\bar{X}$ = 135.3) were significantly lower after school than for children without MR ($\bar{X}$ = 205.7) ($t(44)=3.80$,$p<.001$, $d=1.41$). Children without MR had 52% more activity than children with MR, a difference of 70.4 counts per 15/sec (95% CI: 33.04-107.7). This pattern continued into the weekend where physical activity counts for children with MR

($\bar{X}$ = 135.3) were significantly lower than for children without MR ($\bar{X}$ = 180.5) ($t(44)=2.37$, $p<.05$, $d=.88$). The children without MR were 33% more active than children with MR, a difference in activity levels of 45.2 counts per 15/sec (95% CI: 6.7-83.7). The disparity in physical activity is consistent during all times; Table 1.2 shows the physical activity level means and standard deviations for both groups. There were no significant correlations between physical activity times and motor skills in children with or without MR. A relationship between physical activity and motor skills was not apparent. See Table 1.3 for correlation coefficients between physical activity counts and motor skills.

Table 1.2 Physical activity levels by setting measured in counts per 15 seconds

	MR		Non-MR	
	Mean	SD	Mean	SD
Recess	187.32	47.73	287.34	85.78
PE	188.06	131.10	438.73	103.91
After school	135.28	43.99	205.67	51.08
Weekend	135.29	34.68	180.49	54.44

Table 1.3 Correlation coefficients between physical activity counts and motor skills

	MR		Non-MR	
	r	r^2	r	r^2
Recess	-0.49	0.24	-0.04	0.00
PE	-0.26	0.07	0.25	0.06
After school	-0.13	0.02	0.16	0.03
Weekend	0.54	0.29	0.12	0.01

Discussion

One of the goals of Healthy People 2010 is to promote the health of people with disabilities and eliminate disparities. While Kozub (2003) showed that physical activity levels in individuals with MR decline during adolescence, this study showed that the disparity in physical activity is apparent in elementary school-aged children. During the critical times for physical activity during the weekday and weekend, children with MR had significantly lower levels of activity than their non-disabled peers. Similar results in activity disparity are seen in other groups of individuals with developmental disabilities. Nardella, Sulzbacher, and Worthington-Roberts (1983) found that individuals with Prader-Willi syndrome, a condition in which MR is an associated complication, had lower levels of physical activity than their peers during summer camp. Sharav and Bowman (1992) found that individuals with Down syndrome engaged in less physical activity than their twin siblings who did not have Down syndrome.

The biggest discrepancy of physical activity between children with and without MR was seen during inclusive physical education, which is troubling. The lack of engagement during physical education was similar to the findings of Temple and Walkley (1999) who found that students with mild intellectual disabilities were less engaged in motor and cognitive activity related to the physical education lesson than their peers without disabilities. Follow-up observations of the two physical education classes revealed that children with

MR were often working on specific motor skill development related to an individual education program. One limitation of the current study was that only two physical education teachers taught the physical education classes, thereby increasing the chance that one teacher could be responsible for the differences seen in activity levels during physical education. Another limitation of this study is that it was conducted in one school district; the policy of the district special education coordinator could influence the time students with MR spend in inclusive PE curriculum. However, while it is likely that one PE teacher and/or special education coordinator accounts for some of the disparity, it still does not explain the consistent pattern of lower physical activity during recess, after school and on the weekend.

The disparity in physical activity during recess is not consistent with the results from both Lorenzi et al. (2000) and Horvat and Franklin (2001). This disagreement may be the result of the number of times recess was measured in the two previous studies. Each of these studies recorded physical activity for 16 minutes for two observations in Lorenzi et al. (2000) and three observations in Horvat & Franklin (2001). However, Trost et al., (2000) recommended a minimum of four days to establish a consistent measure of physical activity in children. This study averaged all recess time in each day over five school days, thereby, giving a more comprehensive understanding of the divergence in physical activity during recess. Another factor that may have contributed to the differing results is the presence of an observer in the studies by Lorenzi et al.

(2000) and Horvat and Franklin (2001). This could result in the Hawthone effect which is a change in human behavior with the knowledge that one is being monitored (Bannigan & Zwerman, 2001). This could be even more plausible when the duration of the monitoring is only 16 minutes.

An important finding of this study is that physical activity levels remained significantly different between individuals with and without mental retardation. One of the reasons that children with mental retardation may have lower physical activity levels out of school is that they lack the skills to participate in after-school sports programs (Levinson & Reid, 1991). Another reason is that parents of children with disabilities have additional stresses that parents of children without disabilities do not have (Dyson, 1993, 1997). Kozub (2003) found that while parents perceived physical activity to be important, they did not have the time to commit to it. The physical activity level of parents has also been identified as playing an important role in the physical activity levels of their children (Sallis, Prochaska, & Taylor, 2000; Trost, Pate, Ward, Saunders, & Riner, 1999). A limitation to the weekend data is that only one weekend was sampled. However, this information still gives valuable insight into a consistent pattern of disparity in physical activity levels between individuals with and without mental retardation.

The overall results of the study raise the concern that individuals with MR may not be engaged in the same physical activities as their peers. One has to ask the question, does a child with MR get invited to play a pick up

game of basketball in the neighborhood? If not, then what opportunities are provided for children with MR outside the organized setting? It is recommended that one way to increase acceptance and inclusion of individuals with disabilities in activities is through disability awareness lessons (Wilson & Lieberman, 2000). By providing disability awareness as part of the physical education curriculum children without disabilities will be given the chance to understand the importance of including all children in play.

The finding that there was no significant correlation between motor ability and physical activity in individuals without MR is close to the findings of Fisher et al. (2005) who found only a weak correlation between the two. It was expected, however, that a relationship would have been more apparent for children with MR. While these results suggest that a relationship may not exist, it may be likely that this relationship is complex and needs an advance form of statistical modeling that can only be analyzed with a large sample. It is interesting that both times physical education was observed, students with MR were not as active as their peers because they were working on improving their motor skills.

Limitations of this study, other than those previously mentioned, include the fact that accelerometers are not perfect in measuring all aspects of physical activity. They cannot detect the extra work load in graded climbs or changes in load such as a child carrying a heavy daypack. Also, omni-directional accelerometers, which are sensitive to motion in all planes, have a

sensitivity bias toward the length of the case in which they are housed (Puyau et al., 2002). It is also possible that children who volunteer for this study are more active than their average classmates. Children who are overweight are often less active and may be self conscious about participating in a study about physical activity.

While this study is limited because of its small sample size, the results provide evidence that a disparity in physical activity between children with and without MR. This study shows the need to increase the physical activity of children with MR. The lack of physical activity across the study may indicate that more work needs to be done on the incorporation of individuals with MR into common activities both in and outside of school. It is recommended that the results of this study be replicated on a larger scale that encompasses more than one school district.

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Chapter 3: An exploratory study of after-school sedentary behavior in elementary school-age children with mental retardation.

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Abstract

The primary purpose of this study was to investigate if children with mild/moderate MR spend more time watching TV or on the computer than their peers without disabilities. The secondary purpose of this study was to find if total screen time correlates with physical activity levels. Parents of the participants, 9 individuals with MR and 22 without, recorded time spent watching TV and time spent engaged on the computer/video games. Physical activity levels of the children were recorded with accelerometers sampling every 15 seconds. Independent t-tests revealed that there was no difference in time spent watching TV in children with MR ($\bar{X}$ =.95, SD .73) and children without MR ($\bar{X}$ =.89, SD .64) (p=.81). Time spent on the computer or engaged with video games was not discernable between children with MR ($\bar{X}$ =.40, SD .59) and those without MR ($\bar{X}$ =.42, SD .67) (p=.94). The correlation between after school physical activity and screen time is moderate in children with MR (r=.76, p=.04) while the relationship between after school physical activity and screen time for children without MR was low and not significant (r=-.32, p=.2). These results suggest that there might be different patterns in the development of sedentary behaviors between children with and without MR, indicating that unique interventions may be needed for individuals with MR.

Introduction

Individuals with mental retardation (MR) have a lifetime cost of over one million dollars per person; the highest in all categories of developmental disabilities (U.S. Department of Health and Human Services, 2004). It has been suggested that by improving the healthy behaviors of individuals with MR, secondary health conditions can be reduced thereby lowering overall health care costs and improving quality of life (Traci, Seekins, Szalda-Petree, & Ravesloot, 2002). Obesity and physical inactivity have been shown to be high predictors of poor health in individuals with mental retardation (Robertson et al., 2000). Rimmer and colleagues (2004) suggest that by increasing physical activity in individuals with developmental disabilities, health risks associated with sedentary behavior can be reduced.

Owen and colleagues (2000) cite the importance and need for research into sedentary behaviors associated with low levels of energy expenditure. This is particularly important as childhood obesity has reached epidemic proportions (Cole, Bellizzi, Flegal, & Dietz, 2000). Public health interests are concerned because overweight children tend to have higher risks of diabetes, increased cholesterol and greater chances of being overweight as adults (Goran, Ball, & Cruz, 2003; Magarey, Daniels, Boulton, & Cockington, 2003). Individuals with mild MR have a higher incidence of obesity than individuals with severe MR (Moran et al., 2005). Furthermore, individuals in the United States, both those with and without MR, have more body fat than their

counterparts in other countries (Frey & Rimmer, 1995; Janssen et al., 2005). This would indicate that issues concerning lifestyle, such as sedentary behavior, may play a role in the high incidence of obesity in individuals with mild MR in the US.

Draheim, Williams, and McCubbin (2002) reported that 51 percent of adult males and 47 percent of adult females with mental retardation engaged in little to no leisure-time physical activity. Recent data from the CDC (2004) show the level of no leisure-time physical activity in the general population to be 22 percent for adult males and 25 percent for adult females. This indicates that there is a disparity between individuals with mental retardation and the general population. This disparity is evident as early as elementary school when children with MR have been shown to have lower physical activity levels than their non-disabled peers after school and on the weekends (Foley, Bryan, & McCubbin, 2005). Similar results were also found by other researchers in different subpopulations with developmental disabilities (Davies & Joughin, 1993; Sharav & Bowman, 1992). Montgomery and colleagues (2004) found a direct relationship between longer time spent in sedentary behavior and decreased physical activity levels. It would be reasonable to think that children with MR, who are less active than their non-disabled peers, would spend more time in sedentary behavior.

It has been suggested that when children engage in the specific sedentary behavior of television (TV) viewing, they displace time spent in

physical activity (Robinson, 2001). Pate and colleagues (1997) found that time spent watching TV was correlated to lower activity levels. It has also been shown that an increase in TV time is associated with an increased prevalence of being overweight in children (Andersen, Crespo, Bartlett, Cheskin, & Pratt, 1998; Crespo et al., 2001). Those children who watch four or more hours of TV a day have the highest incidence of obesity (Crespo et al., 2001). Additionally, increases in television viewing are associated with greater energy intake (Robinson & Killen, 1995). Robinson (1999) found that overweight children could lose weight by reducing the time spent watching television.

The effect of another sedentary behavior, computer time, is equivocal in its relationship to obesity. Stettler (2004) found an association between obesity and electronic games while Hernandez et al.(1999) and Foley (2005) did not. One reason for this may be that eating is harder to do while playing video games or typing on the computer. Regardless of its impact on obesity, computer time is still considered a relevant factor in the displacement physical activity (Brodersen, Steptoe, Williamson, & Wardle, 2005). The combined use of computer and TV time as a measure is often referred to as total screen time (Gordon-Larsen, Nelson, & Popkin, 2004).

The American Academy of Pediatrics (2001; 2003) recommends parents limit the time children spend watching TV and engaged in other electronic media. The Institute of Medicine (2004) has identified childhood as a crucial time for obesity prevention programs. One reason for this is the notion

that it is easier to maintain a healthy weight by preventing fat accumulation than it is to lose weight by the reduction of fat stores (Hill & Peters, 1998). While studies have looked at the after-school behavior of children without disabilities, few studies have investigated sedentary behaviors of children with mental retardation. Therefore the primary purpose of this study was to investigate if children with mild/moderate MR spend more time watching TV and on the computer than their peers without disabilities. The secondary purpose of this study was to find if total screen time correlates to physical activity levels.

Methods

Participants: The participants in this study were 9 students with mental retardation and 45 students without physical or cognitive disability ages 7 to 12. Of the 45 students without disability, 22 returned the forms completed and were used in the study. Of the remaining 23 not used in the study, 5 of the forms were incomplete and 18 were not returned. Descriptive statistics on the participants used in the final analyses are provided in Table 2.1.

Students with MR were recruited for this study based upon the following criteria: (a) have mild mental retardation, and (b) participate in the inclusive classroom setting at least 50 percent of the school day. Eligible students were identified by the school district's special education administrator and based on the school's current evaluation used in the formulation of the student's Individual Education Program and qualification under the Individuals with

Disabilities Education Act (P. L.105-17, 1997). Invitations to participate in the study were sent out by the school district to maintain the confidentiality of students receiving special education services. Once students with MR were recruited, their classmates in the inclusive classrooms were recruited to participate with only the knowledge that this was a physical activity study of elementary school-aged children. They were blinded to the fact that their results would be compared to their classmate(s) with MR. All consent forms and documents were approved by the University Institutional Review Board.

Table 2.1 Physical characteristics of participants

	Non-MR (N=22)		MR (N=9)	
	Mean	SD	Mean	SD
Age	9.00	1.38	9.78	1.56
Wt (kg)	31.90	8.54	30.99	7.48
Ht (cm)	137.06	10.80	129.72	10.69
BMI	16.82	3.02	18.44	3.58

Measurements & Procedures:

Sedentary behavior: The activity log was modeled after a paper version of the Activitygram (Human Kinetics, Champaign, IL) which has been shown to have acceptable reliability as a self-reported instrument (Treuth et al., 2003). For each thirty-minute time block during the after-school day, the parent recorded the predominant activity in which the child participated. Parents also recorded the time the child went to bed. The variables of interest in the logs were the average number of hours a day that a child spent engaged in TV time

and in computer time. Those averages were summed together to arrive at total screen time.

Parents of the children were asked to keep after-school logs of their child's activities from Monday through Thursday night. The parent log format was chosen over child self reporting for three reasons. First, it has been shown that children in this age range have a limited understanding of the concept of physical activity (Trost et al., 2000); second, children with mental retardation may not completely understand the intricacies of keeping an activity log; and third, parents have been shown to give reliable estimates in recording their child's activity (Burdette, Whitaker, & Daniels, 2004).

Physical activity: The Actiwatch AW 16 accelerometer (Mini-Mitter, Bend, OR) was used to measure physical activity and has been shown to be a valid measure of activity for children (Puyau, Adolph, Vohra, & Butte, 2002). Accelerometery has also been shown to provide an effective measurement of physical activity in children with mental retardation (Horvat & Franklin, 2001). The Actiwatch is an omni-directional accelerometer that detects changes in acceleration. Internal analog circuitry amplifies and filters the signal which is then passed into a digital converter to create a digital value. A peak value is identified 32 times a second, then the peak values are summed together to generate an activity count every 15 seconds.

Each child wore an accelerometer attached to the wrist of his/her non-dominant hand for five consecutive days. This placement has been shown to

provide an accurate measure of physical activity (Baxter, Nichols, Sallis, & Calfas, 1998; Chen et al., 2003). The accelerometers were attached to the children with non-removable plastic wrist bands (similar to hospital bands) by a trained assistant Monday mornings at the start of school and replaced Wednesday and Friday mornings to reduce measurement error associated with individual accelerometers. Data from the watches were reported in raw movement counts per 15 seconds to avoid any errors associated with energy expenditure estimations (Welk, Corbin, & Dale, 2000).

Anthropometric measurements: Height and weight were measured within two weeks of the physical activity monitoring. Participants removed shoes and jewelry before being measured. Standing height was measured with a portable stadiometer (GPM, Switzerland) and recorded to the nearest .01cm. Weight was measured on a portable electronic digital strain gauge scale (Health O Meter, Bridgeview, IL) and recorded to the nearest .1kg. The scale was calibrated before each data collection session. Two measures were averaged and used to calculate body mass index for descriptive purposes; according to the CDC (2002) body mass index compares well to laboratory measures of body fat in children.

Data Analysis: All data analysis was performed on STATA V8.2 for Windows (Stata Corporation, TX). To determine if gender differences existed in either group, independent t-tests with equal variances were performed. To determine statistical significance between individuals with and without MR in

the amount of time spent after school watching TV and computer use, independent two-sample t-tests with equal variances were employed. Then, to determine if total screen time was related to physical activity a Pearson product-moment correlation was used. Alpha was set < .05 for all tests.

Results

There were no significant gender differences in TV or computer time in either the MR or Non-MR groups. Therefore, gender was collapsed into the respective groups for all comparative analyses as seen in Table 2.2. The results of the t-tests revealed that time spent viewing TV for children with MR ($\bar{X}$ =.95 hours, SD .73 hours) was greater, but not significantly different, than time spent viewing TV for children with out MR ($\bar{X}$ =.89 hours, SD .64 hours) (t(29)=.23, p=.81). A similar outcome was also found for time engaged on the computer. Children with MR ($\bar{X}$ =.40 hours, SD .59 hours) had spent less time, but not significantly different, engagement in computers than children with out MR ($\bar{X}$ =.42 hours, SD .67 hours) (t(29)=.07, p=.94). The result of the Pearson product-moment correlation showed there was a significant moderate relationship between screen time and after-school physical activity for children with MR (r=.69, p=.04). The more engaged a child with MR was engaged in screen time, the more physically active they were. To the contrary, the relationship between after-school physical activity and screen time for children without MR was inverse, low, and not significant (r=-.29, p=.2).

Table 2.2 The average number of hours a child spends engaged in TV and computer time after school

	Non-MR		MR	
	Mean	SD	Mean	SD
TV Time	0.89	0.64	0.95	0.73
Computer Time	0.42	0.67	0.40	0.59
Total Screen Time	1.31	0.97	1.36	1.14

Discussion

Time spent watching television has been shown to be significantly associated with childhood obesity. In fact, television is such a concern that the American Academy of Pediatrics (2003) calls for no more than two hours of media time a night in its policy statement on the prevention of pediatric overweight and obesity. The primary purpose of this study was to investigate if children with mild/moderate MR spend more time watching TV and on the computer than their peers without disabilities. This study showed that the amount of time a small sample of elementary school-age children with MR spend watching TV is no different than the amount of time their peers spend. This was also the finding in the time spent playing computer games and computer time. While it was hypothesized that a difference would be found, it was encouraging that the majority of the children did not exceed the limit set by the Academy of Pediatrics of 2 hours per day. The averages for TV in this study were also under the 40 percentile of the national averages for elementary school-aged children (Andersen et al., 1998; Crespo et al., 2001).

This could also be the result of parents who did not want to be judged on their TV viewing habits and therefore underreported TV exposure.

The fact that these overall averages for both TV and computer time are lower than the national average could be due to a lack of heterogeneity of the sample. Anderson (1998) found that individuals with Hispanic and African American backgrounds watch more TV than other ethnic groups. While the ethnicity of the children was not surveyed, it was observed that only a small number (2 of the 9) of children with mental retardation were non-white. Another explanation could be that the parents in the community sampled are more concerned with the child's television viewing habits. This is a limitation of the study and the authors recommend that future studies investigate a more ethnically diverse population of individuals with mental retardation.

The secondary purpose of this study was to find if total screen time correlates to physical activity. Results of the correlation revealed contradictory relationships increased screen time had on physical activity in the two groups. The inverse correlation of higher screen time being related to decreased physical activity, as seen in children without MR, was similar to what would be expected. This supports the notion by Robinson (2001) of displacement, in which physical activity is compromised as children increase their screen time. However, children with MR had a significant relationship in which higher screen time was associated with higher physical activity. This correlation was somewhat perplexing. A small sample size could be skewing the magnitude of

the correlation but probably not enough to change the direction of the relationship. It could be a situation in which very active children with MR are given TV or computer time as a behavioral intervention. In an anecdotal example, one parent in a follow-up interview explained that TV kept their child with MR from "getting in trouble" while that parent cooked. If this is the case, then it reinforces an undesirable behavior while trying to mollify another. Or, it may be a case of rewarding appropriate activity (ie. soccer practice) with TV or computer time; in this case, reinforcing a positive behavior with token TV or computer time as a perceived positive reward. Both scenarios may have negative long-term implications for the health of individuals with MR by reinforcing sedentary behaviors.

It has been reported that as adults individuals with mild MR have close to double the rate of obesity compared to those individuals with severe MR (Moran et al., 2005). Many factors may play into this such as medication and living arrangements (Robertson et al., 2000). Another factor that can not be overlooked is independence of choice (Bechtel & Schreck, 2003). If given a choice of behaviors, like their counterparts with out disabilities, individuals with mild MR might choose sedentary behavior over physical activity (Vara & Epstein, 1993). The results from this study suggest that reinforcement of sedentary behaviors may begin during childhood for individuals with MR. These results indicate that there might be different patterns to the development of sedentary behaviors indicating that interventions at an early

age should include a parental component. Due to the limitations of correlational research, this study only provides information about the relationship between screen time and physical activity in children with MR. More research is needed to determine to what extent a more diverse group on children with MR is engaged in screen time and to better understand the dynamics of screen time on physical activity.

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Chapter 4: Conclusion

Summary

The primary focus of this research was to gain an understanding of the disparity of physical activity between children with MR and without MR. By determining during which part of the day children with mental retardation have higher rates of physical inactivity compared to their peers, strategies can be developed to increase their activity levels, thereby reducing health conditions related to physical inactivity. This is important because it is estimated that individuals with mental retardation (MR) have an average lifetime economic cost of $1,014,000 per person; which is the highest per person cost of any category of individuals with developmental disabilities (CDC, 2004). This cost can be reduced and quality of life improved by increasing physical activity and reducing sedentary behaviors (Traci, Seekins, Szalda-Petree, & Ravesloot, 2002).

Therefore, the primary purpose of the first study was to investigate the physical activity levels of elementary school-aged children with and without MR in both the school and after-school environments. The secondary purpose of the first study was to investigate the relationship between physical activity levels and motor skills in elementary school-aged children with and without MR. The primary purpose of the second study was to investigate if children with mild/moderate MR spend more time watching TV and on the computer than their peers without disabilities. And, the secondary purpose of second study was to find if total screen time correlates to physical activity.

In the first study, physical activity levels for children with MR were significantly lower than for their peers during both the school day and after school. These findings are consistent with the results found for children with other developmental disabilities (Davies & Joughin, 1993; Nardella, Sulzbacher, & Worthington-Roberts, 1983; Sharav & Bowman, 1992). During school, the predominant time for unstructured play is recess (NASPE, 2001). At recess, children without MR had 53% higher activity levels than children with MR. Because recess is where children make choices on ways to be active, these findings suggest that students either chose not to be active or were not given the opportunity by their peers without disabilities to participate in physical activities.

During inclusive physical education, children without MR were 133% more physically active than children with MR. The lack of engagement during physical education is similar to the findings of Temple & Walkley (1999) who found that students with mild MR were less engaged in motor and cognitive activity related to the physical education lesson than their peers without disabilities. In follow-up observations of the two physical education classes, it was evident that some of the children with MR were working on specific motor skill development related to an individual education program and therefore, not engaged in the group lesson. This result would suggest that children with MR might not be receiving the same fitness benefits from physical activity as their peers during inclusive physical education.

The disparity in physical activity continued outside school time. Children without MR had 52% more activity than children with MR after school. This pattern continued into the weekend, where children without MR were 33% more active than children with MR. This indicates that children with MR might not be provided the same opportunities to be physically active after school as their peers. These findings would be in line with Levinson & Reid (1991) who reported that children with developmental disabilities face barriers to participation in physical activities due to lack of motor skills.

The second part of the first study investigated the relationship between motor skills and the physical activity levels in children with or without MR. Correlations between the two for both children with and without MR were not significant, indicating that there is little relationship between children's physical activity levels and their motor skills. While these results suggest that a relationship may not exist, it is likely that this relationship is complex and needs an advanced form of statistical modeling that can only be analyzed with a larger sample.

The second study looked indirectly at why children without MR were 52% more active than children with MR after school. It has been suggested by Robinson (2001) and Brodersen, Steptoe, Williamson, & Wardle (2005) that time spent watching TV and on the computer displace time spent engaged in physical activity. However, few studies have looked at sedentary behavior in children with MR. The primary purpose of the study was to investigate if

children with MR spend more time watching TV and on the computer than their peers without disabilities. The results of the second study showed that the amount of time elementary school-aged children with MR spent watching TV was no different than the amount of time their peers spent. This was also the finding in the time spent playing computer games and computer time. Both groups had spent fewer hours per day watching TV or on the computer than the national average. It was encouraging that the majority of the children did not exceed the limit set by the Academy of Pediatrics of two hours per day.

The purpose of part two of the second study was to find if total screen time correlates to physical activity. The results revealed a small, but not statistically significant, inverse correlation of higher screen time being related to decreased physical activity in children without MR. The direction of the relationship is aligned the with notion of displacement, in which physical activity is reduced as children increase their screen time (Robinson, 2001). However, children with MR had a significant relationship in which higher screen time was associated with higher physical activity. This association is somewhat puzzling and could be the result of TV being used as reinforcement for participation in physical activity or a diversion to calm over active behavior. If this is the case it may have negative long-term implications for the health of individuals with MR by reinforcing sedentary behaviors.

This research confirms that disparity between individuals with and without mental retardation exists not only in adulthood but in childhood as well.

This is essential because childhood has been identified as a critical time for interventions to reduce obesity and instill the importance of a physically active lifestyle (Institute of Medicine, 2004; President's Council on Physical Activity and Sports, 1994). By increasing the physical activity levels of children with MR health care cost can be reduced and quality of life improved. Findings from this study also indicate that more research needs to be conducted on sedentary behavior habits in children with MR.

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APPENDICES

Appendix A - Literature Review:

Introduction

Developmental disabilities are defined as chronic disabilities attributable to mental and/or physical impairment, which manifest before age 22 and result in substantial limitations in three or more of the following areas: self-care, receptive and expressive language, learning, mobility, self-direction, capacity for independent living, and economic self-sufficiency (U.S. Department of Health and Human Services, 2004). It is estimated individuals with mental retardation have an average lifetime economic cost of $1,014,000 per person; which is the highest per person cost of any category of individuals with developmental disabilities (Centers for Disease Control and Prevention, 2004a). It has been suggested that by increasing physical fitness in adults with developmental disabilities, secondary health conditions can be reduced thereby reducing overall health care cost and improving quality of life (Traci, Seekins, Szalda-Petree, & Ravesloot, 2002).

Robertson and colleagues (2000) investigated the lifestyle and risk factors related to poor health in individuals with intellectual disabilities. The participants in the study were 500 individuals living in the United Kingdom. Interviews and questionnaires of each person's support team were used to collect data. The results from this study indicate that overall levels of obesity and physical inactivity were higher predictors of poor health than the usual predictors of smoking and alcohol consumption. The authors of the study suggest that increasing physical activity might be the most effective method of

improving health and reducing secondary health concerns in individuals with disabilities.

In 2002, Draheim, Williams, & McCubbin (2002) reported on the prevalence of leisure-time physical activity in individuals with moderate to mild mental retardation. A sub-group of this population that has been shown to have a higher incidence of obesity than individuals with severe MR (Moran et al., 2005). The researchers interviewed 76 men and 74 women, between the ages of 19 and 65, and their care providers. The results of the study showed that 51 percent of the males and 47 percent of the females engaged in little to no leisure-time physical activity. Recent data from the CDC (2004b) show the level of no leisure-time physical activity in the general population to be 22 percent for males and 25 percent for females. This would indicate that there is a disparity between individuals with mental retardation and the general population. Unfortunately, there is little research evidence on the physical activity levels of children with mental retardation, thus supporting a need for related research (Cooper et al., 1999).

Opportunities throughout the day for children to be physically active are varied but the four most commonly recognized times are the following: 1) during recess at school, 2) during physical education at school, 3) during after-school activities such as organized sports, and 4) during the weekend. Recess can be defined as a time for unstructured play where children make choices on ways to be active (NASPE, 2001b). Physical education, conversely

provides a structured opportunity for children to participate in physical activity and improve related skills and knowledge (NASPE, 2001a). After-school and weekend activities can be diverse and range from structured sports to unstructured play. Each of these times presents an opportunity for an intervention to provide a positive impact on physical activity levels.

Physical Activity During School

One of the best opportunities for children to be physically active in school is during physical education. Datar and Sturm (2004) analyzed data from the Early Childhood Longitudinal Study to investigate if physical education had an impact on the body mass index of early elementary school children. Their findings showed that overweight children reduced their body mass index over a years time when provided physical education. They also found that children with normal weight did not see a chance into the overweight category. This indicates that physical education classes provide an important component in the prevention of childhood obesity.

The authors of the School Health Policies and Program Study (Burgeson, Wechsler, Brener, Young, & Spain, 2001) reported that 78 percent of states require physical education in elementary schools and that 82 percent of the school districts require students with disabilities to be included in regular physical education when appropriate. In many states, an adapted physical education specialist would have the time to ensure students with mental

retardation were engaged in adequate physical activity. However, Lytle & Hutchinson (2004), found that many adapted physical educators have seen their roles change from someone who has constant contact with the students, to more of a consultant who works with teachers. This places more importance on the classroom teacher and physical education teacher to insure that all children with mental retardation are physically active during physical education.

To investigate how activity levels in children with mental retardation compared to those of their classmates during physical education and recess, Faison-Hodge & Porretta (2004) used systematic observation to compare third, four and fifth graders. Eight students with mental retardation and 38 students without took part in the study. The 38 students without a disability were divided into the following two groups: those with high cardiorespiratory fitness and those with low cardiorespiratory fitness. The results showed that students with mental retardation had lower physical activity levels than those individuals without MR with high cardiorespiratory fitness levels and similar levels to those individuals without MR with low cardiorespiratory fitness levels. It was also shown that all students had higher levels of physical activity during recess than during physical education.

The results from Faison-Hodge & Porretta are a little different than work by Lorenzi, Horvat and Pellegrini (2000), who compared recess activity levels of elementary school children, from kindergarten through fifth grade, both with and without mild mental retardation. Physical activity in each participant was

measured with a heart rate monitor, two accelerometers and systematic observation. Data was recorded in one-minute intervals for 16 minutes, at which time all instruments were removed. This was done on three separate occasions. The results of the study showed that heart rates and activity counts were significantly greater in children with mental retardation than in children without. However, the systematic observation did not show any significant differences between the two groups. After reviewing both studies, it still remains unclear if there is a difference in the physical activity levels of children with and without mental retardation.

Similar to the findings of Faison-Hodge & Porretta, Nardella, Sulzbacher, & Worthington-Roberts (1983) found that individuals with Prader-Willi syndrome, a condition that causes mental retardation, tended to have a wider range of physical activity levels than individuals without mental retardation in a semi-structured environment. The participants, ages 11-22, used both pedometers and actometers to record activity over a one week period. While there was no comparison of the mean differences, a review of the actometer measurements indicated that individuals with Prader-Willi syndrome were less active than their peers. However, results from this study need to be interpreted with caution because the comparison group was comprised of children at a different summer camp. This study, along with the previously mentioned studies, shows that there is limited research on physical activity during school time of children with mental retardation.

Physical Activity After School

In a study by Kozub (2003), the physical activity patterns for 7 individuals with mental retardation were observed. The participants in the study ranged in age from 13 to 25 and wore accelerometers that measured their physical activity during waking hours. The results of the study show a trend of increasing activity as the day progresses, with a spike in activity after 3 p.m.; little research has been done on after-school physical activity levels in elementary school-aged children with mental retardation. Research has shown that the after-school environment is a ideal time to increase children's physical activity (Kelder et al., 2005).

A survey of parents of 105 Canadian children, ages 4-21, with developmental disabilities, Levinson & Reid (1991) showed a result of declining physical activity in older individuals age 11 and above compared to those age 10 and younger. Other questions relating usual location of activity and barriers to participation in activity, found that the majority of activity in younger children took place in the home with less activity occurring in parks and even less at school. The biggest reported barriers to participation of younger children in activities were the lack of skills followed by the lack of facilities.

Sallis et al. (1999), in a survey of 1,504 children in the fourth through twelfth grades, found that children who were participating in after-school sports or other outdoor activities had a higher level of overall physical activity. In a

study of 360 fifth grade-students, Pate et al. (1997) investigated the correlation of lifestyle behaviors and physical activity. Participants in the study were measured on physical activity using the Previous Day Physical Activity Recall. The results of the study suggest that the amount of time spent watching television is correlated to lower activity levels. A similar finding by Arluk et al. (2003) showed that time spent in sedentary behaviors such as watching television and on the computer correlated with higher obesity levels in children. These studies show the importance of studying physical activity in the after-school environment of children with mental retardation.

Motor skills

Reduced physical activity and increased sedentary behavior may have been linked to youth obesity. Two reasons for the increase in sedentary behavior may be the increased availability of televisions and transportation means other than self propulsion by individuals with poor motor coordination. To investigate whether motor coordination was related to obesity, Petrolini, Iughetti, & Bernasconi (1995) tested 40 children between the ages of 6-10 years old; 20 were classified as obese and 20 as having normal body fat. The children's visual motor coordination was assessed with the Bender's Visual Motor Gestalt Test. The result of the study showed significantly poorer visual motor scores for children who were obese. The authors of the study proposed

that deficits in visual-motor coordination may lead to an increase in sedentary behavior as a form of self protection from injury during physical activity.

Hills and Parker (1992) investigated gait characteristics between children who were obese and that who were not. The participants in the study were 10 children classified as obese and 4 children within normal weight classification. Kinematic data was taken while the children walked down a 10 meter walkway at slow, normal and fast speeds. The results from the study showed that obese children had a tendency to have a slower walking velocity but not a shorter stride length than non-obese children. These gait characteristics would suggest that obese children are spending more time in double support phase of their walking which has been associated with instability in balance. This tentative walking gait may lead to decreased initiative to engage in moderate to vigorous physical activity.

To investigate the relationship between physical activity and motor development, Rosa, Rodriguez and Marquez (1996) evaluated 1083 children from the ages of 6 to 12. Motor development was measured by the Lincoln-Oseretesky Motor Development Scale (Sloan, 1955) and physical activity was assessed by a questionnaire. The results found that a reduction in physical activity was related to lower motor development scores in children 6 years of age. Their study also showed a visual trend until the age of 12; however, a level of statistical significance was not reached after the age of 6. One of the reasons may have been that the Lincoln-Oseretesky may not have been

sensitive enough to changes in motor ability in the later years. These findings similar to the findings of Fisher and colleagues (2005) who found and that physical activity was associated with motor skills in preschool aged children.

In a study of 554 first grade children, Graf and colleagues (2004) looked at the correlation between motor abilities, BMI, physical activity patterns and television viewing behavior. Based on BMI children were coded into one of two groups: overweight/obese and normal/underweight. The results showed children with higher motor abilities were significantly correlated with greater amounts of physical activity, spending less time watching television and having a lower BMI. Additionally, there was no correlation found between physical activity patterns and BMI. The authors suggest that physical inactivity may result in motor deficits that foster sedentary behavior which in turn contributes to obesity. Considering individuals with mental retardation often have lower motor ability scores than their same age peers, it is important to investigate this line of research further to determine if motor abilities correlate to time spent in sedentary behavior in children both with and without mental retardation.

Sedentary Behavior

It has been suggested that when children engage in the specific sedentary behavior of television (TV) viewing, they displace time spent in physical activity (Robinson, 2001). Pate and colleagues (1997) found that time

spent watching TV was correlated to lower activity levels. It has also been shown that an increase in TV time is associated with an increased prevalence of being overweight in children (Andersen, Crespo, Bartlett, Cheskin, & Pratt, 1998; Crespo et al., 2001). Those children who watch four or more hours of TV a day have the highest incidence of obesity (Crespo et al., 2001). Robinson (1999) found that overweight children could lose weight by reducing the time spent watching television. These results were also seen by Epstein and colleagues (Epstein et al., 1995) who showed that by reducing sedentary behavior children were able to reduced lose weight. They also showed that promoting the reduction of sedentary behavior was a more effective method of weight reduction for children than promoting increased physical activity.

The effect of another sedentary behavior, computer time, is unclear in its relationship to obesity. Stettler (2004) found an association between obesity and electronic games in Swiss children. However, this has not been the case in studies of children in the United States (Foley, 2005; Hernandez et al., 1999). One reason for this discrepancy may be that eating is harder to do while playing video games or typing on the computer. Regardless of its impact on obesity, computer time is still considered a relevant factor in the displacement physical activity (Brodersen, Steptoe, Williamson, & Wardle, 2005). The combined use of computer and TV time as a measure is often referred to as total screen time (Gordon-Larsen, Nelson, & Popkin, 2004). It

has been recommended by the American Academy of Pediatrics (2001; 2003) that parents limit the total screen time to a maximum of two hours per day.

Summary

While there is a general understanding of physical activity levels in the school and after-school environments for children without disabilities, there is little information about activity levels in children with mental retardation. The few studies that have looked at physical education and recess remain inconclusive: Faison-Hodge & Porretta (2004) indicate a difference between individuals with and without mental retardation, while Lorenz, Horvat and Pellegrini (2000) found no difference. In the after-school environment little is known about activity levels with children with mental retardation in relation to their peers without mental retardation. Considering the importance of after-school activity found by Sallis and colleagues (1999), more research is needed in this area. While Faison-Hodge & Porretta (2004) looked at the influence of cardiovascular fitness on activity levels of children with mental retardation, a search of Medline and Sportdiscus databases shows no one has published articles on the influence of motor skills on the physical activity levels of children with mental retardation. The same databases also failed to produce results for searches on the influence of sedentary behavior on physical activity in children with mental retardation. The deficit of information on physical activity levels in children with mental retardation in both the school and home

environment makes it difficult to develop strategies to increase their physical activity levels, thereby reducing secondary health concerns.

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Appendix B – Informed Consent Document:

Oregon State UNIVERSITY | Open minds. Open doors.™
DEPARTMENT OF EXERCISE AND SPORT SCIENCE
College of Health and Human Sciences - Corvallis, OR 97331 - (541)-737-2176

INFORMED CONSENT DOCUMENT

Project Title: Exploring the physical activity levels of students in both school and after-school environments.

Principal Investigators: Dr. McCubbin and John Foley

PURPOSE

This is a research study. The purpose of this study is to investigate the physical activity levels of children both during school and after-school environments. The purpose of this consent form is to give you the information you will need to help you decide whether to be in the study or not. Please read the form carefully. You may ask any questions about the research, what you will be asked to do, the possible risks and benefits, your rights as a volunteer, and anything else about the research or this form that is not clear. When all of your questions have been answered, you can decide if you want to be in this study or not. This process is called "informed consent". You will be given a copy of this form for your records.

We are inviting you and your child to participate in this research study because your child is aged 7-14 and in the Corvallis School District.

PROCEDURES

If you and your child agree to participate, your child will be asked to wear an accelerometer (similar to a watch) on the wrist, 24 hours a day, for one week. The accelerometer will measure your child's physical activity levels at all times. The week following the activity monitoring your child will be tested on balance and motor coordination; this test will take approximately a half-hour to complete. Also at that time, height and weight measures of you child will also be taken to calculate your child's body mass index.

As parent/guardian you will be asked to fill out a questionnaire and record you child's after-school activity for the two weeks of the study. The estimated daily time commitment to fill out the logs is less than 15 minutes.

RISKS

The possible risks associated with participating in this research project are no greater than the everyday risk associated with activities during school and after school.

BENEFITS
A potential personal benefit that may occur as a result of your child's participation in this study is a positive experience from his or her involvement in a scientific research project. He or she may enjoy being exposed to higher education and scientific inquiry, knowledge about physical activity, and the benefits of engaging in physical activity. The broader benefits of the study are the identification of causes of the disparity in physical activity levels in children with and without mental retardation. This will potentially lead to strategies can more effectively increase physical activity levels in individuals with disabilities and thereby reducing the risk of secondary health conditions.

COSTS AND COMPENSATION
There will be no cost for participation in this research project. There will be no compensation given for participation in this research project.

CONFIDENTIALITY
Records of participation in this research project will be kept confidential to the extent permitted by law. However, federal government regulatory agencies and the Oregon State University Institutional Review Board (a committee that reviews and approves research studies involving human subjects) may inspect and copy records pertaining to this research. It is possible that these records could contain information that personally identifies you. To help protect both the identity of the child and parents all information will be coded and numerical identifications given during data entry. The original files will be kept in a locked file box until they are destroyed. Names and addresses will remain in a separate database for contact information regarding the study. In the event of any report or publication from this study, your identity will not be disclosed. Results will be reported in a summarized manner in such a way that you cannot be identified.

RESEARCH RELATED INJURY
In the event of research related injury, compensation for medical treatment is not provided by Oregon State University.

VOLUNTARY PARTICIPATION
Taking part in this research study is voluntary. You and/or your child may choose not to take part at all. If you and your child agree to participate in this study, you and/or your child may stop participating at any time. It is your right and the right of you child to skip any questions that you or your child would prefer not to answer. If you and/or you child decide not to take part, or if you and/or your child stop participating at any time, that decision will not result in any penalty or loss of benefits to which you or your child may otherwise be entitled. If you chose to withdraw from the study, any activity data collected four days or more will be used in the final research analysis. Participants who withdraw with less than four days of data not be included in the final research analysis and their files will be destroyed.

QUESTIONS

Questions are encouraged. If you have any questions about this research project, please contact: Dr. Jeff McCubbin or John Foley at (541) 737-2176. If you have questions about your rights as a participant, please contact the Oregon State University Institutional Review Board (IRB) Human Protections Administrator, at (541) 737-3437 or by e-mail at IRB@oregonstate.edu.

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Child's Name: _____

(printed)

Parent/Guardian's Name: _____

(printed)

_____ _____

(Signature of Parent/Guardian) (Date)

RESEARCHER STATEMENT

I have discussed the above points with the participant or, where appropriate, with the participant's legally authorized representative, using a translator when necessary. It is my opinion that the participant understands the risks, benefits, and procedures involved with participation in this research study.

_____ _____

(Signature of Researcher) (Date)

OSU IRB Approval Date: 08-20-04
Approval Expiration Date: 08-19-05

Appendix C – Assent Document:

Oregon State UNIVERSITY | Open minds. Open doors.™
DEPARTMENT OF EXERCISE AND SPORT SCIENCE
College of Health and Human Sciences - Corvallis, OR 97331 - (541)-737-2176

ASSENT DOCUMENT

Project Title: Exploring the physical activity levels of students in both school and after-school environments.
Principal Investigators: Dr. Jeff McCubbin and John Foley

We are doing a research study. A research study is a special way to find out about something. We are trying to find out how physically active elementary school children are in school and at home. This form is about the study, so you can learn about the study and decide if you want to be in the study or not. You can ask any questions. After all of your questions have been answered, you can decide if you want to be in this study or not.

If you decide that you want to be in this study, we will ask you to do several things. First, you will need to wear a special watch that is actually an activity monitor on your wrist all day and night for two weeks. Second, you will be tested on your balance and coordination skills during one recess or physical education class. Also, your parents will be asked to keep a log of your after school activities.

If you decide to be in this study, some good things might happen to you find out how active you are. We might also find out things that will help other children some day.

When we are done with the study, we will write a report about what we found out. We won't use your name in the report.

You don't have to be in this study. It's up to you. If you say okay now, but you want to stop later, that's okay too. All you have to do is tell us.

If you want to be in this study, please sign your name.

I, _____, want to be in this research study.
(Print your name here)

_____ _____
(Sign your name here) (Date)

OSU IRB Approval Date: 08-20-04
Approval Expiration Date: 08-19-05

Appendix D – Teacher's Informed Consent Document:

Oregon State UNIVERSITY | Open minds. Open doors.™
DEPARTMENT OF EXERCISE AND SPORT SCIENCE
College of Health and Human Sciences - Corvallis, OR 97331 - (541)-737-2176

TEACHER'S INFORMED CONSENT DOCUMENT

Project Title: Exploring the physical activity levels of students with mental retardation and students without disabilities in both school and after-school environments.

Principal Investigators: Dr. McCubbin and John Foley

PURPOSE: This is a research study. The purpose of this study is to investigate the physical activity levels of children in the inclusive classroom both during school and after-school environments. The purpose of this consent form is to give you the information you will need to help you decide whether to be in the study or not. Please read the form carefully. You may ask any questions about the research, what you will be asked to do, the possible risks and benefits, your rights as a volunteer, and anything else about the research or this form that is not clear. When all of your questions have been answered, you can decide if you want to be in this study or not. This process is called "informed consent". You will be given a copy of this form for your records.

We are inviting you to participate in this research study because you teach an inclusive class of children in the Corvallis School District.

PROCEDURES: If you agree to participate, you will be asked to fill out a questionnaire on your educational background that will take approximately 10 minutes to complete. This will help provide background information on teachers that will be used in a group summary and keep confidential at all times. Also, you will be asked to keep a log of your class schedule for two weeks. The estimated daily time commitment to fill out the logs is approximately 5 minutes a day.

RISKS: The possible risks associated with participating in this research project are no greater than the everyday risk associated teaching.

BENEFITS: The benefits of the study are the identification of causes of the disparity in physical activity levels in children with and without mental retardation. This will potentially lead to strategies can more effectively increase physical activity levels in individuals with disabilities and thereby reducing the risk of secondary health conditions.

COSTS AND COMPENSATION: There will be no cost for participation in this research project. There will be no compensation given for participation in this research project.

CONFIDENTIALITY: Records of participation in this research project will be kept confidential to the extent permitted by law. However, federal government

regulatory agencies and the Oregon State University Institutional Review Board (a committee that reviews and approves research studies involving human subjects) may inspect and copy records pertaining to this research. It is possible that these records could contain information that personally identifies you. To help protect your identity, all information will be coded and numerical identifications given during data entry. The original files will be kept in a locked file box until they are destroyed. Names and addresses will remain in a separate database for contact information regarding the study. In the event of any report or publication from this study, your identity will not be disclosed. Results will be reported in a summarized manner in such a way that you cannot be identified.

VOLUNTARY PARTICIPATION: Taking part in this research study is voluntary. You may choose not to take part at all. If you agree to participate in this study, you may stop participating at any time. It is your right and the right to skip any questions that you would prefer not to answer. If you decide not to take part, or if you stop participating at any time, that decision will not result in any penalty or loss of benefits to which you may otherwise be entitled. If you chose to withdraw from the study, any data collected will be used in the final research analysis.

QUESTIONS: Questions are encouraged. If you have any questions about this research project, please contact: Dr. Jeff McCubbin or John Foley at (541) 737-2176. If you have questions about your rights as a participant, please contact the Oregon State University Institutional Review Board (IRB) Human Protections Administrator, at (541) 737-3437 or by e-mail at IRB@oregonstate.edu.

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Teacher's Name: _____
(printed)

_____ _____
(Signature of Teacher) (Date)

RESEARCHER STATEMENT

I have discussed the above points with the participant or, where appropriate, with the participant's legally authorized representative, using a translator when necessary. It is my opinion that the participant understands the risks, benefits, and procedures involved with participation in this research study.

_____ _____
(Signature of Researcher) (Date)

OSU IRB Approval Date: 08-20-04
Approval Expiration Date: 08-19-05

Appendix E – Classroom Log:

Classroom Log

This log will be used in a study to help understand physical activity levels in children with and without mental retardation. Your participation is completely voluntary. If you have any questions please contact John Foley @ 541-737-3402

Name:_____Grade level currently teaching:____

District Name:_____School Name:_____

Please fill in the start and end times when your class goes to recess, PE or lunch. When the class is at PE please list the instructors name. Thank you for your effort.

Time	Activity (Recess/PE/Lunch)	Lead Instructor
Start Time:		
End Time:		
Start Time:		
End Time:		
Start Time:		
End Time:		
Start Time:		
End Time:		
Start Time:		
End Time:		
Start Time:		
End Time:		
Start Time:		
End Time:		

Appendix F – Activitygram:

Day # _____

ACTIVITYGRAM Logging Chart

Name_____ **Age**_____ **Date**_____
Homeroom Teacher _____**Grade**_____

Record the *primary* activity your child did during each 30 minute interval during the day using the list at the bottom of the page. Then select an intensity level that best describes how it felt (Light: 'Easy'; Moderate: 'Not too tiring '; Vigorous: 'Very tiring'). *Note:* All time periods of rest should have Rest checked for intensity level.

Example: If a child played soccer at a "Vigorous" level between the hours of 3:00 and 4:00 the chart would be filled in as follows:

TIME	ACTIVITY	REST	LIGHT	MOD.	VIG.
3:00	*Soccer*				X
3:30	*Soccer*				X

TIME	ACTIVITY	REST	LIGHT	MOD.	VIG.
3:00					
3:30					
4:00					
4:30					
5:00					
5:30					
6:00					
6:30					
7:00					
7:30					
8:00					
8:30					
9:00					
9:30					
10:00					
10:30					