Comparison of Physical Activity Levels Between Adults With and Without Mental Retardation

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Background: Adults with mental retardation (MR) have been identified as being more sedentary than those without disabilities based on (a) proxy reports of physical activity (PA) and (b) physiological measures such as body composition or cardiovascular fitness. However, there exist no objective, direct comparisons of PA levels between adults with and without MR. The purpose of this study was to compare physical activity (PA) levels between adults with and without MR using accelerometry. Methods: Twenty-two adults with MR (11 men, 11 women; age = 34.9 ± 9.0 y), 17 sedentary controls without MR (SC; 8 men, 9 women; age = 35.8 ± 7.6 y), and 9 active controls without MR (AC; 5 men, 4 women; age = 34.1 ± 5.8 y) wore a Manufacturing Technology Inc (model 7164) accelerometer for 7 d. Data were collected in 1-min epochs and categorized according to light, moderate, hard, and very hard PA. Differences between groups on dependent measures were examined using a 1-way ANOVA. Results: Both MR and SC groups were less active ($F_{2,47} = 12.17$, $P = 0.00$, $\eta^2_p = 0.35$), engaged in less moderate-hard PA ($F_{2,47} = 11.28$, $P = 0.00$, $\eta^2_p = 0.33$), and engaged in fewer bouts of moderate-hard, continuous PA ($F_{2,47} = 11.71$, $P = 0.00$, $\eta^2_p = 0.34$) than AC subjects. There were no differences between MR and SC subjects on the variables measured. Conclusions: The results suggest that adults with MR exhibit PA patterns similar to sedentary adults without MR. Interventions for this population should target participation in continuous, moderate PA.

Key Words: intellectual disability, cognitive impairment

During the past 30 y, individuals with mental retardation (MR) have been progressively deinstitutionalized into community-based settings. As a result, health issues in this population, including physical activity (PA) behaviors, have received increased attention. Research trends indicate that community residents with MR are at greater risk for morbidity and mortality from chronic diseases associated with inactivity than both people without MR and their institutionalized counterparts. This is largely attributed to the high incidence of obesity, poor blood-lipid profiles, high rate of hypertension, and poor cardiorespiratory fitness levels frequently

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observed in this population. There are several speculative reasons for these findings: a) There is typically less structure in community settings, which results in less programmed PA time, than in other settings (i.e., group homes and institutions), b) adults with MR have limited access to and options for community-based recreation or fitness programs, c) adults with MR have large amounts of leisure time, and d) adults with MR in the community choose to be inactive, which might not be a choice honored in institutions. Unfortunately, the movement toward providing greater opportunities for independence to adults with MR could also be predisposing them to health problems associated with sedentary behavior.

As previously stated, the poor health status of adults with MR in community settings is associated with inactivity; however, there is limited research on the actual PA patterns and behaviors of this population. The majority of studies that have specifically examined PA variables in adults with MR indicate that they do not meet recommended health-related activity guidelines and are less active than people without MR. Conversely, recent reports have shown that the prevalence of inactivity is similar among adults with and without MR.

The majority of PA behavior research in this population is based on surveys and secondary sources of information (i.e., care providers). PA surveys have not been validated for this population, and the problems associated with using traditional survey methods with adults with MR, such as comprehension and acquiescence, have been documented. Secondary sources might not accurately represent and often overestimate primary-source activities. In addition, lack of control groups limits population comparisons. It appears that methodology should be considered before conclusions are drawn regarding the PA behaviors of adults with MR.

Activity monitors (i.e., accelerometers) would be appropriate to use with adults with MR because they require little cognitive commitment from subjects. To date, only 2 studies have employed accelerometry to measure PA in adults with MR. These were not conducted in the United States, which limits generalizability because disability services (e.g., residential options) often vary across countries. Iwaoka and associates examined energy expenditure and PA levels in 23 institutionalized Japanese men with MR. Subjects were evaluated during sitting, standing, and walking at 3 different speeds, for 4 min at each speed. Energy expenditure and PA levels were simultaneously measured using indirect calorimetry and accelerometry, respectively. The higher relative energy costs observed in the MR group than in controls was partially attributed to poor movement efficiency and coordination. These data are interesting but provide little insight into the PA behaviors of adults with MR in nonlaboratory settings. Temple et al. conducted an ambitious study to assess PA levels in 6 Australian group-home residents with MR, using direct observation and accelerometry. Participants wore a uniaxial accelerometer and were observed continuously for 7 consecutive days. Activity levels were variable, but 4 participants engaged in moderate to vigorous activity, 30 min in duration, at least 3 days a week, and all walked for transportation more than 80 min per day. These findings challenge the majority of research, which maintains that adults with MR living in the community are generally inactive, and provide the impetus for additional investigation of PA levels in this group using objective measures.

The purpose of this study was to compare PA levels between US residents with and without MR living in the community. The work of Temple et al. was
expanded by examining PA a) in a larger sample of adults with MR, b) across a broader range of community-based living environments, and c) employing 2 comparison groups of sedentary and active adults without MR. It was hypothesized that adults with MR would be less active than both comparison groups.

**Method**

**Subjects**

**Participants With MR.** An initial sample of 34 adults with MR was recruited through both personal contact and agencies serving people with disabilities. Twelve participants were eliminated from final analysis because of an inability to complete the study protocol, primarily because of a failure to wear the monitor for the required sampling period, resulting in a final sample of 22 (11 women, 11 men). The largest reported attrition rate occurred among group-home residents as a result of problems in staff communication and compliance regarding study procedures.

Because most of the estimated 1.5 million people in the United States with mental retardation function in the mild range, recruitment efforts were restricted to individuals with this classification. Access to intelligence-quotient scores was not available for many participants, but all received various levels of support for employment, transportation, or housing through community agencies that serve people with disabilities. The level of these supports was confirmed as intermittent or limited (i.e., mild MR) by parents, job coaches, and case workers. All reported that they had received special education services during school.

Fourteen participants were diagnosed with idiopathic MR, 6 with Down syndrome, 1 with William’s syndrome, and 1 with Klinefelter’s syndrome (XXYY karotype, often associated with MR). Participants were free from physical or sensory conditions that could impede or interfere with movement. Several participants manifested 1 or more of the following secondary conditions controlled by medication: high blood pressure (n = 2; not associated with obesity), high cholesterol (n = 1; not associated with obesity), seizure disorder (n = 2; seizures infrequent), mild arthritis (n = 2), type II diabetes (n = 2; 1 case associated with a specific syndrome and not obesity), and gout (n = 1, not active). Two wore minor orthotic devices (n = 1 ankle-foot orthosis on 1 foot; n = 1 orthotic insert for flat-footedness) but ambulated freely. Care providers and participants confirmed that these conditions did not limit PA participation or other activities of daily living.

Residential placements included family home with parents (n = 7); supported living either alone (n = 3), with a roommate (n = 5), or with a spouse (n = 5); and group homes (n = 2). Four participants resided with roommates with MR, and 1 with a roommate without MR. Two sets of married couples participated, and 1 individual was married to someone not classified as MR (i.e., not eligible for services). Three were employed full-time, 18 part-time, and 1 was unemployed. Most worked in community-based service positions such as lawn maintenance, janitorial or food service. Three held driver’s licenses, and 1 provided work transportation to 3 other participants. One individual rode a bicycle to work, 1 frequently walked to work, 1 was transported by a coworker, and the remaining participants used specialized transport for those with disabilities, regular public transport or received transport
from care providers. Ten were actively involved in Self-Advocates, a nationwide program that empowers people with disabilities to become involved in public policy and decisionmaking.

Eighteen participated in at least 1 Special Olympics sport during the year, and training for these activities did not occur more than 3 times per week. Two who held driver’s licenses also participated in Special Olympics, even though this ability often excludes participation in these sport programs. Special Olympic sport activities available in the community were bowling, basketball, and bicycling. Five (4 men, 1 woman) were involved in Special Olympics basketball or bicycling during the data-collection period.

**Subjects Without MR.** An initial sample of 19 age- and gender-matched, sedentary individuals without MR were recruited as controls (SC). Two were eliminated because of health problems, resulting in a final sample of 17 (9 women, 8 men). These subjects were classified as sedentary based on self-reports that they did not engage in regular, moderate to vigorous exercise of at least 30 min in duration, at least 3 days per week. Two were diagnosed with high blood pressure (unmedicated), and 3 were tobacco users. An additional control group of 10 healthy, active subjects (AC) was recruited to establish instrument sensitivity to activity differences and confirm the sedentary status of the SC group. One subject was eliminated because of equipment failure, resulting in a final sample of 9 (4 women, 5 men). These subjects were classified as active based on self-reports of participation in regular exercise of 30 min in duration, at least 3 times per week. Sedentary and active control participants were free from physical or sensory conditions that could impede or interfere with movement.

Data were collected October through May in a southern state, with temperatures during this time characterized as mild to moderate. All participants resided in 2 adjacent communities dominated by a large public university (combined population, ~170,000). Subjects affiliated with the university (n = 24 non-MR, 7 MR) had access to a recreational facility and fee-based fitness programs. There were many accessible PA options in the communities, including fitness clubs, bowling alleys, golf courses, aquatic facilities, and tennis courts. The existence of bike lanes and sidewalks was limited, and the community was not viewed as “bicycle friendly.” Special Olympics was the only specialized community-based program for adults with MR. Access to most PA opportunities within the community required motor or bicycle transportation.

**Procedures**

**Consent.** All participants signed consent forms approved by the university institutional review board for the protection of human subjects. Subjects with MR were provided a simplified consent form to accommodate various reading abilities. This group was verbal, able to provide signatures, and served as their own representatives. Subjects with MR also received individualized familiarization before data collection (e.g., practice trials, extra meetings) to ensure their voluntary participation and understanding of the project.

**Instrumentation.** Each subject wore a portable accelerometer (Manufacturing Technology Inc [MTI] Model 7164, Shalimar, FL) during waking hours, except
bathing or water activities, throughout a 7-d assessment period (5 weekdays, 2 weekend days), as previously recommended.\textsuperscript{19} The device is small, lightweight, and unobtrusive. It detects normal human motion in a single vertical axis, within a 0.05- to 2-G magnitude and 0.25- to 2.5-Hz frequency. Accelerometers were programmed to collect data in 1-min epochs during the assessment period. Activity counts were categorized by metabolic equivalents (MET) according to light (<2.99 METs), moderate (3.0 to 5.99 METs), hard (6.0 to 8.99 METs), and very hard (>9.0 METs).\textsuperscript{20} For the purposes of this study, it was concluded that this equation could provide reasonable, relative estimates of PA intensity across groups. Bouts of continuous moderate, hard, and very hard PA were defined as consecutive time >1952 counts/min. Time frames used were 5 to 10 min, 10 to 20 min, and 20 to 30 min. For example, a 10-min continuous bout of moderate PA required that all 10 min be >1952 counts/min.

The accelerometer was placed in a pouch and attached to an elastic belt fitted to each subject to allow maximum comfort. The monitor was positioned over the right hip for consistency. Data sheets were provided to record when the device was worn. When available, care providers recorded when the device was worn for those individuals with MR identified as unable to perform this task independently. If a care provider was not available, the researcher either visited the subject’s house each morning and evening to attach and detach the monitor and document when the device was worn, or contacted subjects each morning and evening via telephone as a reminder to attach the monitor and record times.

Subjects were also provided an activity diary to record computer or TV time, and frequency and intensity of everyday activities such as occupation, walking, sport and exercise, house or yard work, personal care, and transportation.\textsuperscript{21} Pilot research revealed that subjects with MR had difficulty recalling effort and duration, and proxy reports of this information were speculative, so diary data were used to provide a better contextual understanding of the accelerometry data and not as an activity measure. The researcher maintained activity diaries for those unable to perform this task independently by visiting or calling daily and prompting verbal reviews of activities ($n = 8$). Care providers maintained diaries for 7 subjects, and another 7 subjects with MR asked to keep their own diaries. The diary process for these subjects was simplified by asking them to identify the TV programs they watched each day and the instances in which they exercised, walked somewhere (e.g., to bus stop) or exercised (e.g., Special Olympics). They were provided practice training and verbal reminders as needed. In addition, care providers were contacted, if available, to help verify these reports, and the diaries were reviewed with participants when returned.

**Data Analysis**

Day-to-day consistency in PA was evaluated using the intraclass correlation coefficient. Group differences were analyzed using a 1-way ANOVA, with Scheff post hoc tests calculated when $F$-test significance occurred. Effect-size calculations are reported as partial eta squared ($\eta^2$). Analyses were performed using SPSS® (Statistical Package for the Social Sciences, Inc, Chicago, IL), and significance set at $P<0.05$. Data are presented as mean ± standard deviation.
Results

Equipment failure and lost data resulted in at least 5 completed collection days, including 1 weekend day, for all subjects (mean = 6.6 ± 0.6 d). As there was a high level of consistency in PA across days (ICC = 0.87), they were combined for further analysis. Subjects wore the device a minimum of 10 h (mean = 14.0 ± 1.2 h/d) each day, which represented 60% of a 16-h waking day. Data are reported as relative rather than absolute values because both control groups wore the monitor longer than the MR group ($F_{2,47} = 6.29, P = 0.004, \eta_p^2 = 0.22$) and highly varied schedules prevented comparison of 1 time period across subjects. There were no group differences in age or weight, but participants with MR were shorter than SC participants. Participants with MR also exhibited higher body-mass index (BMI) values and worked fewer hours and days each week than both control groups. Subject characteristics are presented in Table 1.

Because only 6 subjects from the MR and SC groups engaged in hard or very hard activity, these categories were combined with moderate activity (MHPA) for further analysis. The AC group was more active than MR and SC subjects during the assessment period ($F_{2,47} = 12.17, P = 0.00, \eta_p^2 = 0.35$; Table 1). The MR and SC groups also engaged in less MHPA per day than AC subjects ($F_{2,47} = 11.28, P = 0.00, \eta_p^2 = 0.33$; Table 1).

Only 1 subject from the MR group, 5 AC subjects, and no SC subjects acquired at least one 5-min bout of continuous hard or very hard PA. Active controls participated in more continuous bouts of MHPA, particularly 20 and 30 min duration, than the other groups ($F_{2,47} = 11.71, P = 0.00, \eta_p^2 = 0.34$; Figure 1). There were no differences between MR and SC groups on all PA variables measured (Table 1, Figure 1).

Table 1  Comparison of Group Descriptive and Physical Activity Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>MR</th>
<th>SC</th>
<th>AC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>($n = 22$)</td>
<td>($n = 17$)</td>
<td>($n = 9$)</td>
</tr>
<tr>
<td>Age (y)</td>
<td>34.9 ± 9.1</td>
<td>35.8 ± 8.9</td>
<td>34.1 ± 5.9</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>158.9 ± 13.0</td>
<td>172.7 ± 7.6</td>
<td>166.4 ± 5.6</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>85.7 ± 21.2</td>
<td>86.1 ± 21.0</td>
<td>74.3 ± 7.5</td>
</tr>
<tr>
<td>BMI (kg/m$^2$)</td>
<td>34.0 ± 8.2</td>
<td>28.6 ± 5.3</td>
<td>26.8 ± 2.4</td>
</tr>
<tr>
<td>Work (d/wk)</td>
<td>4.3 ± 1.3</td>
<td>5.0 ± 0.0</td>
<td>5.0 ± 0.0</td>
</tr>
<tr>
<td>Work (h/wk)</td>
<td>23.1 ± 11.0</td>
<td>37.4 ± 6.6</td>
<td>40.0 ± 0.0</td>
</tr>
<tr>
<td>Time monitor worn (h/d)</td>
<td>13.1 ± 1.7</td>
<td>14.8 ± 1.6</td>
<td>14.7 ± 1.6</td>
</tr>
<tr>
<td>Counts/min</td>
<td>329.0 ± 115.3</td>
<td>312.5 ± 127.3</td>
<td>548.0 ± 141.3</td>
</tr>
<tr>
<td>MHPA (min/d)</td>
<td>19.7 ± 17.6</td>
<td>31.6 ± 21.8</td>
<td>55.9 ± 18.2</td>
</tr>
</tbody>
</table>

*Significant difference between MR and SC groups ($P < 0.05$).
*Significant difference between MR and each control groups ($P < 0.05$).
*Significant difference between AC and other groups ($P < 0.05$).
The quality of diary data varied greatly, and some were either not completed \((n = 9)\) or incomplete \((n = 9)\). Information documented by the researcher and subjects with MR was essentially descriptive. Few subjects in the MR \((n = 5)\) and SC \((n = 2)\) groups engaged in any form of formal exercise behavior during the assessment period. Commonly reported leisure activities among subjects with MR were watching TV \(\text{estimated range, 1 to 5 h/d}\), shopping, eating out, visiting friends or family, and involvement in religious activities. The main source of formal activity for most of these individuals was Special Olympics. Sedentary controls frequently watched TV \(\text{estimated range, 1 to 5 h/d}\), read books or newspapers, played with children, shopped, dined out, and engaged in religious activities. Physical activity in this group typically occurred as walking for transportation. It appeared that household chores, child care, and yard work were primary PA avenues for both MR and SC groups. Active controls exhibited a broader spectrum of activities that included aerobics, jogging, tennis, volleyball, paddling, and badminton. No participants reported engaging in water activities during the assessment period. Accelerometer intensity measurements are less accurate during non-weight-bearing activities, and PA levels could have been underestimated in these cases.

**Discussion**

To date, no other research has directly compared PA levels between US citizens with and without MR, living in community-based settings. Results from this study demonstrate that PA levels are similar between adults with MR and sedentary peers without MR. Furthermore, neither the MR nor SC group met published guidelines for health-related PA.\(^{22}\) These data support previous research that reported similar PA patterns among adults with and without MR.\(^{7,8,17}\)

![Figure 1 — Average bouts of continuous 5-, 10-, 20-, and 30-min moderate activity in bouts/d. *Significant difference between AC and other groups at \(P < 0.05\).](image)
The low activity levels observed among adults with MR and SC subjects in this study were not surprising, because 40% of the population engages in no leisure-time PA, and fewer participate in regular, continuous MHPA. A minority of subjects with MR in the current study engaged in MHPA, which has also been demonstrated in previous research. Draheim et al. suggested that adults with MR generally choose less intense activities, and programs that involve moderate PA will likely result in greater adherence. Fernhall proposed that the employment options (i.e., manual labor) for many people with MR require participation in light to moderate PA. Temple et al. supported this theory and reported that participants with MR in their study accumulated most moderate PA while at work or day-placement programs. This was somewhat misleading because 4 of the 6 study subjects were not employed and participated in day-placement programs that provided scheduled recreation activities. In addition, these authors reported accrued, not continuous, MHPA. The manual-labor positions of most subjects with MR in this study did not require sustained periods of MHPA, and they seldom reported participating in MHPA during leisure time. Because government-imposed restrictions on income and receipt of disability pensions often limit work opportunities for this population, as was observed in this study, reliance on employment as an avenue to acquire MHPA might be inappropriate.

A potential factor contributing to these findings is the social environment of adults with MR. Over the past 30 years, there has been a progressive movement toward deinstitutionalizing people with MR from large, extremely controlled environments to a range of community-based living accommodations, primarily group homes (≤6 residents plus care providers). Supported living is becoming an increasingly popular disability service and is designed to increase community placement of adults with MR. These services incorporate person-centered planning (i.e., the consumer is involved in service plans and decisions) and provide the support needed for individuals to reside in natural environments (e.g., rental unit, family home) with no more than 3 other service recipients. Care providers typically do not reside with the consumer but supervise as needed. Individuals in these settings are usually afforded more autonomy and opportunities for decisionmaking than those who live in group homes are.

Howe et al. found that supported-living residents were involved in a greater frequency and volume of community activities than group-home counterparts. Supported-living residents also participated in more community activities with people without MR than did those in group homes. Contrary to previous research, a majority of adults with MR in this study (n = 13) received supported-living services and were relatively independent compared with people residing in group homes. Most in supported living were also involved in a variety of community activities because of independent transportation or various levels of transportation support (e.g., public transport). This could have resulted in PA levels higher than in studies based primarily on group-home residents and more similar to people without MR.

BMI also appears to be a factor in the low PA levels of subjects with MR. The average BMI for those with MR classified them as obese (>30 kg/m²) and was significantly higher than BMI in the 2 control groups. This finding could help explain the low PA levels in those with MR, but it does not explain the similarity in PA levels between the MR and SC groups. Nutritional habits might contribute
to this observation but limitations in study design preclude definitive conclusions regarding this theory. Accurate dietary records were not kept, but general questions regarding food intake were asked (e.g., where and what did you eat?). Many subjects with MR, particularly those in supported-living environments, frequently ate fast food during at least 1 meal every day, more often if they also worked in food service (i.e., they received discounted meals), and low-fat options were seldom chosen. In contrast, many SC participants were thin and reported that this status was maintained through caloric restriction, not exercise. Based on these interesting, albeit anecdotal, observations, further investigation of the interaction between diet, body composition, and PA in adults with MR is recommended.

Similar to people without MR, the low PA levels and overall poor health status of adults with MR in the community are ascribed to a complex interaction of several physical, psychological, and environmental determinants, but only 1 published study has specifically examined exercise determinants in this population. Messent et al. conducted informal, semistructured interviews with 24 participants residing in various community-based settings and 12 care providers. Barriers were primarily identified by care providers and included a) unclear policy guidelines about activities; b) financial constraints, including personal resources, transportation, and staffing; c) limited geographical access to PA opportunities; and d) limited choices and options for community PA. Responses from adults with MR suggested that they had few opportunities for PA, little environmental control, and frustration with a lack of leisure choices. Subjects with and without MR in this study actually reported similar leisure activities but the MR group identified few PA interests beyond those offered by the local Special Olympics agency. Additional research is needed to further examine the influence of knowledge, choicemaking, and opportunity on PA participation in adults with MR.

The lack of differences in PA between the MR and SC groups was unexpected but not unprecedented. Frey et al. also found no differences in fitness measures between age-, gender-, and activity-matched runners with and without MR. This suggests that the magnitude of some previously reported fitness and PA disparities of those with MR are attenuated when a matched comparison group of participants without MR is included in the analysis.

Certain study limitations affect the generalizability of these findings. First, the sample of adults with MR represented those on the higher end of the mild spectrum. A sample of individuals with more severe forms of MR could have resulted in larger group disparities. Second, most participated in Special Olympics and might have represented a more active group of adults with MR than normal. Third, the activity cut points used could have underestimated MHPA, particularly in the MR and SC groups, but this did not affect relative group comparisons. Design limitations notwithstanding, these findings provide meaningful, new information about PA in adults with MR compared with peers without MR.

In summary, results from this study indicate that PA levels of adults with MR are similar to those of sedentary peers without MR. Neither group engages in recommended levels of PA, and both are highly inactive during leisure time (i.e., nonwork days). These findings are discouraging but important because the condition of MR can be excluded as a primary factor in low PA levels. That is, the fact that an individual has mild MR does not automatically predispose him or her to sedentary behavior. Further research is needed to a) compare PA levels and
behaviors between individuals living in supported-living and group-home settings, b) identify the specifics of PA psychosocial determinants in this group, c) examine PA in a group of active adults with MR, and d) explore age and gender differences. Service providers and health professionals should focus efforts on promoting healthy decisionmaking and facilitating access to activities that involve continuous bouts of moderate PA. The status of adults with MR as integrated, productive, and independent members of society is contingent on their ability to maintain good health, which can be achieved largely through regular participation in moderate PA.

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