

Self-Reported Health Status Predicts Physical Activity in Adults with Intellectual and Developmental Disabilities

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Abstract

Background: Health promotion and maintenance require behavior such as regular physical activity. Inactivity has been associated with morbidity and mortality in persons with intellectual and/or developmental disability (I/DD). Self-reported health has been shown to influence health behavior and has consistently predicted overall mortality and cardiovascular mortality in adults with I/DD. Precise physical activity measurement and knowledge of correlates of physical activity among persons with I/DD are limited. This study aims to continuously measure physical activity over a two week period in persons with I/DD while wearing Personal Activity Monitor (PAM) and determine if self-report health status influences physical activity.

Methods: Seventeen (10 male/7 female) participants with I/DD aged 18 to 59 years of age continuously wore PAM 24 hours a day for 14 days providing subject-specific individualized motion classification. Baseline assessment of factors associated with physical activity included assorted tools designed for persons with I/DD.

Results: Findings indicate that higher ratings of self-reported health status predicted greater physical activity in adults with I/DD. Those self-reporting their health as excellent/very good or good demonstrated significantly greater physical activity measured by PAM than those self-reporting their health as good or fair. Time spent in physical activity was below the recommended guidelines for health benefits. Neither age nor body mass index correlated with activity values.

Conclusions: Evaluation of self-reported health in persons with I/DD should be part of primary prevention strategies. Understanding the impact of self-reported health in this often under-served population can lead to focused interventions to improve fitness and well-being.

Keywords: Developmental disability; Intellectual disability; Self-Reported health status; Physical activity; Tele-Health; Health promotion; Nursing

Introduction

According to recent analysis, approximately 30% of adults with intellectual and developmental disabilities (I/DD) were meeting the national recommendations for physical activity compared to 49.4% of their non-disabled counterparts [1]. Not all studies are in agreement with some researchers reporting no difference in physical activity levels between adults with I/DD and controls and others reporting activity levels similar to sedentary controls [2].

Self-reported health status is often a predictor of exercise participation among the general population [3] and in persons with I/DD [4]. Self-reported physical activity has been shown to be significantly related to better subjective health in adults with I/DD [4]. Self-reported health and inactivity are both strong predictors of mortality and cardiovascular mortality in several population-based studies worldwide. Adults with I/DD are able to report their health status with males reporting better health [5].

Health promotion and maintenance require such behavior as regular physical activity. In an effort to reduce health disparities in persons with I/DD, the Surgeon General's Report has identified the approximate 5 million people in the United States with I/DD as a target for health promotion or physical activity campaigns. The Health and Human Services report acknowledges the lack of attention and health promotion efforts or physical activity campaigns directed toward this underserved population [6].

As with the general population, lack of physical activity in the I/DD population has been associated with higher Body Mass Index (BMI), and obesity [2]; lower maximal oxygen consumption [7], and decreased muscle strength, endurance and flexibility [8]. These factors lead to the risk of disorders such as diabetes, hypertension and cardiovascular disease [9].

Limited studies reported physical activity patterns in the I/DD population by direct observation, self-report, care giver report, or motion sensors (pedometers or accelerometry or both) [10]. One of the few investigations to utilize accelerometer methodology successfully measured physical activity in adults with I/DD and control groups of sedentary adults without I/DD for seven days. Findings demonstrated physical activity patterns that were alike

between adults with I/DD and sedentary adults without I/DD, but both had significant differences when compared with physical activity of active counterparts without I/DD [2]. Few other studies have reported objective measures of physical activity in this population, particularly the use of wireless technology. Furthermore, physical activity programs developed and tailored to meet the specific needs of people with I/DD are reported as inferior [11]. Modern wireless technology now offers applications to objectively measure physical activity including wearable biosensors, and/or chronic disease monitoring devices, smart phones and tablet computers to remotely consult and monitor patients, as well as provider-patient video conferencing sessions [12].

In addition to quantifying physical activity in the I/DD population, research on the correlates of physical activity are necessary to design appropriate and targeted interventions [1,13]. In the general population, correlates of physical activity and those associated with greater physical activity include: age (inverse), higher levels of education, gender (male), ethnicity (white), perceived activity competence, intentions, previous physical activity, community sports, sensation seeking, social support and opportunities to exercise, as well as self-reported health [3].

Survey analysis using the Behavioral Risk Factor Surveillance System (BRFSS, 2001) data examining correlates of physical activity reported that race, age greater than 50, income greater than 50K and self-reported health status were correlated with improved physical activity level among persons with disabilities including I/DD [14]. In another study exploring 2004 BRFSS data, self-reported health highly correlated with self-reported physical activity in those who self-identified as disabled [15].

Therefore, to develop an intervention that reduces morbidity and mortality in persons with I/DD, objective assessment measures and behavioral correlates of physical activity are needed. This study aims to

determine if self-reported health status influences physical activity while objectively measuring physical activity patterns over a two week period of time in persons with I/DD while wearing a Personal Activity Monitor (PAM).

Methods

Participants

Participants were community-dwelling ambulatory adults with I/DD who were part of an intervention study to determine if the use of a PAM increases physical activity in adults with I/DD. Participants were recruited from the west side of Los Angeles. This intervention study was approved by the UCLA Human Institutional Review Board. Informed written consent was obtained from participants prior to any data collection.

Inclusion criteria included community-dwelling adults with I/DD eligible to receive services from the local regional center; between the age of 18 to 50 years; higher-functioning (i.e., living with family, independently, or with supported services in the community); having the capacity to provide consent; willing to participate in a research study that requires wearing an accelerometer daily for 2 weeks except when bathing or swimming; and English speaking. Having a diagnosis of intellectual disability or developmental disability was confirmed by the fact that each person was receiving service coordination from a local regional center that provides supports only to individuals who qualify as having a developmental disability (which includes persons with intellectual disabilities).

Exclusion criteria included pregnancy, unable to ambulate without assistive devices; and increasing activity would be a possible health risk. Following consent, participants underwent a screening conducted by a nurse practitioner.

Domains Correlates of Physical Activity	Measures Scales and Tools
Demographics (age, gender, ethnicity)	Investigator-developed demographic form
Anthropomorphic measures	Height, Weight (calculated BMI)
Health Status	Self-reported Health Status 4-item scale (E/VG, G, F, P)
Physical Activity Measures	
PA (self-report)	Exercise and Activity Scale
PA (PAM)	Accelerometer using PAM Categorized as Low, Mod, Total and Sedentary

Note: Adapted from Table 2 in Hall & Thomas, 2008). For a copy of the complete assessment questionnaire, see Exercise Health Education Self –Assessment packet for Adults with Developmental Disabilities: Baseline Interview Questionnaire. (Aging Studies Program, Department of Disability and Human Development, University of Illinois at Chicago.URL; http://www.rrtcadd.org/Research/HP/Related_Project/Staff_Education/Curriculum/Content_assets/HP_Assessment_tools.pdf)

Table 1: Domains and scales/measures

Screening measurements

Height measured in centimeters and body weight measured in kilograms were measured to the nearest 0.25 cm and nearest 1.0 kg,

respectively; body mass index (BMI) was calculated as kilogram per meter squared. Blood pressure and heart rate were obtained. Information was collected regarding age, gender, and ethnicity using an investigator-developed questionnaire. Participants completed a

questionnaire from the Exercise Health Education Self-Assessment Packet for Adults with Developmental Disabilities from the Aging Studies Program Department of Disability and Human Development University of Illinois at Chicago [16], with the nurse practitioner who read the questionnaire aloud and explained if necessary. The Exercise Health Education Self-Assessment Packet was published as part of a training packet for improving physical activity in persons with I/DD and pilot tested and found to have “Alpha reliabilities ranged from .66 to .91 and test-retest reliabilities ranged from .48 to .72” [17]. Table 1 describes the domains and the scales or measures that were used in this study. For self-reported health status the interviewer simply and directly asks the respondent to categorize his or her health into one of four levels: excellent/very good, good, fair, or poor.

Self-reported exercise

Participants completed by interview the Exercise and Activity Inventory reporting if they participated in the Special Olympics, sports activities by type, as well as other exercise activities by type and frequency per week noted as 1 = A Little (<1 day); 2 = Some (1-2 days) or 3 = A lot (3-7 days) [16].

Personal Activity Monitor (PAM)

The PAM system is a wearable compact unobtrusive device (less than one cubic inch), different from prior technology where devices were large and cumbersome. With the use of the wireless PAM developed at the UCLA Wireless Community, we were able to capture the types of movements that can be linked to determinants of physical activity for a community-dwelling sample of adults with I/DD. These data were uploaded weekly by study team members directly from devices over standard computer USB interfaces via the Internet to the PAM Server system. The data from each device represents acceleration information in 3 cardinal directions recorded by the device. PAM samples at a rate of 40 samples per second. All of the data points are time stamped. Each sample of data is summarized/converted into a Vector Magnitude Unit ($VMU = \sqrt{x^2 + y^2 + z^2}$). Next, VMU data are then summarized with various common statistical routines to obtain averages over a minute or hours per day. These VMU data are then analyzed by pre-computed VMU thresholds corresponding to average per/minute VMU activities. There are currently two thresholds corresponding to moderate and high intensity activities providing two thresholds and corresponding three classes of activities - low, moderate and high. The data were then, summarized once again using simple statistical routines based on the classification among the three states (low, moderate and high). The low activity number tells us how much time individuals spent in a less than moderate but higher than sedentary activity state. Moderate activity number tells us how much time individuals spent performing moderate to vigorous physical activities. Sedentary is defined as any activity less than low activity, including sleeping. Study team members directly uploaded these data weekly from devices over standard computer USB interfaces via the Internet to the PAM Server system; thus, the PAM provided individual participant physical activity levels.

Procedure

Following screening, participants were instructed on use of the PAM and began wearing the device continuously 24 hours a day for 14 days with the exception of water activities (bathing, water activities). Participants chose and maintained a preferred site of either the ankle

or waist for the study duration; however, they were allowed to switch the PAM from the right to left side of the body ad lib.

Data analysis

Statistical analyses were performed using a statistical package, IBM SPSS version 19.0. All data are expressed as means (M) and standard deviation (SD) for continuous variables and as percentages for categorical/binary variables. If the distribution was non-normal, variables were transformed to approximate a normal distribution. We conducted data analysis to determine if self-report health status influences physical activity and to answer whether or not a statistically significant relationship exists between the baseline measures obtained by questionnaire (e.g., age, gender) and physical activity as measured by the PAM. Self-report health status groups were compared with regard to blood pressure, body mass index, demographic, and lifestyle factors using ANOVA for normally-distributed continuous variables. Chi-square was used to test for gender and self-report health status group differences in categorical variables. Student-t test was used to compare minutes of physical activity and sedentary time by gender and self-report health status. Pearson correlation coefficients were computed for continuous variables. For all test statistics, significance was defined as a $p < 0.05$.

Results

Demographics

The study participants were 17 ambulatory adults 19 to 59 years of age. Age was not statistically different between 10 males (M=33.9, SD=9.3 years) and 7 females (M=35.7, SD=14.9 years). Of the initial 22 participants enrolled in the study, four were not included in data collection as two dropped following screening; one had a data collection error and one was an outlier. Age did not correlate with minutes of physical activity (values not reported).

Characteristics by Gender	Male (n=12)	Female (n=10)
Variable	n mean ± SD or %	n mean ± SD or %
Age	11 33.9 (9.3)	7 35.7 (14.9)
BMI€ (kg*m-2)	11 29.8 (8.7)	7 26.3 (5.1)
BMI Category		
Normal	4 (36.4%)	4 (57.1%)
Overweight	2 (18.2%)	2 (28.6%)
Obese	5 (45.5%)	1 (14.3%)
General Health Self Report		NS
Excellent or Very Good	4 (36.4%)	3 (42.9%)
Good	4 (36.4%)	2 (28.6%)
Fair	2 (18.2%)	2 (28.6%)
Poor	1 (9.1%)	
€Body Mass Index		

Table 2: Sample characteristics

Physical activity and self-reported health status

The majority (72%) of the participants reported their health status as excellent/very good or good. Adults who self-reported their health as excellent/very good or good is significantly greater than physical activity as measured by PAM than for adults who self-reported their health as good or fair. Adults who self-reported health as good or fair spend significantly more time sedentary as measured by PAM than adults who self-reported their health as excellent/very good. No statistical effects were noted for gender in self-reported health status or BMI (Table 2). BMI did not correlate with self-reported health status or minutes of physical activity (values not reported).

We did not observe an overall significant difference in minutes of physical activity or sedentary values between genders (Table 3). However, we observed a statistical effect within gender ($p < 0.05$) (Figure 1). Total minutes of physical activity were significantly higher in females with self-reported health status ratings of excellent/very good ($M = 62.7$, $SD = 3.3$ min/day) compared to females with self-reported health status ratings of good/fair ($M = 42.1$, $SD = 2.2$ min/day). Similarly, total minutes of physical activity were statistically greater for males with self-reported health status ratings of excellent/very good ($M = 98.4$, $SD = 10.1$ min/day) compared to males with self-reported health status ratings of fair or poor ($M = 27.6$, $SD = 11.0$ min/day, $p < 0.05$).

Figure 2 shows statistically significant lower sedentary time ($p < 0.001$) measured in females with self-reported health status ratings of excellent/very good ($M = 22.96$, $SD = 0.06$ hr/day) compared with females with self-reported health status as good/fair ($M = 23.29$, $SD = 0.04$ hr/day). Similarly in males, statistically significant lower sedentary time ($p = 0.02$) was measured in males with self-reported health status ratings of excellent/very good ($22.53 + 0.32$ hours/day) vs. fair ($23.54 + 0.19$ hours/day).

Total Activity (PAM) by Gender	Male (n=12) mean ± SD	Female (n=10) mean ± SD	p
Physical Activity per PAM			
Low min/day	49.3 ± 23.2	45.7 ± 11.6	NS
Mod** min/day	13.9 ± 12.9	6.7 ± 1.7	NS
Total min/day	63.2 ± 28.3	52.4 ± 11.6	NS
Sedentary hrs/day	22.9 ± .47	23.1 ± .19	NS

Note: Mod = moderate, min = minutes, hrs = hours
 Superscript letters denote significant group differences using, Bonferroni's Post Hoc Comparisons, $p < .05$
 **moderate or greater

Table 3: Characteristics of physical activity

Self-reported exercise

Participation in Special Olympics was reported by 66% of the study participants. Significantly more men than women (80% vs. 28.6% respectively, $p = 0.03$) reported that they regularly engaged in sports, noting the top four activities as basketball, bowling, swimming, and volleyball (Table 4). Despite the majority of participants (70% males and 71.4% females) self-reporting some form of physical activity three or more times per week, the values were not reflected in the objective physical activity measured by the PAM.

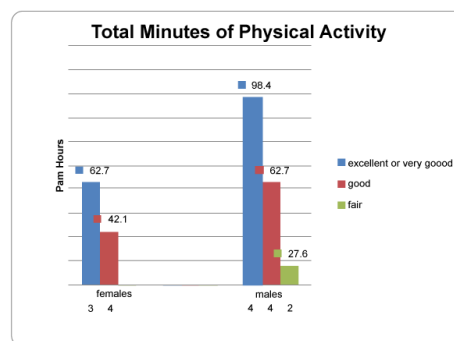


Figure 1: Total minutes of physical activity by gender and self-reported health



Figure 2: Total hours of sedentary time by gender and self-reported health

Discussion

This is one of the few studies to objectively and continuously measure physical activity and physical activity patterns over time and to assess factors which may influence physical activity in persons with I/DD. Our main finding indicates that high ratings of self-reported health status predicted greater minutes of physical activity in persons with I/DD. To our knowledge, our findings of self-reported health status and its impact on continuous objective measures of physical activity in this population has not been reported. Despite its simplistic response, self-reported health status has been shown to be a predictor of important health outcomes as functional disability, morbidity and mortality, even stronger than clinician observed medical records [18]. Our findings are consistent with self-reported health status as a predictor of exercise participation [4]. Alternatively, our results differ from a study where perceived health status did not predict exercise frequency in adults with cerebral palsy including 37% to 66% who had intellectual disabilities [4]. Unlike previous findings [5], no significant gender differences were observed in self-reported health status.

There is debate on the validity of self-health report measures in person with I/DD, suggesting difficulty in concepts of health due to cognitive impairment. Our findings of very good/good self-reported health status percentages of 72% are consistent with previous findings of self-report health status in persons with I/DD [5,19]. Interestingly,

these percentages do not differ from non- I/DD counterparts (74%-87%) [20].

	Female's (n=10)	Males (n=12)	p value
Exercise frequency			NS
More than three times/week	71.4%	70%	
Less than three times/week	28.6%	10%	
Not sure	0%	20%	
Participate in sports	28.6%	80%	0.03
Participate in Special Olympic	16.7%	50%	NS
<i>Group Self-Reported Exercise Type</i>			
Types of sport			
Basketball	44.4%		
Bowling	27.8%		
Swimming	22.2%		
Volleyball	22.2%		
Jogging/running	16.7%		
Water skiing	11.1%		
Dancing	11.1%		
Snow ski	11.1%		
Tennis	11.1%		
Row a boat	5.6%		
Bicycling	5.6%		
Skating/rollerblading	5.6%		
€ – body mass index			

Table 4: Self-reported exercise frequency

Time spent in minutes of moderate per week of physical activity for this study population was far below the U.S. Department of Health and Human Services guidelines of a minimum of 150 minutes at a moderate-intensity level per week or 75 minutes a week at a vigorous-intensity aerobic activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity per week (<http://www.health.gov/paguidelines>). Our findings are consistent with evidence showing that more than two thirds of adults with I/DD not meeting the current physical activity guidelines, compared with nearly half of the general population [11,21,22]. However, not all studies are in agreement and some researchers report no difference in physical activity between persons with I/DD and the general population [2].

Our findings are consistent with evidence that gender differences have generally not been observed in the research findings on physical activity among adults with I/DD [23]. Our self-reported findings of activities are similar with others reporting that persons with I/DD engage including, walking, jogging, cycling, swimming or dancing

[24]. Time spent in sedentary behavior was also similar with other investigations [2,9].

Although I/DD is reportedly associated with insufficient physical activity, findings are based upon a few population based surveys that are subject to issues of accuracy and reliability with proxy respondents or self-report with care giver assistance [25,26]. Despite a small sample size, our study confirms reports of insufficient physical activity to achieve beneficial health effects in this population using a direct measure of physical activity. Our advanced wireless technology, PAM, can differentiate quantitative levels of physical activity and appears to be usable in persons with I/DD. The PAM allowed for more objective characterization of physical activity over a continuous two-week period.

Identification of correlates of physical activity in persons with ID/ D is necessary as regular physical activity is an essential behavior for the promotion of health, prevention of disease, and maintenance of functional independence [13,25]. Recent survey data examining health status and health risk in persons with I/DD reported that people who do not utilize I/DD services are less likely to access health service and promotion activities and are more likely to be exposed to known social determinants of poorer health [27]. Although not measured in the current study, socioeconomic disadvantage, especially hardship, has been found to be associated with indicators of self-reported health among adults with I/DD [28].

Our study participants received I/DD service coordination/case management services from a regional center, which may have facilitated access to health services and health promotion activities that are offered by supporting agencies. In addition, the majority of participants in this study had access to sport activities. Although not predictive in our study participants, age and social support have been shown to predict greater physical activity among persons with I/DD [4,29]. Furthermore, lack of energy has been reported as a barrier to exercise participation in a study of adults with Down syndrome, although not observed in our findings [27,30].

Several studies have shown that insufficient physical activity results in high rates of chronic disease such as obesity, cardiovascular disease, diabetes, and hypertension, contributing to increased premature and preventable morbidity [25,31], although hypertension was not observed in this study population. The prevalence of overweight and obesity reported in our study is similar to previous findings [32]. Although factors contributing to the increased prevalence of obesity among persons with I/DD are not fully understood, obesity contributes towards health disparities [19] placing this group at further health risk [31].

Limitations

National physical activity recommend 150 minutes of moderate or 75 mintes of vigorous physical activity in bouts greater than ten minutes across the week (USDHHS, (<http://www.health.gov/paguidelines>)). We did not determine if physical activity was performed in episodes of 10 minutes or more. The conditions of individuals that qualify them for receiving services for a developmental disability were not collected in this study. Therefore, we were unable to look for differences by etiology. The current findings are focused on differences between self-report health status groups and gender with relatively simple comparative statistics and further analysis with these data could address more complex issues relating to multivariate differences between groups, the identification of constellations of factors that

distinguish these self-report health status groups, and interrelationships among predictors. It would be important to examine these factors in future research with larger samples to guide evidence-based interventions specific to the nature of the disability. Although preliminary, these findings warrant further investigation and replication.

Summary and Conclusion

The significance of this project is the contribution to the limited science on physical activity for adults with I/DD using an objective continuous measure. There needs to be a greater acknowledgment of the potential influence of self-reported health status on physical activity in persons with I/DD. Study findings are helpful to guide and develop specific interventions aimed at increasing physical activity, improving well-being, reducing health disparities and preventing complications associated with inactivity in an often under-served population.

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