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## PHYSIOLOGY & REHABILITATION | RESEARCH ARTICLE

# A mixed methods exploration of how university students with physical disabilities perceive physical activity and the influence of perceptions on physical activity levels

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**Abstract:** *Purpose:* The purpose of this study was to investigate university students with physical disabilities' (SWD) perceptions of physical activity (PA) and how these perceptions may influence activity levels. *Methods:* Using reliable and validated surveys with in-depth interviews, researchers examined the perspectives of 13 undergraduate SWD regarding PA in the context of their university environment. Four quantitative surveys were used to understand participants' health practices (SRAHP), exercise self-efficacy (EXSE), barriers to PA (BARSE), and outcome expectations for PA (MOEES). To gather richer, exploratory data, interviews were focused on answering how do SWD perceive and define PA, and what factors influence their PA participation? Correlational analysis and independent *t*-tests were used to examine survey outcomes. Interviews were analyzed using thematic analysis and line-by-line coding strategies. *Results:* Quantitative analysis revealed correlations between all MOEES surveys, as well as the EXSE, BARSE, and SRAHP. Analysis of the surveys and interviews resulted in two primary themes and seven subthemes. The first primary theme, personal perceptions of PA, had two subthemes: Personal definitions and

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### PUBLIC INTEREST STATEMENT

Although physical activity (PA) is considered to be the single most important outcome of successful rehabilitation, severe physical inactivity and deconditioning is well known to be a crucial health issue in individuals with physical disabilities (IWD). Because many barriers to PA are removed at the university level, this study aimed to understand the perceptions and influences university students with physical disabilities have toward PA. Many participants verbalized a detachment from the conventional definitions of PA, indicating a belief they could not be physically active. While participants made use of resources provided by their university, such as physical therapy, they acknowledged a lack of regular use. Participants also demonstrated low values on PA for health. Health professionals may need to redefine PA or introduce PA earlier in life to help IWD better identify with their ability to perform PA for health.

personal practices. The second theme, influences on PA participation, consisted of five subthemes: University assistive resources, aspects of personal well-being, symptoms and physical limitations, time and scheduling, and social inclusion. *Conclusions:* Results from this study helped to understand how SWD identified with PA and identified both motivations and barriers to PA unique to SWD. Data from this study can be used to improve accessibility and disability programming for SWD to promote PA.

**Subjects:** Disability; Health Education and Promotion; Rehabilitation Medicine

**Keywords:** physical disability; exercise; college students; adapted recreation

### 1. Introduction

According to the Annual Disability Statistics Compendium in 2013, almost 13% of the United States population had a physical disability (Houtenville, Brucker, & Lauer, 2014). In 2010, about 1.1 million of those individuals with physical disabilities (IWD) were students attending postsecondary institutions in the US, making up almost 6% of the undergraduate population (Brault & U. S. B. o. t Census, 2012). The occurrence of severe physical deconditioning has been thoroughly studied in IWD and is known to be a crucial health issue. For example, less than 30% of adults with physical disabilities participate in regular, aerobic physical activity (PA) and only 15% participate in regular resistance training each week (Erickson, Lee, & von Schrader, 2010; USDHHS, 2011). Lack of regular PA and exercise often leads to overuse injury, pain, and chronic health implications, such as cardiovascular disease and diabetes (Ballinger, Rintala, & Hart, 2000; Curtis et al., 1999; Dearwater et al., 1986; Noreau, Shephard, Simard, Paré, & Pomerleau, 1993; Siddall, McClelland, Rutkowski, & Cousins, 2003; van der Ploeg et al., 2007; Washburn, Zhu, McAuley, Frogley, & Fioni, 2002). Compounding the problem, many IWD are at an increased risk for developing secondary complications due to sedentary lifestyles, including osteoporosis, increased spasticity, high blood pressure, obesity, anxiety, depression, decreased quality of life, and poor activity tolerance (Dijkers, 1997; Gutierrez, Thompson, Kemp, Mulroy, & P. T. C. R. Network, 2007; Heath & Fentem, 1996; Liou, Pi-Sunyer, & Laferrere, 2005; Manns & Chad, 1999; Noreau et al., 1993; Rice, Pohlig, Gallagher, & Boninger, 2013; Santiago & Coyle, 2004; Turner & Noh, 1988; van den Berg-Emons et al., 2011). Of equal importance, inactive IWD are also at heightened risk of feelings of social isolation, lack of acceptance by peers, and negative self-perceptions, which can directly conflict with success in the workplace and social circles (Devine, 2013; Devine & Lashua, 2002; Devine & O'Brien, 2007; Devine & Parr, 2008; McLaughlin, Bell, & Stringer, 2004; Rimmer & Braddock, 2002).

Unfortunately, similar to adults with disabilities living in the general population, university students with physical disabilities (SWD) are proposed to participate less in PA than their able-bodied peers (Devine, 2013; Erickson et al., 2010; Martin Ginis et al., 2011; USDHHS, 2011; Yoh, Mohr, & Gordon, 2008). While reports estimate that 78–88% of able-bodied university students participate in recreational PA on their campus (Reichard, Stolzle, & Fox, 2011; Tinto, 2006; USDHHS, 2008), Yoh, and colleagues found that almost 70% of SWD use their campus recreation gyms and facilities less than five times each year (Yoh et al., 2008). Even SWD who participate in leisure time physical activities or athletics during high school are more likely to experience a drop-off from those activities once they enter college and adulthood (Bray & Born, 2004; Tumusiime & Frantz, 2006; USDHHS, 1996). These numbers are particularly alarming, as research has demonstrated that long-lasting healthy lifestyle behaviors, both physical and psychological, are often developed during an individual's university years (Georgiou et al., 1997; Huang et al., 2003; Sparling & Snow, 2002; Steptoe & Wardle, 2001; Steptoe et al., 2002). Participation in campus recreational PA also encourages healthy physical, physiological, and social behaviors in students (Henchy, 2011; Jacobs, Nash, & Rusinowski, 2001; Mohr et al., 2001; Wolfensberger & Nirje, 1972). Additionally, recreational PA participation can result in better adherence to academic programs, academic performance, and perceived social integration (Astin, 1999; Elkins, Forrester, & Noël-Elkins, 2011; Henchy, 2011; Kampf & Teske, 2013). These

benefits may be particularly important for SWD, as they have been reported to have greater university attrition rates, feelings of stress, and social isolation than their able-bodied counterparts (Devine & Koch, 2003; Devine & O'Brien, 2007; Getzel, 2008; Henchy, 2011; Miller, 2011).

Numerous studies have attempted to clarify why PA levels remain low in adult IWD despite the known benefits of exercise (Devine, 2013; Martin Ginis et al., 2011; Rimmer, 1999; Rimmer, Riley, Wang, Rauworth, & Jurkowski, 2004). Researchers have found that negative self-perceptions and low self-efficacy, outcome expectations, and self-regulation are major barriers to PA participation (Martin Ginis et al., 2011; Phang, Martin Ginis, Routhier, & Lemay, 2012; Warm's, Belza, & Whitney, 2007). Low levels of exercise self-efficacy (EXSE), outcome expectations, and high barriers to exercise have been observed to also negatively influence perceptions of PA (Martin Ginis et al., 2011; Latimer & Martin Ginis, 2005). Additionally, adult IWD in the general population have reported high costs of equipment and facilities, lack of knowledge and available information, and a lack of resources, such as transportation and facilities as major barriers to being physically active (Devine, 2013; Kirchner, Gerber, & Smith, 2008; Rimmer et al., 2004; Wolfensberger & Nirje, 1972). However, little is known about the factors influencing PA participation in SWD during their college years. Given that many of the aforementioned barriers to PA adults with disabilities report are provided to students attending universities (available facilities, transportation, recreation opportunities at no additional cost), it is unclear why activity levels amongst SWD still remain low (Rimmer, Riley, Wang, & Rauworth, 2005; Rimmer et al., 2004; Rimmer, Rubin, & Braddock, 2000; Yoh et al., 2008). This may indicate that internal features like personal perceptions to PA are more influential to participation levels in SWD than previously speculated.

Due to vast lack of the literature examining SWDs' influences and perceptions of PA, the purpose of the present study was to qualitatively investigate SWDs' perceptions of PA and how these perceptions may influence their activity levels. This study uses a mixed methods design to explore the knowledge and perspectives SWD have on PA and exercise at their current university. Quantitative surveys were used to examine SWD personal characteristics and beliefs on PA to determine underlying personal influences to PA participation. Qualitative interviews were focused on two primary questions: (1) What are SWDs' personal perceptions and knowledge of PA, and (2) What are SWDs' primary influences to participation in PA? These questions were chosen to help understand what SWD consider to be PA and how they personally perceive PA. Additionally, these questions were used to determine what influences exist at a disability-accessible university that contributes to their participation in PA. The information from these interviews may explicate what internal and external factors drive PA participation in SWD, a population at high risk for physical inactivity and deconditioning. A comprehensive understanding of the perceptions and needs of SWD is essential to make effective changes that have a lasting impact both at the postsecondary education level and later in life (Bartholomew, Parcel, & Kok, 1998; Warm's et al., 2007).

## 2. Methods

### 2.1. Study design

A mixed methods research design was implemented using validated surveys and semi-structured interviews for data collection on 13 university students with mobility limitations due to physical disabilities. A mixed methods approach allows for more extensive examination and interpretation of data collected. Additionally, complimenting survey data with explanatory interviews may strengthen the results found (Johnson & Christensen, 2008; Johnson & Onwuegbuzie, 2004).

All surveys were reliable and previously validated examining EXSE, outcome expectations, barriers to exercise, and health practices (Becker, Stuijbergen, Oh, & Hall, 1993; McAuley, 1992; McAuley, Lox, & Duncan, 1993; Wójcicki, White, & McAuley, 2009). All interviews were analyzed using thematic analysis (Braun & Clarke, 2006; Corbin & Strauss, 2008). Semi-structured interviews with open-ended questions were chosen as we aimed to obtain the individual perspectives and experiences of the participants. We acknowledge that analysis of qualitative data is subject to researcher

interpretation and bias (Hammersley & Atkinson, 2007); therefore, for this study we aimed to understand our own experiences, opinions, and expectations, to better recognize and minimize bias in analysis of the data.

## 2.2. Participants

The study protocol was approved by the university institutional review board. A sample of SWD was recruited from a Midwestern University, recognized for its long-standing commitment to SWD including campus accessibility, extensive student services for SWD, and adapted athletic sports programs. Participants were recruited through information provided to the Division of Disability Resources and Educational Services (DRES), athletics coaches/administrators of adapted sport teams, the Interim Director of Residential Support Services, as well as flyers posted within university housing and facilities. Inclusion criteria for participation were: (1) 18 + years of age, (2) currently a student at the participating university, and (3) identified as a person with a physical disability. A total of 15 SWD volunteered and were screened for the study. Two students did not respond for interviews, resulting in a final sample size of 13 participants.

## 2.3. Demographic and quantitative measures

Data collection was separated into two sessions, set one week apart. During the first session, informed consent and basic demographic information were obtained. Additionally, to better understand the sample, participants completed multiple reliable and validated survey tools measuring EXSE, outcome expectations, barriers to exercise, and health practices (see Table 1 for demographics and survey results).

Exercise-specific self-efficacy was measured through the EXSE scale (McAuley et al., 1993). The 8-item EXSE scale examines an individual's belief in their ability to participate in 40 min or more of moderate PA three times per week in one-week increments, for the next 8 weeks. Scores range from 0 to 100, higher scores indicating greater EXSE. The EXSE has been found to be reliable and valid measure for EXSE, with high internal consistency estimates in IWD and older adults (McAuley, Jerome, Elavsky, Marquez, & Ramsey, 2003; McAuley et al., 1993; Motl, Snook, McAuley, Scott, & Douglass, 2006).

Exercise outcome expectations were measured through the multidimensional outcomes expectations for exercise scale (MOEES) (Wójcicki et al., 2009). The 15-item scale contains three subscales of outcome expectations: Physical, social, and self-evaluative outcome expectations. The scores of each subscale are summed and form measures of outcome expectations. Scores ranges for each of the subscales are as follows: Physical: 6–30, social: 4–20, and self-evaluative: 5–25. Higher scores indicating greater outcome expectations in each subscale for exercise. The MOEES has been found to have adequate internal consistency, with excellent validity and reliability in IWD and older adults (McAuley, Motl, White, & Wójcicki, 2010; Snook & Motl, 2008).

Barriers to exercise were measured through the barriers-specific self-efficacy scale (BARSE) (McAuley, 1992). The BARSE is a 13-item scale that identifies a participant's perceived capabilities to exercise three times per week for 40 min over the next two months when facing commonly identified barriers. The scores range from 0 to 100, higher scores indicating greater ability to overcome barriers. The BARSE has been found to have excellent internal consistency, with acceptable validity and reliability in IWD and older adults (McAuley, 1992; Morris, McAuley, & Motl, 2008).

Participants' self-perceived ability to implement health-promoting behaviors was measured through the self-rated abilities for health practices scale (SRAHP) (Becker et al., 1993). The 28-item, 5-point scale, contains four subscales of exercise, nutrition, responsible health practice, and psychological well-being. The scores of each subscale are summed and form measures of ability to perform health practices. Scores range from 0 to 112, higher scores indicating greater ability to perform health practices. The SRAHP has been found to have high internal consistency, with acceptable validity and reliability in IWD and undergraduate students (Becker et al., 1993).

**Table 1. Participant demographics**

Participant	Gender	Age	University attendance (# of years)	Disability	Primary assistive device*
1	F	39	3	CP	Power
2	Ma	18	1	MD	Power lift
3	Ma	27	8	MD	Power
4	F	20	1	CP	Power
5	F	18	1	Friedreich's Ataxia	Power
6	F	21	0.5	CP	Power
7	F	26	0.5	CP	NA
8	Ma	28	5	CP	Power
9	Ma	24	6	MD	Power
10	F	20	1	Scoliosis	Manual
11	F	25	2	Transverse Myelitis	Power
14	Ma	28	4	CP	Power
15	F	22	3	CP	Power
M (SD)		23.69 (5.68)	2.50 (2.33)		

Notes: Ma: Male; F: Female; M (SD): Mean (standard deviation); CP: Cerebral palsy; MD: Muscular dystrophy; Power: Power Wheelchair, Manual: Manual Wheelchair, and NA: No assistive devices used.

\*Participants often reported secondary assistive devices.

#### 2.4. Interview protocol

During the second session, participants completed one, individual interview to allow personal elaboration and details. Interviews were conducted with the purpose of capturing rich, personal information beyond what surveys may be able to provide. The information collected during the interviews was used to compliment data collected from the surveys and allow for deeper analysis and interpretation. Interviews were conducted in a quiet, private conference room using a semi-structured interviewing protocol. Formal initial, intermediate, and ending questions were developed prior to data collection, using intensive interviewing strategies and grounded theory to gather rich data from participants (Charmaz, 2014; Corbin & Strauss, 2008). Interview questions focused specifically on PA and exercise, to obtain participant activity levels, perceptions, barriers, motivators, and other influences. Sample interview questions can be found in Table 2. Multiple researchers conducted interviews with participants to minimize bias of intermediate questions and interview focus. All researchers used the same formal initial questions (see Table 2), but were allowed the freedom of intermediate questions to direct conversation and probe participants for elaboration and greater insight to opinions and experiences. Interviews lasted an average of 60 min, were audio recorded using a digital recorder (Sony ICD-PX312 Digital Voice Recorder, Sony Corporation, New York, NY, USA). At the end of each interview, participants were given the opportunity to add any additional thoughts they may have on the interview topics of PA and exercise.

#### 2.5. Data analysis

##### 2.5.1. Quantitative analysis

Analyses of the survey and demographic data were conducted using IBM SPSS statistics, Version 22 (SPSS, Inc., Chicago, IL). The primary quantitative analysis estimated the associations between the three MOEES scales, EXSE, BARSE, SRAHP, and demographic variables of age and years of schooling using Spearman's rho correlations analysis. The magnitude of the correlations was interpreted as small, medium, and large based on values of 0.10–0.29, 0.30–0.49, and 0.50–1.0, respectively (Cohen,

**Table 2. Sample interview questions**

Physical activity interview sample	
Formal initial	1. To help me better understand, can you tell me how would you describe physical activity?
	2. What are the things that prevent you from or help to motivate you to participate in physical activity?
Intermediate	1. How do the resources at the university shape that?
	2. Have you utilized any resources that the university provides and how did that affect your physical activity levels?
Ending	1. What is most influential to your participating in physical activity?
	2. Do you feel as though you participate in physical activity a healthy amount and can you describe how so?

1988). Using Shapiro–Wilks tests, all data were found to be normally distributed; therefore, independent *t*-tests were used to determine if gender had significant influence over survey scores. Significance for all correlations statistics was set at  $p \leq 0.05$ . As four independent *t*-tests were run, a Bonferroni correction was used to determine a new *p*-value of  $p \leq 0.01$ . All description statistics are reported as mean (*M*) and standard deviation (*SD*). Range (*R*), interquartile range (*IQR*), and median (*Med*) are reported for variable scores in Table 3.

### 2.5.2. Qualitative analysis

All interviews were transcribed verbatim by a researcher who did not conduct that specific interview and then read over by the interviewing researcher to verify for accuracy. Thematic analysis was first performed by three coders to identify, analyze, and interpret common primary themes found in the data (Braun & Clarke, 2006). In accordance with Corbin and Strauss (2008), the coders used line-by-line, open coding strategies on the first five interview transcriptions to develop categories of most importance based on the data. Next, for further examination, coders re-read the transcriptions and developed subthemes within each primary theme. Once recurring themes and patterns relating to the original research questions were found, a codebook was developed to analyze the remaining eight interview transcriptions. The initial five interview transcriptions were also reanalyzed using the final codebook. All final coded transcriptions were checked for consistency among coders, in addition to an auditor. The auditor was a researcher who did not take part in interviewing or coding. Their primary responsibility was to examine final codes for bias, discrepancies, and address any outstanding data concerns. Any discrepancies were discussed to address possible researcher bias and generate consensus on coding (Braun & Clarke, 2006; Charmaz, 2014).

To maintain rigor during the qualitative analysis, multiple methods were used to insure credibility and transferability of the results. In using a standardized, semi-structured interview in which all researchers were required to follow, we maintained reliability of data collection. Mixed data were compared using multiple triangulations in the combined use of survey, demographic, and interview data to reveal complimentary findings (Erzberger & Prein, 1997; Polit & Beck, 2004). Finally, researchers searched for negative cases, or outliers, to determine if any participants or data were not consistent with the emerging themes.

Although these measures were carried out to ensure the credibility and transferability of the data, caution should be taken when generalizing the results to other SWD that may function differently in other environmental contexts. When considering researcher bias with regard to the credibility and transferability of the data, there is no perfect separation of the researchers from the participants (Locke, 1989). It should be noted that one of the interviewing researchers may have interacted with the participants previously as an instructor for an unrelated course. All other researchers had no direct prior relationship with the participants, and had no personal or professional obligations that would have led to the coerced participation in this research study.

**Table 3. Descriptive statistics for survey variables**

	<b>M (SD)</b>	<b>Range</b>	<b>IQR</b>	<b>Median</b>
MOEES				
Physical	25.23 (4.67)	17.00–30.00	9.00	27.00
Social	11.15 (4.16)	4.00–20.00	5.50	12.00
Self-evaluative	19.85 (3.74)	12.00–25.00	4.50	21.00
EXSE	55.09 (33.09)	0–100.00	61.88	60.00
BARSE	48.28 (21.14)	13.08–82.31	39.23	52.31
SRAHP	89.46 (9.76)	73.00–110.00	14.50	89.00

Notes: M: Mean; SD: Standard deviation; IQR: Interquartile range; MOEES: Multidimensional outcomes expectations for exercise scale; EXSE: Exercise self-efficacy scale; BARSE: Barriers specific self-efficacy scale and SRAHP: Self-rated abilities for health practices scale.

### 3. Results

The participant population was predominantly female ( $n = 8$ ), Caucasian ( $n = 11$ ), and full-time students ( $n = 11$ ) (Table 1). The participant population had a mean age of 23.69 SD 5.68 years and attended the participating university for 2.50 SD 2.33 years. Cerebral palsy was the most common cause of disability ( $n = 7$ ), followed by muscular dystrophy ( $n = 3$ ), and Friedreich’s ataxia, scoliosis, and transverse myelitis (each  $n = 1$ ). All participants, except one had been living with their disability for at least 10 years at the time of data collection. Almost half of participants ( $n = 6$ ) used a combination of power and manual wheelchairs for modes of propulsion.

#### 3.1. Quantitative analysis

Participant sample M, SD, R, IQR, and Med survey scores are reported in Table 3. All correlations are reported in Table 4. Results of the independent *t*-tests showed no significant differences between male and female survey scores: MOEES physical:  $t(13) = 0.488, p = 0.64$ , MOEES social:  $t(13) = 1.07, p = 0.31$ , MOEES self-evaluative:  $t(13) = 0.59, p = 0.95$ , EXSE:  $t(13) = 0.72, p = 0.94$ , BARSE:  $t(13) = 1.18, p = 0.26$ , and SRAHP:  $t(13) = 1.35, p = 0.21$ .

#### 3.2. Qualitative analysis

During the analysis, it was noted that students often used the terms PA and exercise interchangeably. Therefore, to avoid errors in interpretation, the term “PA” will include both definitions of “exercise” and general “PA.” Analysis of the interview transcriptions resulted in two primary themes and a total of seven subthemes based on 21 codes. Research questions, primary themes, subthemes, and codes are reported in Table 5.

##### 3.2.1. Theme 1: personal perceptions of PA

During the interviews, participants were asked to discuss their personal definitions and beliefs about PA, as well as their own PA levels.

**3.2.1.1. Personal definitions.** Many participant definitions of PA stemmed from conventional descriptions, such as “anything that gets your heart rate up” or “anything that keeps your body moving.” Interestingly, when asked to provide examples of what they believed to be PA most participants reported activities they were unable to currently perform. For example, a few participants who relied predominantly on power wheelchairs for mobility cited examples of running or roller skating. Some of the participants also seemed to lack confidence when providing their personal definition of PA. Often, participants would give their personal definition, immediately followed by statements such as “I don’t know,” “I’m not sure if that’s what you consider PA,” or “I don’t know if that’s considered PA.” Participants often expressed that their PA and exercise primarily came from performing activities of daily living (ADLs), such as personal care, transferring, attending class, and participating in social events. One female student described cheering at a sporting event as an activity that she considered to be exercise.

**Table 4. Results of Spearman’s rho correlations analysis on survey variables**

	<b>MOEES: physical</b>	<b>MOEES: social</b>	<b>MOEES: Self- evaluative</b>	<b>EXSE</b>	<b>BARSE</b>	<b>SRAHP</b>
MOEES						
Physical	-	-	-	-	-	-
Social	0.88 (0.00)*	-	-	-	-	-
Self-evaluative	0.74 (0.00)*	0.71 (0.01)*	-	-	-	-
EXSE	0.29 (0.34)	0.39 (0.19)	0.24 (0.43)	-	-	-
BARSE	0.16 (0.61)	0.08 (0.79)	0.34 (0.26)	0.55 (0.05)*	-	-
SRAHP	0.44 (0.13)	0.57 (0.04)*	0.38 (0.20)	0.82 (0.00)*	0.52 (0.07)	-
Age	-0.13 (0.67)	-0.27 (0.38)	0.17 (0.58)	-0.21 (0.48)	-0.00 (0.99)	-0.01 (0.96)
Schooling	-0.30 (0.32)	-0.26 (0.38)	-0.08 (0.78)	0.36 (0.22)	-0.18 (0.55)	-0.02 (0.95)

Notes: Correlations between demographic and survey data. Age and Schooling were not tested for correlations. MOEES: Multidimensional outcomes expectations for exercise scale; EXSE: Exercise self-efficacy scale; BARSE: Barriers specific self-efficacy scale and SRAHP: Self-rated abilities for health practices scale.

\*Level of significant at  $p < 0.05$ .

This theme expanded into participants discussing their personal beliefs of PA. For example, when asked what she personally views as PA, one participant with cerebral palsy explained:

I don’t physically walk, but it does take energy to drive, you know, down the block or across campus. I think that’s considered PA too. I know it sounds ridiculous, but on my PA sheets, whenever I drove home, I didn’t drive, I just road in the car, but I put a 7 for that. Because just sitting in a car is physically exhausting to me. I don’t know why, but it just makes me really tired [participant referenced using a PA recall survey with rate of perceived exertion score (1–10)].

Another female participant with cerebral palsy described,

... what I perceive as my PA is the walker. I feel like I get a pretty good exertion and workout because by the end of it, I’m breathing heavy and I have broken into a sweat ... I need water. It’s almost like my version of running (laughs), except it’s much slower than the others.

Additionally, many participants expressed that what they believed to be PA for themselves was much different than what it may be for a person without physical disabilities. One example of this was a response by a male student with muscular dystrophy: “anything I consider PA is just your [individuals without physical disabilities] regular day to day things, like going to class or just like socializing.”

Some participants expanded on these differences, and seemed to feel that PA wasn’t something they were able to perform. One male with muscular dystrophy stated:

I don’t really personally identify with that word just [because] I picture exercise as like being at the gym or, you know, running or something like that. So when I say stretching, I don’t really use it as exercise as what you guys would [referring to individuals without a physical disabilities] ...

**3.2.1.2. Personal practices.** When asked about their participation in PA, a majority of the students stated their physical therapy (PT) sessions, provided at the university, were a primary source of PA. Almost all ( $n = 11$ ) of the participants reported going to PT or performing therapeutic exercises 1–2 times each week. Additionally, students reported daily therapeutic activities, such as using a walker for 30-min each day, as part of their personal practices. Some of the more common examples

**Table 5. Interview codes, themes, and subthemes**

Research question	Primary themes	Subthemes	Relative codes used
What are SWDs' personal perceptions and knowledge of physical activity?	Personal perceptions of physical activity		
		Personal definitions	Definitions, knowledge of physical activity
		Personal practices	Personal practices
What are the primary influences on participation in physical activity that SWDs have?	Influences on physical activity participation		
		University assistive resources	University/Staff/Assistance, physical resources, access to information at university
		Aspects of personal wellbeing	Physical and psychological benefits, choice/Self-regulation, confidence for physical activity participation
		Symptoms and physical limitations	Physical limitations and health, weather
		Time and scheduling	Academic classes/Schedules
		Social inclusion	Peer/Social influences

of exercises provided were therapeutic stretches, movement exercises for blood flow, and muscle strengthening. Very similarly to what was noted in the personal definitions subtheme, participants often described their PA practices as performing daily activities. For example, a female participant with transverse myelitis stated,

I'm pretty independent, ya know, flipping on the light switch, or lifting my computer from my lap to the table, or getting it down, opening it up, writing, taking a drink and eating, cutting stuff up - if I can cut it up. I mean its all, brushing teeth, brushing hair, doing your hair, putting on makeup when I do put it on. Ya know, that kind of stuff.

Similarly, when asked what he personally did for PA, a male participant with muscular dystrophy stated,

... definitely just like day to day, if I were to go out to class several hours and [be] out and about, that would definitely be burning calories and sort of a physical exertion there. So I don't really have to do anything additional than what I already do.

Only four of the 13 participants reported participating in recreational activities outside of their scheduled PT and therapeutic exercises. One of those participants was also a member of the university's wheelchair basketball team. These four participants stated they participated in numerous activities offered by the university that they enjoyed performing, such as weight lifting, aerobic classes, practicing walking, and using the treadmill, stair climber, and swimming pool.

### 3.2.2. Theme 2. Influences on PA participation

In order to obtain more rich information, participants were asked to expand beyond their personal PA habits. Researchers asked participants what motivated them to be physically active, as well as what barriers to PA they faced. Participants were asked to expand on other individuals, physical and social resources, and personal feelings or beliefs that influenced their PA levels.

3.2.2.1. *University assistive resources.* All of the students interviewed addressed the influence of specific university resources on their PA levels. The most commonly stated influences were personal assistants (PA) and staff, such as a physical therapist, provided by the university. Only two instances occurred in which students stated that a PA was considered to be a barrier to activity. The first was when a PA was unable to physically maintain a level of aerobic activity with the student, such as not keeping pace with a power wheelchair. The second dealt more with the comfort of the student and the experience level of the PA. This is described in a statement made by a male participant with cerebral palsy comparing his PA levels at home to on campus,

Physical activity is a little more involved when I'm home, but I think for here, it's like, and it's not like I don't trust my PA's, because I trust them, but I think when I'm home it's a little more involved because it's my parents and they've been doing those things ever since I was like four.

Another student described her frustration with fitness staff at the recreation center,

When I was younger, I took a fair number of dance classes and that kind of thing and I had fun. I was in disability specific classes and that was great, but now I notice when I've taken workout classes or dance classes, my instructors ... often get frustrated with my disability before I do. It will take me some time to get a move, they are like oh you aren't getting this, and I'm like I'll get it, it will just take me a few more times ...

Many of the participants ( $n = 9$ ) stated that their PA and PT were positive sources for PA participation. Participants who utilized these resources stated that the university-provided PTs and PAs helped to provide necessary assistance, beneficial information on health and activity, and motivate them to regularly perform PA. A female participant stated about the university, "There is a really good support system here. You know, everybody is willing to help you out and they all kind of make sure your goals and your dreams happen." It should be noted that three of the participants who did not find their PA or PT influenced their PA levels did not regularly practice PA and the fourth did not require PA or PT resources.

3.2.2.2. *Aspects of personal wellbeing.* All participants, except one, believed there are physical and psychological benefits to PA participation. Most commonly, participants discussed stress reduction and relaxation. One male participant with muscular dystrophy explained,

I think a lot of people think of the body and the mind as a separate thing, but having a healthy body and having PA [have] a huge impact on how you think and how much stress you deal with on a daily [basis], so I think if your body is less stressed, your mind is less stressed.

Another very commonly stated benefit was the feeling of accomplishment and independence gained by PA participation. One female student with cerebral palsy explained, "I think the biggest satisfaction is knowing that you personally feel good and, really, at the end of the day we all have to be okay with ourselves". Another female student with scoliosis described her motivation as, "to show people that just because I have a disability, it's not going to stop me from furthering my goals and what I can do and why." She expanded on this by stating, "I've come to realize the fact that emotional health is just as important as eating healthy and physical [activity]." Overall, six of the participants described that "feeling good" or "feeling happier and healthier" both during and after PA were primary motivators.

3.2.2.3. *Symptoms and physical limitations.* For participants, the symptoms and physical limitations of their disabilities played very significant roles in influencing their PA participation. Participants often discussed the benefits of PA in alleviating secondary symptoms of disability. Many of these discussions on benefits stemmed from their exercises performed in PT, such as, "get my body moving so I don't get stiff or [pressure] sores from sitting in my chair" and, "[we do] traction to straighten

out my spine, because that helps me breathe a little bit better.” However, participants strongly emphasized the importance of independence. A male student explained this in a response about his perceived benefits of PA, stating,

Oh, they’re numerous, they’re numerous for me - it’s being able to help my PAs or assistants here with, what I like to call them, “tasks of daily living”, which are transfers or getting dressed or getting ready for bed or taking medications.

Additionally, maintaining current levels of health and preventing loss of functionality was a common motivator. A female student with Friedreich’s explained,

I didn’t want to be in a chair because once I’m in a chair, like, then you lose so much strength that you can use walking, so that’s definitely a big motivator that I want to keep being able to walk.

Participants also discussed that without regular PA, secondary symptoms of their disability, such as depression, balance, energy, and sleep quality often become exacerbated.

Although PA was stated to benefit participants, symptoms and physical limitations were also addressed as a barrier to PA. Some participants outright described their disability or condition as a barrier to PA, stating that “being in a wheelchair” prevented them from participation. Additionally, participants reported feeling limited in their abilities, one describing, “I don’t think there is as much for, you know, people with more severe physical limitations.” A male participant with ataxia muscular dystrophy expanded on this, stating,

It’s just, when you have a disability it’s hard to get into the mindset that you can be physically active as much as ... someone that doesn’t have such challenges.

Another female participant with cerebral palsy addressed how her disability symptoms often discouraged her from trying new activities, stating,

I have a lot of anxiety, disability-related anxiety, of trying new things and things being more difficult for me when I start them. It’s like getting in that mental state of knowing that I am going to try something that is really hard and will take me a long time and I am going to be frustrated, but I have to be ok with that first before I go on.

Furthermore, although some participants discussed maintaining independence, health, and happiness as a facilitator, a lack of these was also noted to be a barrier to PA.

**3.2.2.4. Time and scheduling.** For almost all of the participants ( $n = 10$ ), time management and scheduling was stated as an influence to participation in PA. Particularly, studying for exams, homework, and attending classes were cited as barriers to PA ( $n = 9$ ). Additionally, participants addressed the amount of time it took to prepare for and complete physical activities prevented them from wanting to participate. One female student with cerebral palsy mentioned, “Most people, when they are physically active, do so without thinking about it, whereas for me it has to be a, I mean even transferring, is a carefully planned out thing.” Another female with cerebral palsy described that she didn’t go swimming as often as she liked on campus because it would take more than an hour to get ready, even with the help of a PA.

**3.2.2.5. Social inclusion.** Almost all ( $n = 11$ ) of the students interviewed addressed their peers as an influence to their PA participation levels in some way. Nine of the participants stated they felt their peers positively influenced their PA levels through encouragement, role models/motivation, and social support. A male participant with cerebral palsy explained that when he doesn’t want to exercise, he gets encouragement from his peers. In detail he explained, “We encourage each other, be like, ‘no you gotta go for the benefit of your muscles’, and stuff like that. I get feedback from my peers to

when we encourage each other.” Commonly, participants also described that performing PA with peers made it more enjoyable and promoted a social connection to others. The same male student with cerebral palsy explained,

I enjoy like being able to do my exercises at DRES, not only for the physical aspect of stretching the muscles, but for that communication aspect of it as well because while we are doing that, we are talking about certain things that are going on around campus or about classes ... I look at it as a holistic experience.

For some participants, not having peer support was noted as a barrier to being physically active. For instance, a female student with cerebral palsy described,

Walking and hiking are things that I actually don't mind doing with other people - I prefer to them with other people. So if I have people to spend time doing those things with, they are more enjoyable .... I do have friends that I can do those things with, but it is a little more difficult [at the university] because if I want to do those things and there is no one to do them with, I kind of lose my motivation.

Participants also explained that their peers were often able to help them in performing any activities, as well as providing information on the benefits of being physically active.

#### 4. Discussion

In numerous studies, participation in PA has been observed to greatly improve both the physical and psychological health of IWD. This study adds to the literature aimed at better understanding university SWD and their perceptions of PA. We were able to address two primary questions (1) What are SWDs' personal perceptions and knowledge of PA, and (2) What are the primary influences on participation in PA that SWDs have? With this information we are able to provide rich data, answering these questions and helping build a more comprehensive understanding of the perceptions and needs of SWD. Most importantly, with the qualitative data, we were able to find differences in the factors influencing PA participation among SWD compared to their able-bodied peers and those reported to influence IWD living in the general population of IWD (Rimmer et al., 2000, 2004, 2005).

##### 4.1. Quantitative survey results

Results of the quantitative analysis indicate that participants in this study had similar, yet higher survey scores to those found in previous literature (McAuley, 1992; McAuley et al., 1993; Salaj & Markovic, 2011; Sheppard, Young, Doyle, Sheppard, & Newton, 2006). However, it should be noted that survey scores in previous literature are of different populations, both in age and disability. Participant scores for the MOEES scales and EXSE were observed to be very similar to previous literature on IWD. However, previous literature has been focused on older populations and adults with multiple sclerosis (McAuley, 1992; McAuley et al., 1993; Salaj & Markovic, 2011; Sheppard et al., 2006). Interestingly, participants' average scores for the physical and self-evaluative MOEES scales were relatively high in the top 25% of the scale ranges, but the average score for the social MOEES scale was closer to a moderate range (56% of maximum score). This may give indication that our younger participants found PA to be more beneficial for symptom control/reduction, independence, and perceived abilities, over benefits to social inclusion and peer acceptance.

Interestingly, participant BARSE scores were very similar to those of college students without physical disabilities (48.30 SD 21.10 vs. 48.50 SD 22.67) (Garrin, 2014). Although IWD generally report more barriers to PA, living on an accessible campus with numerous opportunities for assistance may have contributed to higher scores. Investigating young adults with disabilities who are not living on an accessible campus may help to clarify the influence of university resources. Finally, SRAHP scores were also higher than previously reported in the literature (Becker et al., 1993; Stuijbergen, Seraphine, Harrison, & Adachi, 2005; Stuijbergen, Seraphine, & Roberts, 2000). Although both the EXSE and BARSE demonstrated moderate level scores for participant's exercise-specific self-efficacy and ability to overcome barriers to exercise, participants had relatively high average SRAHP scores

(79% of maximum). These higher scores for perceived abilities to perform health-promoting practices may reflect participants placing higher importance on nutrition, happiness, stress reduction, and symptom management for health rather than regular PA. In contrast, however, the SRAHP does not measure the actual degree to which health practices are carried out, only whether participants believe they are able to perform them. Therefore, results should be interpreted with caution.

As anticipated by researchers, significant correlations were found between survey measures. Specifically, all three scales of the MOEES were highly correlated, suggesting participants who perceived positive outcomes from PA, believed they would occur in physical, social, and self-evaluative domains. Additionally, the EXSE was moderately correlated with the BARSE. The moderate correlation found between participant's self-efficacy and barriers to PA support findings from previous literature. Self-efficacy and barriers to PA have been noted to be underlying contributing factors to IWD participation in PA (Martin Ginis et al., 2011). Given that no participants reported barriers common to IWD in the general population, such as transportation or available facilities, it is pertinent to understand the existing barriers SWD face to reduce negative effects on SWD self-efficacy.

The EXSE was also highly correlated with the SRAHP. The high correlation found between the EXSE and the SRAHP indicates that SWD with higher levels of self-efficacy also have higher belief in their ability to perform health practices. Although this belief does not suggest action in practice, further research should investigate whether these beliefs relate to PA participation. No correlations were found between survey measures and age or years of school. This may be due to the limited sample size.

Due to the small sample size and unique university setting, all interpretations of the quantitative data should be done with caution. Future research should be performed to examine the relationships between survey scores for larger sample sizes of SWD. Additionally, further studies should be performed at universities with less disability services and accommodations to determine whether the survey scores of SWD change. Because the participating university is very unique in its commitment to SWD, these results may not apply to all university settings.

#### **4.2. Qualitative themes**

In the first primary theme, personal perceptions of physical activity, it became very clear by the participants' definition of PA that many believed PA was not something they were able to do. Most participants who provided examples of physical activities that they were personally unable to perform stated a lack of association with the word and practice of PA. Additionally, it was noted that the same participants reported not partaking in regular physical activities outside of their exercises performed in PT. This was in contrast to participants who were generally more physically active, both in recreation and in PT participation. Participants who reported being more active gave more personalized examples of activities they were able to perform. This is particularly concerning as a SWDs' personal definition of PA may greatly influence their self-efficacy of being physically active. If an IWD only perceives PA as movements they are physically unable to or have difficulty performing, than it may lead to a belief that PA is not possible for them.

As this research is preliminary in nature, further examination is necessary to investigate the influence of personal definitions on activity levels. Educators and rehabilitation specialists may need to introduce IWD to a definition or redefine their current perspectives of PA that include adaptive exercises. Thus, emphasizing that even with physical limitations, individuals can adapt movements and exercise to practice regular PA. Previous literature has observed similarly low numbers of IWD who participate in recreational PA (Caddick & Smith, 2014; de Groot, van der Woude, Niezen, Smit, & Post, 2010; Devine, 2013; Wolfensberger & Nirje, 1972). However, multiple studies involving interventions of recreational activities with IWD have found participants experience a "redefining of abilities" (Caddick & Smith, 2014; Wolfensberger & Nirje, 1972). Introducing recreational PA outside of a therapeutic setting earlier in life may help IWD better identify with their abilities to participate.

The findings from the second theme, influences to physical activity participation, provided both support of previous literature and new, novel information in relation to university students. In line with previous literature on general population IWD, students reported barriers to PA participation were lack of time, lack of interest or motivation, the disability itself, and fatigue (Brughelli, Cronin, Levin, & Chaouachi, 2008; Cowan, Nash, & Anderson, 2013; Rimmer et al., 2004). However, most findings were very unique to the university setting. Although very common in general population IWD, no participants reported accessibility of facilities, lack transportation, costs, or lack of access to information as barriers (Brughelli et al., 2008; Cowan et al., 2013; Rimmer et al., 2004). These aspects were encouraging, as they likely indicate that students felt their university was both accessible and adequate in provision of transportation and information services.

It was also promising that a majority of participants ( $n = 11$ ) regularly used university staff, either a PA, PT, or both, to aid in practice of therapeutic exercises, PA, or access to information. However, many students emphasized a lack of regularity in attending sessions or a recognition that they should meet with their PT more often. One proposed cause for a decrease in SWD utilizing disability resources is at the postsecondary level, is the student must take on sole responsibility for themselves. SWD entering the postsecondary level must identify their needs, make accommodation or service requests, and make decisions about academic and disability services (Getzel, 2008; Shaw, Madaus, & Banerjee, 2009; Stodden & Conway, 2003). It is suggested that some students may become accustomed to depending on adults during adolescence, resulting in difficulty with responsibility, assertiveness, and confidence at the postsecondary level (Graham-Smith & Lafayette, 2004). This lack of independence may result in SWDs' decreased scheduled therapy sessions in comparison to adolescent years. Many factors influence a student's ability to advocate for themselves to receive disability services. Particularly, education in self-advocacy, health needs, and available support may benefit students in obtaining services at the university level, as well as postgraduation (Getzel, 2008). Further research should investigate the influence of student's independence on requesting and scheduling rehabilitation services at the university level. Moreover, it is concerning that participants stated PT was their sole form of regular PA. As participants reported only going to PT sessions 1–2 times each week, this might indicate they may not be sufficiently physically active for health benefits and management (USDHHS, 2008, 2011).

The subtheme of social inclusion was particularly interesting, as the literature on social inclusion for IWD continues to grow. In particular at the university setting, SWD have been observed to lack feelings of social inclusion and acceptance by their peers (Devine, 2013; Devine & Lashua, 2002; Devine & O'Brien, 2007). In previous literature, SWD report that feeling accepted and belonging to their university was of particular importance, therefore, the results of this study are promising (Thomason, Burton, & Hyatt, 1998). Almost all of the students ( $n = 11$ ) reported peers as a facilitator to participating in PA. Except for one participant who reported feeling discouraged by a fitness instructor, none of the participants reported feelings of lack of inclusion, social acceptance, or peers as barriers. This may be a result of the inclusive environment the participating university has provided, in which disability accessible dorms and rehabilitation academic programming aim to integrate students with and without disabilities. However, participants not addressing the barriers of social inclusion during the interviews does not completely indicate that they do not exist. Other measures or further in-depth interviewing specifically addressing peer inclusion and acceptance may better examine these influences (Murphy & Carbone, 2008).

Some limitations of the study should be addressed prior to drawing conclusions. First, the data collected in this study are based on a relatively small sample of university students, attending at highly accessible campus. These results should be interpreted with caution when applying the information to other campuses, as well as more diverse and broad populations. While the survey measures did help to better describe the sample, more information is needed on similar populations, such as students without disabilities or SWD at other universities, before strong comparisons or generalizations can be made. Finally, our analysis, as with any qualitative study, is subject to researcher bias. In light of this, multiple measures were taken to best address and eliminate bias prior to analysis

and drawing conclusions from the data. However, caution should be taken when generalizing the results to other SWD in other environmental contexts.

## 5. Conclusion

In this study, important differences were found on what influences SWD to be physically active in comparison to the general population of non-disabled adults. Conventional definitions of PA may deter or detach SWD from participation in PA. While living at a university with a long-standing tradition toward inclusive policy for SWD, many barriers faced by the general population of IWD are eliminated for SWD. However, even in an accessible environment, SWD still experience barriers to LTPA. Identification of these themes will facilitate further research and help to make effective changes to current universities for improving the lives and experiences of SWD. Further inquiry may help develop strategies at the university level to progress program development and organization to better promote and facilitate PA in SWD.

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## Competing Interest

The authors declare no competing interest.

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