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PREDICTORS OF PHYSICAL ACTIVITY AMONG CZECH AND AMERICAN CHILDREN WITH HEARING IMPAIRMENT

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Research is scarce in relation to using social-cognitive theory inclusive of social-cognitive, affective and environmental constructs to predict physical activity (PA) and fitness with hearing impaired (HI) children. Hence, the purpose of our investigation was to evaluate the ability of social cognitive variables (e.g., self-efficacy and social support), environmental (i.e., time outside) and affective constructs (e.g., physical activity enjoyment) to predict PA. Children from the Czech Republic and the USA (N = 64, M age = 14.1) with hearing impairments completed questionnaires assessing predictor variables and PA. Using multiple regression analyses we accounted for 29% of the variance in PA. Based on standardized beta-weights, the best predictors of PA were gender, country, and a block of social-cognitive constructs. Compared to males and females from the Czech Republic and to females in the USA, American males receiving social support from their friends and who enjoyed physical education were the children most likely to be physically active. Future research examining environmental influences more fully (e.g., school settings, after school programs) both within the USA and cross-culturally and adult influences beyond parents (e.g., teachers, coaches) are encouraged.

Keywords: social cognitive theory, environmental influences, adapted physical activity

INTRODUCTION

Given the overweight and obesity crisis, research on physical activity (PA) is increasing rapidly (Martin & Kulinna, 2005). Obtaining adequate PA is important as it provides numerous cognitive benefits as well as mental and physical health benefits such as enhanced self-esteem, less stress, reduced colon cancer and heart disease (Friedenreich & Orenstein, 2002; Sibley & Etnier, 2003; USDHHS, 2000). Theory based research is often advocated in order to make explicit the mechanisms undergirding both sedentary behavior and increased PA behavior (Martin & Kulinna, 2005; Martin & Hodges-Kulinna, 2004). Although some researchers have focused on understanding PA in ethnic (e.g., Arab-American) minority children (Martin & McCaughtry, 2008a; 2008b; Martin, McCaughtry, & Shen, 2008; Martin, Oliver, & McCaughtry, 2007) far fewer researchers have explored PA in children with disabilities[1] in general (e.g., Martin, McCaughtry, Murphy, Flory, & Wisdom, 2011). Finally, there is very little research examining the predictors of PA among children who have hearing impairment (HI). The limited research on children with HI suggests that they do not get adequate PA (Ward, Farnsworth, Babkes & Perrett, 2012). Additionally, deaf children have higher rates of overweight compared to national averages (Dair, Ellis, & Lieberman, 2006).

Some researchers have also indicated that HI children have lower motor ability and motor skills compared to non-HI children (Dummer, Haubenstricker, & Stewart, 1996; Engel-Yeger & Weissman, 2009) which may contribute to reduced PA. However, when compared to health standards of non-deaf children, children with HI meet minimally acceptable levels of fitness (Ellis, Lieberman, Fittipauldi-Wert, & Dummer, 2005). These findings suggest that children with HI might be at some risk for possessing minimal fitness and motor skills which may negatively influence PA engagement. Therefore the purpose of the current study is to address the

dearth of research on PA in children with HI by examining theory based predictors of PA.

The limited research in this area indicates that youth classified as deaf (i.e., complete loss of hearing in one or both ears) or HI (i.e., decrease in hearing sensitivity) reported that, despite enjoying PA, they were not particularly active (Ward et al., 2012). Furthermore, participants reported that they received minimal encouragement from their parents to engage in PA and sport and that peers without disabilities often excluded them from PA. (Ward et al., 2012). In her study of 73 deaf children Ellis (2001) also affirmed the important role of parents in promoting PA suggesting that parental social support of PA is a potentially important predictor of PA for children with HI.

The social support and PA connection has also been consistently upheld in PA research with children without hearing impairments. For example, Beets, Piteti, and Forlaw (2007) found peer social support was a direct predictor of PA. Beets et al. (2007) have argued that social support is multidimensional in that it is offered by distinct groups (e.g., parents). Supporting this view, they found that adult support of children's PA was unrelated to PA; whereas, peer support was linked. Other researchers have reported similar positive relationships between social support and PA (Davison, 2004). However, we could find no research aimed at determining if peer social support from diverse sources was linked to PA. Therefore, 3 forms of peer social support: friends, siblings and classmates in addition to parent social support were assessed in the present study.

We also investigated barrier self-efficacy which reflects a sense of personal agency or confidence in one's ability to overcome common barriers (e.g., competing activities, too tired, not enough time, and no friends to play with) to PA. Many researchers have found that barrier self-efficacy is related to PA in minority children (e.g., Martin & McCaughtry, 2008a; 2008b). Researchers have found that that urban middle school children, in general, had increasingly stronger barrier self-efficacy across the stages of change for free time exercise (Hausenblas, Nigg, Symons Downs, Fleming, & Connaughton, 2002). Children who had been exercising regularly had stronger barrier self-efficacy compared to children who were not exercising and had no intention to begin exercising. Beets et al., (2007) had similar results; they found strong support for the relationship between barrier self-efficacy and PA with adolescent girls. Finally, Martin et al. (2008) found that barrier self-efficacy predicted PA in Arab American middle school children.

Much of the research to date, and as described above has focused on important social and cognitive constructs. Recent research including environmental constructs has used time spent outside as a proxy to examine the influence of the environment in predicting PA for inner city African American children (Martin & McCaughtry, 2008b). It is plausible that children with HI may experience less time outside as a result of parental fear for their safety or few friends who know sign language. Hence, we also included a brief measure of time outside.

Finally, many social cognitive constructs do not address the influence of affect /enjoyment on physical activity participation. A domain specific measure of physical education enjoyment was obtained for the current study: as many children obtain PA in physical education (PE). Global enjoyment of PA also was measured to account for enjoyment of PA in non-school settings such as sport, leisure, and recreation. Enjoyment has been positively linked to PA in children (Martin, McCaughtry, Shen, Fahlman, Garn, & Ferry, 2012; Motl, Dishman, Saunders, Dowda, Felton, & Pate, 2001).

Therefore the purpose of the current study is to address the dearth of research on PA in children with HI by examining theory based predictors of PA. Assessing a broad range of constructs (i.e., social, cognitive, affective, & environmental) allowed us to determine the relative importance of each one. We hypothesized that children with strong barrier self-efficacy, perceptions of positive PA social support from all four sources, who enjoyed PA and PE and who spent time outside would report more PA compared to children with less favorable perceptions in all the constructs assessed.

Secondary goals were to determine if gender or cultural differences existed in PA among children with HI. Researchers examining PA and related psychosocial variables have found a

consistent pattern of gender differences favoring boys. Boys are more active than girls (e.g., Martin & McCaughtry, 2008a), and often report greater efficacy (Martin et al., 2008). Given the significant sociocultural norms that validate sport and PA as a masculine activity, it was expected that boys would be more active, have greater efficacy, and receive more PA social support compared to girls. It also speculated that boys would enjoy PA and PE more given that PE is often a setting that favors boys (McCaughtry, Tischler, & Flory, 2008). However, no research has examined if gender differences exist among children with HI.

Another secondary goal involved examining for cultural differences using country as a proxy for culture. Given the paucity of research on PA with children with HI we could find no research comparing American with Czech Republic children on the antecedents of PA. Hence, our ability to obtain data from large urban settings in two different countries further advances the knowledge base in this area.

METHOD

Participants

Participants with HI (N = 64) were from the two large cities in the USA (N = 30) and in the Czech Republic (N = 34). Participants were mostly male (N = 42) and female (N = 22) youth (M age = 14.1, SD age = 2.1).

Instruments

Students provided demographic information including their school name, grade level, age, gender, and ethnicity and answered questionnaires assessing all predictor variables (4 forms of social support, self-efficacy, two types of enjoyment, and time spent outside) and PA. All questions were developmentally appropriate and have been used with similarly aged children (Duncan, Duncan, & Strycker, 2005; Martin et al., 2005, 2007, 2008). For translation of scales into Czech, we used a modified direct translation method for participants from Prague. With the exception of language both the USA and Czech versions were identical.

Social Cognitive Theory Measures

Barrier Self-Efficacy (BSE) Children responded to eight items on a 7 point likert scale. Items were taken from valid and reliable youth PA self-efficacy scales used previously (Barnett, O'Loughlin, & Paradis, 2002). A sample item was" "How confident are you of participating in physical activities that make you breathe hard or feel tired when you have a lot of homework to do." Anchors were "not at all confident" (1) and "very confident" (7). All items were summed and divided by eight to obtain an overall barrier self-efficacy score ranging from 1 to 7.

Social Support Scales (SS). Four sources of social support were obtained. Children were asked four identical sets of five questions on a 5 point scale taken from the "friends" subscale developed by Duncan et al. (2005). The "friends" scale was adapted by changing "friends" to "classmates", "parents/adult caregiver", and "siblings." Duncan et al. (2005) obtained items from valid and reliable social support scales used previously in research with children. A sample question was: "How much do your classmates talk with you about your physical activity". Anchors were "never" (1) and "very often" (5). All items were summed and divided by four to obtain an overall score for social support ranging from 1 to 5.

Physical Activity Enjoyment (PAE) Children responded to a 16 item physical activity enjoyment scale developed by Motl, Dishman, Saunders, Dowda, Felton, and Pate (2001). Responses were collected on a 5 point likert scale. A sample item was" "When I am active I find it pleasurable." Anchors were "disagree a lot" (1) and "agree a lot" (5). All items were summed and divided by 16 to obtain an overall PAE score ranging from 1 to 5.

Physical Education Enjoyment (PEE) Children responded to a 12 item physical education enjoyment scale developed by Motl et al. (2001). Responses were collected on a 5 point likert scale. A sample item was, "When I am in PE class learning new skills is something that I?" Anchors were "dislike a lot" (1) and "enjoy a lot" (5). All items were summed and divided by 12 to obtain an overall PEE score ranging from 1 to 5.

Time Outside (TO) Children responded to 2 items used by Martin et al (2011). Responses were collected on a 5 point likert scale. Items were, "How much time do you spend outside on an average school day. A second question replaced "school day" with "weekend day." Anchors were "none" (1) and "a lot" (5). Both items were summed and divided by 2 to obtain an overall TO score ranging from 1 to 5.

Physical Activity Measures

Physical Activity (PA) We employed the Godin Leisure-Time Exercise Questionnaire (GLTEQ: Godin & Shephard, 1985), which yields reliable and valid scores. Students with HI read the header, "How many times in an average week do you do the following kinds of exercise for more than 15 minutes during your free time?" and responded to the next three statements: Strenuous Exercise (Heart beats rapidly), Moderate Exercise (Not exhausting) and Mild Exercise (Minimal effort). We used the phrase "breathe hard or feel tired" to enhance children's understanding. In addition, sample activities that are consistent with each exercise category were provided to further assist students' understanding. Students' answers for strenuous, moderate and mild exercise were then multiplied by nine, five, and three Metabolic Equivalents (METS) units respectively (Godin & Shephard, 1985). The GLTEQ has been successfully employed with similar aged minority children in previous research (Martin et al., 2005, 2007, 2008) and has been validated with children using objective measures of PA (Jacobs, Ainsworth, Hartman, & Leon, 1993).

Procedures

We received permission from the University Internal Review Board, the school principals and teachers and obtained parental consent and children's assent to conduct our study. The authors of the study collected data at the 3 different locations. A deaf residential school in a large urban city in the Midwest and a school for the deaf in the South were sources of USA data. Three schools in Prague provided data for the Czech Republic portion of the study. Students who had difficulty understanding the surveys were given individualized assistance (e.g., an expanded verbal explanation of the question) by one of the authors (E.P) and the school room teacher. Students at the school in the South responded to questions read to them by a sign language interpreter. Students averaged about 20-30 minutes to complete the survey. Participants who gave incomplete or incorrect answers were asked to clarify their responses.

Data Analysis

The Statistical Package for the Social Sciences was used for all analyses. We first examined internal reliability via alpha coefficients and then conducted descriptive analyses and bivariate correlations. Next, we examined gender and cultural differences using an Analysis of Variance (ANOVA). All variables (i.e., self-efficacy, four forms of social support, and PE enjoyment, time outside and PA were analyzed simultaneously. We then conducted a standard multiple regression (MR) analysis in which all the independent variables (IV's) (i.e., self-efficacy, social support, enjoyment and time outside) were entered simultaneously in a block to predict PA (Tabachnick & Fidell, 2001) after accounting for gender and cultural differences in the first two blocks. To guard against multicollinearity, we examined the variance inflation factors and tolerance figures. Both variance inflation factors (1.12-2.32) and tolerance figures (.43-.90) were adequate based on the criteria of above 10 and below .10, respectively (Cohen, Cohen, West, & Aiken, 2003).

RESULTS

Descriptive statistics

Means, standard deviations, and internal consistency (i.e., Cronbach's alpha; Cronbach, 1951) for all variables by country and gender are presented in Tables 1 and 2. Bivariate correlations are presented in Table 3 and MR results in Table 4.

Gender and cultural differences The ANOVA examining for gender differences indicated no differences on all variables, except for PA ($F(1, 62) = 3.81$, $p<.05$) where boys reported more PA. The ANOVA examining for cultural differences revealed 5 differences. Children from the USA reported more PA (F (1,

62) = 8.08, p<.01), greater self-efficacy (F (1, 62) = 3.86, p<.05), and more sibling social support (F (1, 62) = 6.38, p<.05). In contrast children from the Czech Republic indicated that they enjoyed PA (F (1, 62) = 8.02, p<.01) and PE more (F (1, 62) = 5.46, p<.05) then children from the USA.

Multiple Regression Analyses Because some differences in culture (USA vs. Czech) and gender were found we entered these constructs first in blocks 1 and 2 to control for their potential influence (see Table 3). In block 3 all psychosocial constructs were entered simultaneously in order to maintain a reasonable subject to variable ratio in the MR. The overall F(10,53) = 2.04, p <.05) was significant, accounting for 29% of the variance in PA. Gender and cultural accounted for 19% of the variance and 10% was due to the combined effect of the psychosocial variables. No single psychosocial construct had a significant standardized beta weight. However, friends social support (B = .24) and enjoyment of physical education were the largest (B = .21). Our findings tentatively suggest that USA males who enjoyed physical education and received PA support from their friends were the most active participants relative to non USA participants or females from both countries, who did not receive strong friend support or who did not enjoy physical education classes. The above interpretation is offered with caution as PE enjoyment and PA support had large but non-significant beta-weights.

TABLE 1

Means and Standard Deviations by Country

Questions	USA		Czech Republic	
	M	SD	M	SD
1. Parent SS	2.81	0.95	2.56	0.91
2. Classmate SS	3.00	0.75	3.11	1.41
3. Friend SS	2.90	1.14	3.01	1.03
4. Sibling SS	2.83	1.02	2.19	1.00
5. PA Enjoyment	3.08	0.41	3.48	0.67
6. PE Enjoyment	2.90	0.93	3.39	0.72
7. Barrier Self-Efficacy	4.00	1.32	3.46	0.85
8. Time Outside	3.70	1.01	3.47	0.96
9. Physical Activity	59.7	41.5	35.9	24.4

TABLE 2

Means and Standard Deviations by Gender

Questions	USA		Czech Republic	
	M	SD	M	SD
1. Parent SS	2.69	0.93	2.66	0.96
2. Classmate SS	3.03	1.21	3.10	1.03
3. Friend SS	3.03	1.10	2.82	1.05
4. Sibling SS	2.48	1.00	2.50	1.17
5. PA Enjoyment	3.34	0.58	3.21	0.63
6. PE Enjoyment	3.24	0.82	3.00	0.91
7. Barrier Self-Efficacy	3.59	1.07	3.95	1.21
8. Time Outside	3.45	1.03	3.81	0.85
9. Physical Activity	53.2	39.8	35.4	20.8

TABLE 3

Correlations among all Psychological Variables and PA.

	PSS	CSS	FSS	SSS	PEE	PAE	EFF	TO
CSS	.41**							
FSS	.60**	.60**						
SSS	.62**	.33**	.51**					
PEE	.32**	.33**	.29*	.22				
PAE	.24	.15	.23	.07	.56**			
EFF	.43**	.29*	.25**	.45**	.12	-.13		
TO	.16	.03	.02	.16	.00	-.09	.24	
PA	.16	.15	.25	.31*	.14	-.04	.16	.05

Note. PSS = Parent Social Support, CSS = Classmate Social Support, FSS = Friend Social Support, SSS = Sibling Social Support, PEE = Physical Education Enjoyment, PAE = Physical Activity Enjoyment, EFF = Barrier Self-Efficacy, TO = Time Outside, PA = Physical Activity in METS.
Note. ** = Significant at $p < .01$, * = Significant at $p < .05$,

TABLE 4

Multiple regression results predicting PA:

Step	Variable	R	R^2	F	df	p<	ΔR^2	β at entry	*p* at entry
	Gender	.24	.06	3.8	1.62	.05	.06	-.24	.05
	Country	.41	.17	8.2	2.61	.01	.11	-.36	.01
	PSS							-.17	.32
	CSS							.00	.98
	FSS							.24	.19
	SSS							.13	.44
	PEE							.21	.17
	EFF							.02	.91
	PAE							-.07	.65
	TO	.53	.28	1.0	10.53	.05	.12	.04	.74

Note. PSS = Parent Social Support, CSS = Classmate Social Support, FSS = Friend Social Support, SSS= Sibling Social Support, PAE = Physical Activity Enjoyment, PEE = Physical Education Enjoyment, EFF = Barrier Self-efficacy, TO = Time Outside

DISCUSSION

A major purpose of the present study was to predict PA using social support from parents, friends, classmates, siblings; barrier self-efficacy; enjoyment of both PA and PE; and time spent outside. The degree to which culture and gender predicted PA also was of interest. These exploratory findings suggest there is value in examining psychosocial models of PA that include perceptions of enjoyment and multi-dimensional social support while simultaneously

considering the influence of gender and cultural socialization processes. Gender, cultural and a combined effect of the psychosocial and affective constructs accounted for 29% of the variance in PA. We refer to the predictor variables in combination given that no single psychosocial construct had a significant standardized beta-weight. Our findings tentatively suggest that USA males who enjoyed physical education and received PA support from their friends were the most active participants relative to non USA participants or females from both countries, who did not receive strong friend support or who did not enjoy physical education classes. It should be noted that this interpretation is cautiously offered given that friend's social support and PE enjoyment did not have individually significant beta-weights based on conventional p values. Given the historical over-emphasis on significance value (Cohen, 1994), the increasing importance (Fritz, Morris, & Richler, 2012) of effect size (i.e., variance accounted for), and that this study appears to be one of the first to explore theoretically based predictors of PA, singling out the potential value of friend's social support and PE enjoyment for PA engagement seems warranted. It should also be noted that there was virtually no support (β = .00) for a classmate social support and PA association. This finding should not be confused with a lack of classmate support for PA as participant's reported a high absolute level (M = 3.1) of classmate support for PA. Furthermore, Shapiro and Martin (2013) found that children with disabilities reported high mean levels of sport and non-sport friendship quality and strong levels of social competence and close friendships. Finally, Wauters and Knoors (2007) also reported no differences between classmates with/without HI on peer acceptance, social status, and friendships. Cumulatively these findings suggest that children with HI do not report lower levels of support or quality on a host of classmate focused relationship measures compared to hearing children. However, it appears that these strong levels of support are not directed towards PA with one exception. In the current study American boys who enjoy PA may then engage in PA and sport with a close friend and as a result feel supported in their PA engagement by that close friend. Future researchers would be remiss to not consider other important influences on PA. For example, the only measure of the environment in the current study was a proxy (i.e., time outside). Hence, recognition of the friendliness of the physical activity environment for children with HI is warranted. For instance, it would seem that urban areas where bikes and cars may be plentiful could represent a dangerous environment for people whose hearing is constrained and have to rely more heavily on sight. Thus, it would seem that play and activity spaces devoid of bikes and cars would be of value. Future researchers should incorporate more precise and multidimensional assessments of the built environment such as perceptions of the school (e.g., Martin, McCaughtry, Murphy, & Wisdom, 2011). The potential influence of the teacher (e.g., Humphries, Hebert, Daigle, & Martin, 2012) on children's PA was also not assessed. Ellis (2001), Stewart and Ellis (1999; 2005) and (Kurková, Scheetz, & Stelzer, 2010) have suggested that the school setting (e.g., residential schools for the deaf) plays a large role in providing PA opportunities for youth with HI in both PE and sport. Hence, the school setting and deaf culture associated with residential schools should be important considerations.

It is difficult to ascertain why several cultural differences existed. For instance, children from the Czech Republic reported enjoying PE and PA more than USA children. Yet in a study comparing health and PE in schools for the deaf in the Czech Republic and the USA no differences emerged that would suggest Czech Republic schools might provide more enjoyable PE and PA experiences. Qualitative research would seem to be an excellent vehicle for determining the potential barriers and facilitators of PA in children with HI the Czech Republic.

Some limitations should be noted. Our measure of PA was self-report so future researchers should clearly consider obtaining objective measures such as accelerometer data. Our study was correlational and hence can suggest potential cause and effect relationships but not support definitive causal relations. Finally, we employed generic scales and hence did not address any deaf specific considerations.

For instance, because communication is important to some PA (e.g., aerobics music) and some strategic elements of team sports, crafting research studies that tap into such considerations would seem to be quite important.

Perspective

The current paper suggests that American males with a hearing impairment, similar to non-hearing impaired adolescent American males, are likely to be physically active if they enjoy physical activity and have close friends to be active with. This finding, while tentative, has credence given that previous research with non-hearing impaired American boys has supported similar suppositions. For the adapted physical activity practitioner this finding suggests value in highlighting physical activities that hearing impaired children enjoy. The affective experience should not be relegated to a secondary consideration after other valuable goals such as fitness and motor skill development. Such an approach should also prove valuable for girls and youth from diverse cultures.

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