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The Development of a Physical Activity Barriers Questionnaire for Youth with Visual Impairments

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Abstract

We developed a preliminary Physical Activity Barriers Questionnaire for Youth with Visual Impairments (PABQ-VI) using social cognitive theory as the guiding theoretical framework. Twenty-one youth with VI in Ireland participated in our study. Validity (content test, internal structure, and relations to other variables) and reliability evidence of the PABQ-VI scores were examined. Content test validity evidence was assessed using a panel of experts. Item-total correlations were used to assess internal structure validity evidence, and resulted in the removal of nine items. Bivariate correlations were conducted to establish relations to other variables validity evidence. Results revealed that scores obtained on the PABQ-VI were negatively correlated with physical activity levels, but not significantly correlated with self-efficacy for overcoming barriers. Omega and spilt-half reliability estimates were used to establish reliability evidence. Results of these calcuations revealed high reliability estimates. The development of the PABQ-VI will assist researchers to quickly identify PA barriers that limit youth with VI, and to help inform the design of future PA interventions.

Keywords:

INTRODUCTION

A Physical Activity Barriers Questionnaire for Youth with Visual Impairments: A Pilot Study

Youth with visual impairments (VI) have consistently demonstrated lower levels of physical activity (PA) than youth without VI (e.g., Augestad & Jiang, 2015; Greguol, Gobbi, & Carraro, 2015; Haegele & Poretta, 2015). In fact, there is some evidence that youth with VI have the most sedentary lifestyles of the many disabilities examined (Longmuir & Bar-Or, 2000). Parents of youth with VI have acknowledged the value of PA participation for their children (Perkins, Columna, Lieberman, & Bailey, 2013), but have also reported numerous barriers to participation, including fear of injury, lack of opportunity, and lack of trained physical educators (Stuart, Lieberman, & Hand, 2006). Identifying, and seeking to remove/minimize, barriers that have the most significant impact on PA participation in youth

with VI may be influential to their lifelong PA participation. Inventories exist that assess barriers to PA experienced by adults with VI (e.g., Lee, Zhu, Ackley-Holbrook, Brower, & McMurray, 2014), yet none exist for youth with VI. Therefore, the overarching aim of the current study was to develop a questionnaire that assesses PA barriers for youth with VI. Bandura's social cognitive theory (SCT; Bandura, 1997) was used as the guiding framework.

SCT is a well-established behaviour change theory. It emphasizes the dynamic interaction between an individual's internal stimuli (personal factors), social environment, and behaviors (Bandura, 1997). This dynamic interaction is otherwise referred to as reciprocal determinism (Bandura, 2001). Imagine, for example, a child who has an interest in competitive running. The child's interest in running (internal stimuli) might prompt them to join a track team (social environment) which results in the child making new friends to socialize with at lunchtime (behavior). Socializing with these new friends might then reinforce the child's initial interest in competitive running. SCT comprises four major constructs that impact an individual's decision to partake (or not partake) in health-enhancing or health-damaging behaviors. The first and most important construct of SCT is self-efficacy, which reflects a person's beliefs about what they can accomplish with available resources across various situations. Self-efficacy has been shown to have a direct effect on PA participation, as well as indirect effects through the remaining model constructs. These constructs include outcome expectations (one's beliefs of the expected consequences that will occur as a result of performing a particular behavior), socio-structural factors (perceived barriers or facilitators to achievement of goals), and goals. According to SCT, a person with low self-efficacy will likely perceive many barriers to PA, have low outcome expectations, will unlikely establish strong PA goals, and consequently will avoid participating in PA. SCT is one of the most utilized and accepted theoretical frameworks for understanding PA for typically developing populations.

In recent years, researchers have begun to use SCT to understand physical (in)activity for those with VI (e.g., Cervantes & Porretta, 2013; Haegele, Brian, & Lieberman, 2017; Haegele, Kirk, & Zhu, 2018). Haegele et al. (2017) examined SCT-based predictors of PA and sedentary behavior for adults with VI. Results showed that social support significantly predicted PA participation, while self-regulation predicted sedentary time. Cervantes and Porretta (2013) used SCT when investigating the impact of an after school PA intervention on adolescents with VI (N=4). Positive changes in social cognitive constructs were observed from pre- to post-intervention; two of the four participants reported increases in SE to overcome barriers, self-regulation, social support, outcome expectancy, and SE VI.

Measuring PA Barriers

There are inventories that assess barriers to PA participation experienced by adults with VI (Jaarsma, Dekker, Koopman, Dijkstra, & Geertzen, 2014; Lee et al., 2014). The Physical Activity Barrier Scale for Persons with Blindness or Visual Impairment (PBVI; Lee et al., 2014) is a 53-item unidimensional questionnaire that taps into various barriers, such as social influence, personal matters, environmental barriers, and psychological aspects. Lee et al. (2014) found that lack of self-discipline and lack of motivation had the most negative impact on PA for adults with VI. Jaarsma et al. (2014) adapted a questionnaire for Paralympic athletes (Jaarsma, Geertzen, de Jong, Dijkstra, & Dekker, 2013), and sub-grouped items assessing barriers into personal and environmental barriers. Visual impairment was the most important personal barrier, while transport was the most important environmental barrier.

Children and youth with VI face different barriers to PA than their adult counterparts, and thus questionnaires designed to capture and assess these unique PA barriers are required. One of the most common PA barriers for youth with VI is the lack of knowledge and opportunities to participate in PA programs (e.g., Perkins et al., 2013; Stuart et al., 2006). Frequently reported barriers for both young people with VI and their parents include lack of security, high cost, and lack of professional training and

information about the programs (Greguol et al., 2015). Young people with VI have specifically reported that a lack of parental support and negative attitudes of others toward the disability have prevented them from participating in PA (e.g., Shields, Synnot, & Barr, 2012). Additionally, teachers of physical education have reported lack of professional preparation, appropriate equipment, programming or curriculum, and time in schedule as dominant barriers to including youth with VI in physical education classes (Lieberman & Houston-Wilson, 2002). While the aforementioned body of literature has contributed to our understanding of factors that limit youth's PA, this data has generally been collected through qualitative interviews or through questionnaires assessing specific factors (e.g., parental support for PA). An inventory that captures and assesses various barriers for youth with VI may not only be a more efficient approach, but also may also assist in identifying factors that have the most influential impact on PA participation.

The Current Study

The purpose of the current study was to develop an inventory that assesses PA barriers for youth with VI, herein referred to as the Physical Activity Barrier Questionnaire for Youth with Visual Impairments (PABQ-VI). This objective was accomplished using SCT as the guiding framework and through a literature search on PA barriers of youth with VI. Another purpose of the current study was to assess the validity and reliability scores obtained on the PABQ-VI. Validity refers to "the degree to which evidence and theory support the interpretation of test scores entailed by proposed uses of tests" (American Educational Research Association [AERA], 1999, p. 9), whereas reliability refers to the degree to which test scores are consistent (AERA, 1999). The Standards for Education and Psychological Testing (herein referred to as the Standards; AERA, 1999) was used to guide our validity assessment, and is heavily influenced by Messick's (1989) perspective that validity is a unitary concept. The Standards advocates that validation involves collecting validity evidence through five sources: test content (e.g., expert views of item content), internal structure (e.g., factor analysis, item-total correlations), relations to other variables (e.g., convergent, discriminant, concurrent), response processes (e.g., think aloud protocols), and consequences (e.g., intended and unintended consequences of a particular measure). Relations to other variables validity evidence can be examined using various statistical approaches, such as through bivariate correlations, between-group comparisons, and predictive modeling (AERA, 1999). In the current study, the Standards framework was used to assess three sources of validity evidence: (1) test content (panel of experts and members in the community), (2) internal structure (item-total correlations), and (3) relations to other variables (bivariate correlations and independent samples t-tests). Reliability of the scores on the PABQ-VI was examined using two reliability estimates, McDonald's omega and Guttman spilt-half reliability.

METHOD

Item Generation and Content Validity Evidence

An inventory of PA barriers was generated by conducting a literature search and assembling a panel of content experts. Combinations of the terms 'physical activity', 'barriers', 'youth' and 'visual impairment' were used to search CINAHL, ERIC, Scopus, SPORTDiscus, Web of Science, and Google Scholar. The reference lists of retrieved studies were also searched. The barriers identified in the literature were analyzed by the first author and divided into three categories: personal, social, and environmental barriers. In line with SCT, the personal subscale included cognitive, affective, and physical barriers, while the social and environmental subscales included barriers in the social environment and physical/built environment, respectively. The categories of barriers were then submitted to a panel of Adapted Physical Activity (APA) experts for review (N=4). This panel included two Adapted Physical Education (APE) specialists, a professor of APE with expertise in the areas of VI and blindness, and an APA specialist with a strong background in the psychosocial aspects of disability

sport. If experts disagreed over the placement of a barrier into a category, the barrier was discussed until an agreement was reached. A statement was then constructed to address each barrier or group of barriers. For example, the statement "I like how my body looks and feels during physical activity" was constructed to address a group of personal barriers including a dislike of being hot and sticky and feeling embarrassed or self-conscious during PA.

The initial pool of 42 items were reviewed by the four panel experts as well as the members of the committee responsible for organizing the sports camp where the questionnaire was piloted. All reviewers were invited to make suggestions for improving item content and readability. Recommendations were made to reword or restructure certain items that appeared to belong to multiple subscales or were considered confusing. One reviewer recommended including an additional question (item 37) to address policy barriers. Recommendations were also made to minimize the negatively worded and reverse-scored items. Therefore, four reverse-scored items were retained because the reverse-scored version (e.g., "My parents worry about my safety when I do physical activity") was more appropriate than the negatively worded alternative ("My parents do not worry about my safety when I do physical activity"). Table 1 displays the initial pool of items and the changes made based on the feedback from the panel experts and committee members.

Table 1

Changes made to PABQ-VI items following the review process

Preliminary Item Stem	Changes Following Review Process
1. PA is important to me.	1. I believe PA is important.
2. I cannot be bothered to do PA.	2. I feel motivated to do PA.
3. I have enough time after homework or chores to do PA.	3. I think I have enough time after homework and chores to do PA.
4. I want to be more physically active, but I don't know what to do.	4. I know how to do PA if I want to.
5. I can't do PA because I am blind.	5. I believe I can do PA even though I have a VI.
7. I am confident to try new sports and PA.	7. I feel confident to try new sports and PA.
8. I do not like how my body looks or feels when I do PA.	8. I like how my body looks and feels when I do PA.
9. I am scared to get hurt when I play sports and do PA.	9. I'm scared to get hurt when I do PA.
10. I do not like to do sports or PA because they are not fun.	10. PA and sports are fun.
11. I get too tired when I do PA.	11. PA makes me very tired because I have a VI.
12. My vision impairment stops me from doing PA.	12. My vision impairment does not keep me from doing PA.
13. For the most part, my family has time to participate in PA with me.	13. My parents have time to do PA with me.
14. I do not have anyone at home to show me how to do PA.	14. My parents show me how to do PA.
15. For the most part, my family encourages me to do PA.	15. My parents encourage me to do PA.
16. My family can afford for me to participate in sport and PA.	16. My parents can afford for me to do sport and PA.
18. My parents believe that school is more important than sport and PA.	18. My parents believe that PA is just as important as school.

20. PA is important to my family.	20. PA is important to my parents.
21. There is no time to play sport or do PA because my siblings do sport and PA.	21. My parents have time to take me to sport even if my brothers or sisters also play sport*
22. My family has a way to get me to places where I can do sport or PA.	22. My parents have a way to get me to places to do sport or PA.
23. My classmates include me in games and PA during recess.	23. My classmates include me in games and PA during play time.
24. I know other children with VI who will do PA with me.	24. I know other children who will do PA with me.
25. Other kids make fun of me when I play sports or do PA.	25. Other kids have made fun of me during sports or PA.
26. My teachers expect me to participate in PA like everyone else.	26. My teachers expect me to do PA just like everyone else.
28. My teacher worries about my safety when I do PA.	28. My teacher worries about my safety when I do PA.
29. My PE teacher makes changes to games and PA so I can participate.	29. My PE teacher makes changes to games and activities so I can participate.
31. Other people do not think I can do PA because I am blind.	31. People in my community don't expect that I can do PA.
32. I know about opportunities to do PA in my community.	32. I know about opportunities to do PA outside of school.
33. There are no sport programs or PA available in my community.	33. There are sport programs or PA available in my community.
34. There are sighted guides or interpreters who can help me do PA if I need them.	34. There are sighted guides who can help me do PA in my community.
37. (Policy item not included in preliminary version).	37. Sports clubs in my community allow me to join even though I have a VI.
38. I have equipment (e.g.: balls, rollerblades, bike, etc.) that allow me to be active. outdoors.	38. I have sports equipment at home that I can use to be physically active.
39. There is a space at home that is safe for me to do PA.	39. There are spaces at home that are safe for me to do PA.
40. Even though I have a VI, I have to take part in PE class because it's a school rule.	40. I have to participate in PE class because it is a school rule.

Note: Items that were unchanged during the review process have not been included in this table. Physical activity (PA) and visual impairment (VI) are not abbreviated in the PABQ-VI.

A short, semi-structured interview was also conducted with a nine-year-old girl with a VI, recruited through the after-school sports program. Although the PABQ-VI was developed based on barriers identified by children, parents, and teachers in the literature, this session was used to gain feedback on the structure and delivery of the questionnaire. During this session, the participant demonstrated understanding of the items that were dictated and provided positive feedback about the large print version, as she preferred to read along. The resulting questionnaire contained 42 items, divided into personal (n=12), social (n=18) and environmental barriers (n=12). Items were rated on a 5-point Likert scale (1 = strongly agree to 5 = strongly disagree).

Participants

Participants included a convenience sample of 21 youth (female = 9, male= 12), aged 9 to 14 years (M = 11.095, SD = 1.61) who attended a sports camp for children with VI. All participants had a VI according to the WHO definition of VI (World Health Organization, 2013). Participants were categorized into low vision (n=16) or complete blindness (n=5).

Measures

Physical activity. The Godin Leisure Time Exercise Questionnaire (GLTEQ; Godin & Shephard, 1985) was used to assess youths' PA levels. Youth reported the number of times they participated in at least 15 minutes of mild, moderate, and strenuous exercise. Mild exercise was described as minimal effort, moderate exercise as not exhausting, and strenuous exercise as heart beats rapidly. Sample exercises of each intensity category were also provided to further assist youths' understanding. An overall PA score was calculated by summing the frequencies within each intensity category, multiplying these frequencies by their respective metabolic equivalents (3 for mild, 5 for moderate, and 9 for strenuous), and then summing the three intensity categories. The GLTEQ was used because it is brief, easy to administer, and has been used with similar aged minority children in past research (e.g., Martin, Shapiro, & Prokesova, 2013). Scores on this inventory have produced high reliability coefficients with similar samples (e.g., Martin, McCaughty, & Shen, 2008).

Barrier self-efficacy. Participants reported their level of confidence to overcome common PA barriers by responding to 8 items. These items have been commonly used to assess barrier self-efficacy among youth with disabilities (Martin et al., 2013). A sample item was, "How confident are you in participating in physical activity that makes you breathe hard or feel tired when you have a lot of homework to do." Items were rated on a 5-point scale (as opposed to a 7-point Likert scale; Martin et al., 2013) in order to be consistent with Likert-scale format of the PABQ-VI. Anchors were not at all confident (1) and very confident (5). Items were summed and divided by 8 to create an overall barrier self-efficacy (BSE) score.

Procedures

Upon receiving ethical approval, the PABQ-VI was piloted during a sports camp in Ireland in 2014. Trained camp counselors, who were paired one-on-one with campers throughout the week, dictated the PABQ-VI to their camper using identical scripts. Large print copies were provided to participants who wished to read along. Counselors and participants were also asked to make a note of any items that were difficult to understand.

Data Analysis

All data analyses were performed using IBM SPSS version 25. To assess internal structure validity evidence, item-total correlation (i.e., the correlation of each individual item with the overall subscale/test score without the respective item) and relations to other variables were used to assess validity evidence. Based on the item-total correlations, items were considered to be performing poorly if the item-total correlation was below 0.20 (Kline, 1986). To examine relations to other variables, bivariate correlations were conducted between each subscale of the PABQ-VI and the GLTEQ and BSE. Relations to other variables was also assessed using independent samples t-tests to investigate between-group differences for level of vision. Based on the central tenets of SCT, it was predicted that PABQ-IV scores would be inversely related to GLTEQ and BSE scores (bivariate correlations), and that youth with low vision would report fewer PA barriers than youth who were blind (independent samples t-tests). Reliability evidence of the PABQ-VI scores was assessed using two internal consistency coefficients: (1) McDonald's omega, and (2) Guttman split-half reliability. Coefficients greater than .70 were deemed acceptable.

RESULTS

Descriptive Statistics

Means, standard deviations, and ranges were calculated for the GLTEQ and the BSE scale. Overall, youth indicated moderate levels of PA (M=51.48, SD=29.20, range=90) and moderate levels of BSE (M=3.24, SD=0.77, range=3.25). The omega coefficient for the BSE scale was 0.61.

Internal Structure

Item-total correlations. Nine item-total correlations did not meet the accepted cutoff of 0.20 and were considered potential candidates for removal (see Table 2). Four of the nine items comprised the negatively worded items. The low item-total correlations suggested that the items were not sufficiently related to their respective subscale.

Table 2

Item-total correlations for PABQ-VI subscales

	Subscale/Item	Pearson's *r*	ω[a]
Personal Barriers			
1	I believe physical activity is important.	.77	.894
2	I feel motivated to do physical activity.	.74	.896
3*	I think I have enough time after homework and chores to do physical activity.	**.10**	.919
4	I know how to do physical activity if I want to.	.62	.901
5	I believe I can do physical activity even though I have a visual impairment.	.77	.895
6	Sport and physical activities are fun because I'm good at them.	.87	.889
7	I feel confident to try new sports and physical activities.	.62	.901
8	I like how my body looks and feels when I do physical activity.	.55	.906
9	I'm scared to get hurt when I do physical activity.	.40	.912
10	Physical activity and sports are fun.	.82	.892
11	Physical activity makes me very tired because I have a visual impairment.	.42	.912
12	My vision impairment does not keep me from doing physical activity.	.74	.897
Social Barriers			
13	My parents have time to do physical activity with me.	.48	.831
14	My parents show me how to do physical activity	.42	.840
15	My parents encourage me to do physical activity.	.82	.819
16	My parents can afford for me to do sport and physical activity.	.71	.826
17*	My parents expect me to do physical activity.	**.03**	.855
18	My parents believe that physical activity is just as important as school.	.21	.845
19*	My parents worry about my safety when I do physical activity.	**.04**	.855
20	Physical activity is important to my parents.	.71	.822
21	My parents have time to take me to sport even if my brothers or sisters also play sport.	.63	.826
22	My parents have a way to get me to places to do sport or physical activity.	.79	.818
23	My classmates include me in games and physical activities during play time.	.60	.828
24	I know other children who will do physical activity with me.	.60	.831

25*	Other kids have made fun of me during sports or physical activity.	**.16**	.850
26	My teachers expect me to do physical activity just like everyone else.	.29	.847
27	My PE teacher encourages me to do physical activity.	.66	.827
28*	My teacher worries about my safety when I do physical activity.	**.05**	.856
29*	My PE teacher makes changes to games and activities so I can participate.	**-.06**	.858
30	My PE teacher includes me in games and physical activities	.27	.846
	Environmental Barriers		
31*	People in my community don't expect that I can do physical activity.	**.06**	.818
32	I know about opportunities to do physical activity outside of school.	.41	.795
33	There are sport programs or physical activities available in my community.	.73	.759
34*	There are sighted guides who can help me do physical activity in my community.	**-.05**	.842
35	There are sports or activities that I can join which are close to home.	.69	.766
36	There are places in my community that are safe for me to do physical activity.	.73	.760
37	Sports clubs in my community allow me to join even though I have a visual impairment.	.75	.761
38	I have sports equipment at home that I can use to be physically active.	.61	.769
39	There are spaces at home that are safe for me to do physical activity.	.55	.779
40	I have to participate in PE class because it is a school rule.	.26	.807
41*	My school have physical activity equipment for people with visual impairment	**-.32**	.836
42	My school has sport teams and physical activity clubs that I can join if I want to.	.48	.785

Note. [a]Indicates internal consistency of remaining items if the elected item was deleted from the total score. Item-total correlations below 0.20 are in boldedface. *Items deleted based on low item-total correlations.

Relations to Other Variables

Bivariate correlations between the PABQ-VI and the GLTEQ and BSE scale are displayed in Table 4. The personal, social, and environmental subscale scores of the PABQ-VI had a moderately strong, negative relationship with PA levels (GLTEQ score). No significant correlations were found between the PABQ-VI subscale scores and BSE scores. Results of the independent samples *t*-tests revealed that youth with low vision reported fewer PA barriers (M=84.88) than youth who were blind (M=112.00), $t(19) = -2.65$, p=.016.

Table 4

Descriptive Statistics and Internal Consistency Estimates for the PABQ-VI

Variable	M (SD)	ω	Guttman
PABQ-VI	91.33 (22.81)		
Personal	2.01 (.72)	.912	.960
Social	2.25 (.57)	.845	.955
Environmental	2.23 (.62)	.802	.917

Reliability Evidence

Omega coefficients for the personal (□= .912), social (□= .845), and environmental (□= .802) subscale scores provided strong reliability evidence. The Guttman spilt-half coefficients (.917-.960) also indicated strong reliability evidence of the PABQ-VI subscale scores. Descriptive statistics and internal consistency estimates (omega and spilt-half) for the PABQ-VI are displayed in Table 3.

Table 3

Bivariate Correlations Between PABQ-VI

Variable	Personal	Social	Environmental	GLTEQ	BES
PABQ-VI					
Personal	-				
Social	.58**	-			
Environmental	.69**	.66**	-		
GLTEQ	-.47*	-.47*	-.63**	-	
BES	.09	-.13	-.15	-.04	-

Note. **p < .01, *p < .05. GLTEQ = Godin's leisure time exercise questionnaire, BES = barrier self-efficacy.

DISCUSSION and CONCLUSION

In the current study we used SCT as a guiding framework to develop the PABQ-VI. We also assessed the validity and reliability of scores obtained on the PABQ-VI. The *Standards* framework was used to assess three sources of validity evidence: *test content, internal structure,* and *relations to other variables*. A panel of experts were used to assess *test content* validity evidence. This phase resulted in an initial 42-item questionnaire assessing three categories of barriers, namely, personal, social, and environmental. Item-total correlations were used to assess *internal structure* validity evidence, and revealed a total of nine items that did not meet the item-total correlation cut-off criteria. Bivariate correlations and independent samples *t*-tests were used to assess *relations to other variables* (i.e., convergent) validity evidence. These results indicated that (a) the personal, social, and environmental subscale scores of the PABQ-VI had moderately strong, negative relationships with PA levels (GLTEQ score), but not with BES scores, and (b) youth with low vision reported fewer PA barriers than youth who were blind.

The majority of items of the PABQ-VI correlated with their intended subscale. However, item-total correlations revealed that nine items did not meet the cut-off criteria, four of which were the reverse-

scored items. Future researchers should consider examining the internal structure of the PABQ-VI using factor analyses. Based on SCT-based perspectives, PA barriers that are related to personal and environmental factors likely interact to influence PA behavior, rather than operating exclusively (Ramirez, Kulinna, & Cothran, 2012). For example, the item, "Physical activity and sports are fun", addresses the lack of enjoyment of PA barrier. Although 'enjoyment' is very much related to the person, level of enjoyment might be contingent on social or environmental factors, such as having friends to be active with (Lieberman, Ponchillia, & Ponchillia, 2013).

Scores on the PABQ-VI were negatively correlated with PA levels, but not with BSE scores. This finding may reflect that for this sample, the experience of PA barriers is unrelated to youths' efficacy for overcoming a different set of barriers included in the BSE scale. For example, if a child indicated high SE for exercising in situations where their parents demand more time of them (item 3, BSE scale), this does not mean that the same child has high SE for overcoming barriers not included in the BSE scale, but are addressed in the PABQ-VI, such as a lack of transport. Moreover, it should be noted that parent-related barriers (e.g. over-protective parents) and environmental barriers (e.g. inaccessible facilities) were cited as major barriers to participation for youth with VI (Perkins et al., 2013; Stuart et al., 2006). Unlike controllable personal barriers, such as motivation or time management skills, the ability to exercise in the face of external barriers is likely beyond the child's control. For example, even if a child enjoys PA and has high SE for exercising in situations where the locus of control is internal, (e.g. when they are feeling sad), they may be restricted by situations where the locus of control is external (e.g. an overprotective parent). Additionally, items 1, 4 and 5 (personal barriers) were the top-three highest scoring items for our sample. This means that our participants recognize PA as important (item 1); believe they can be active regardless of their VI (item 5) and are aware of ways to do PA (item 4). Item 5 was the absolute highest scoring item, with 71.4% of participants responding with "strongly agree". This may reflect that children with VI do not consider their VI as a major barrier to PA, but perceive other factors as most limiting (Greguol et al., 2015; Perkins et al., 2013). In support of the latter theory, our participants were limited by social and environmental factors such as a lack of sighted guides (item 34), parent's concerns for safety (item 19), PE teacher's ability/willingness to adapt activities (item 29) and a lack of specialized PA equipment at school (item 41). Again, this is consistent with existing barrier research that has identified parent, peer and teacher-related barriers as well as policy and environmental barriers as pertinent to children with VI (Greguol et al., 2015; Stuart et al., 2006). Collectively, these findings provide good evidence of validity in support of the PABQ-VI.

The most obvious limitation to our study was the small sample size. Future researchers should aim to recruit larger samples to allow more comprehensive analyses. Another limitation was that cohorts were recruited from sports camps, meaning that youth might have had more access to PA opportunities compared to other youth with VI. A greater diversity of participants would be beneficial in the future to test the generalizability of results. Furthermore, the GLTEQ was used to estimate PA levels. Subjective,

self-report scales have inherent risks of under or overestimating actual PA levels. Because wearable PA devices (e.g., pedometers) provide more reliable estimates of PA, researchers should consider investigating relationships between PA barriers and participation using such devices. Finally, test-retest reliability was not investigated in the current study due to issues with feasibility and participant burden. Hence test re-test analysis should be conducted. Researchers who wish to apply the questionnaire in its preliminary form should be aware of these limitations, interpret results with caution, and seek to address these in future studies. Despite the aforementioned weaknesses, the PABQ-VI shows strong potential to identify multiple (personal, social, and environmental) PA barriers among children with VI. Based on the results, it can be concluded that the PABQ-VI demonstrates preliminary validity and reliability evidence. For example, that the scores of the PABQ-VI differed between youth with low vision and youth who were blind provide some support for relations to other variables validity evidence.

Hubley and Zumbo (2011) describe validation as an ongoing process that involves presenting various types of evidence to help inform overall judgment. Further, they emphasize that validity is more about the interpretation and consequences of the test scores, rather than a property of the measure itself (Hubley & Zumbo, 2011). To this end, it is important to acknowledge the sample and contexts in which the PABQ-VI will be used, to ensure that the scale measures the intended construct (PA barriers), and produces scores that are relevant to the population it was designed for (youth with VI). For example, the decision to use the PABQ-VI as a unidimensional or a multidimensional (three subscales) scale depends on researchers' goals as well as the context. For example, analyzing data as three separate subscales might be useful when interpreting and comparing data across different groups, particularly if the goal is to identify clusters of barriers that children perceive as being most limiting. On the other hand, a single barrier score might be appropriate to track general changes in perceived barriers before and after an intervention. The inclusion of an open question at the end of the PABQ-VI allows users to identify additional barriers that may be perceived by an individual child, which could be useful to inform PA program development.

Perspective

We developed the PABQ-VI, assessing personal, social, and environmental barriers. Statistical analyses provided good internal structure validity evidence, convergent validity evidence, and reliability evidence of the PABQ-VI. These findings, although preliminary, provide a starting point for continued research in this area. The development and intended purpose of the PABQ-VI is to assist researchers to quickly identify PA barriers that limit youth with VI and to help inform the design of future PA interventions. Future efforts to validate the PABQ-VI for this purpose will focus on recruiting sufficient participant numbers to investigate the three-factor structure.

References

American Educational Research Association (AERA), American Psychological Association (APA), & National Council on Measurement in Education (NCME). (1999). Standards for educational and psychological testing. Washington, DC: American Educational Research Association.

Augestad, L., & Jiang, L. (2015). Physical activity, physical fitness, and body composition among children and young adults with visual impairments: A systematic review. *Brittish Journal of Visual Impairment, 33*(3), 167-182.

Bandura, A. (1997). *Self-efficacy: The efficacy of control*. New York: W. H. Freeman & Company.

Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review Psychology, 52*, 1–26.

Cervantes, C. M., & Porretta, D. L. (2013). Impact of after school programming on physical activity among adolescents with visual impairments. *Adapted Physical Activity Quarterly, 30*, 127–146.

Godin, G., & Shephard, R. J. (1985). A simple method to assess exercise behavior in the community. *Canadian Journal of Applied Sport Sciences, 10*, 141-146.

Greguol, M., Gobbi, E., & Carraro, A. (2015). Physical Activity Practice Among Children and Adolescents with Visual Impairment - Influence of Parental Support and Percieved Barriers. *Disability and Rehabilitation, 37*, 327-330. doi:10.3109/09638288.2014.918194

Haegele, J., Brian, A., & Lieberman, L. (2017). Social cognitive theory determinants of physical activity in adults with visual impairments. *Journal of Developmental and Physical Disabilities, 29,* 911-923. doi:10.1007/s10882-017-9562-0

Haegele J., Kirk, N., & Zhu, X. (2018). Self-efficacy and physical activity among adults with visual impairments. *Disability and Health Journal, 11,* 324-329. doi:10.1016/j.dhjo.2017.10.012

Haegele, J., & Porretta, D. (2015). Physical activity and school-age individuals with visual impairments: a literature review. *Adapted Physical Activity Quarterly, 32*, 68-82. doi:10.1123/apaq.2013-0110

Hubley, A. M., & Zumbo, B. D. (2011). Validity and consequences of test interpretation and use. *Social Indicators Research*, *103*, 219-230. doi:10.1007/s11205-011-9843-4

Jaarsma, E., Dekker, R., Koopmans, S., Dijkstra, P., & Geertzen, J. (2014). Barriers to and facilitators of sports participation in people with visual impairments. *Adapted Physical Activity Quarterly, 31*, 240-264. doi:10.1111/sms.12218

Jaarsma, E. A., Geertzen, J. H., de Jong, R., Dijkstra. P. U., & Dekker, R. (2013). Barriers and facilitators of sports in Dutch Paralympic athletes: An explorative study. *Scandinavian Journal of Medicine & Science in Sports, 24,* 830-836. doi:10.1111/ sms.12071

Kline, P. (1986). *A handbook of test construction: Introduction to psychometric design*. London: Methuen.

Lee, M., Zhu, W., Ackley-Holbrook, E., Brower, D., & McMurray, B. (2014). Calibration and validation of the Physical Activity Barrier Scale for persons who are blind or visually impaired. *Disability and Health Journal*, 309-317.

Longmuir, P., & Bar-Or, O. (2000). Factors influencing the physical activity levels of youths with physical and sensory disabilities. *Adapted Physical Activity Quarterly, 17,* 40–53.

Lieberman, L. J., Houston-Wilson, C., & Kozub, F. M. (2002). Perceived barriers to including students with visual impairments in general physical education. *Adapted Physical Activity Quarterly, 19,* 364-377.

Lieberman, L., Ponchillia, P., & Ponchillia, S. (2013). *Physical Education for People with Visual Impairments and Deafblindness: Foundations of Instruction.* New York: AFB.

Martin, J. J., McCaughtry, N., & Shen, B. (2008). Predicting physical activity in Arab-American children. *Journal of Teaching Physical Education, 27*, 205-219.

Martin, J., Shapiro, D., & Prokesova, E. (2013). Predictors of physical activity among Czech and American children with hearing impairment. *European Journal of Adapted Physical Activity, 6*, 38-47.

Messick, S. (1989). Validity. In R. L. Linn (Ed.), *Educational measurement*, 3rd ed. (pp. 13-103). New York: Macmillan.

Perkins, K., Columna, L., Lieberman, L., & Bailey, J. (2013). Parents' perceptions of physical activity for their children with visual impairments. *Journal of Visual Impairment & Blindness, 107* (2), 131-142.

Ramirez, E., Kulinna, P., & Cothran, D. (2012). Constructs of physical activity behaviour in children: the usefulness of social cognitive theory. *Psychology of Sport and Exercise, 13*, 303-310. doi: 10.1016/j.psychsport.2011.11.007

Shields, N., Synnot, A., & Barr, M. (2012). Perceived barriers and facilitators to physical activity for children with disability: A systematic review. *British Journal of Sports Medicine, 46*, 989-997. doi: 10.1136/bjsports-2012-090236

Stuart, M. E., Lieberman, L.J., & Hand, K. E. (2006). Beliefs about physical activity among children who are visually impaired and their parents. *Journal of Visual Impairment & Blindness, 100*, 223-234.

World Health Organization. (2013). Visual impairment and blindness. *Media centre.* Retrieved from: http://www.who.int/mediacentre/factsheets/fs282/en/