

Development of Questionnaires to Measure Psychosocial Influences on Children's Physical Activity¹

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Background. The purpose of this study was to develop and validate questionnaires used to measure psychosocial determinants of physical activity in pre-adolescent children.

Methods. Three theory-based questionnaires and a measure of after-school physical activity were administered to 422 fifth-grade students. A cross-validation design was employed for psychometric development of the scales, including factor analysis, reliability, and validation by correlating scale scores with intention to be physically active and after-school physical activity.

Results. The Social Influences scale contained a single factor. The Self-Efficacy scale contained three factors: support seeking, barriers, and positive alternatives. The Beliefs scale contained two factors: social outcomes and physical activity outcomes. Reliability coefficients ranged from about 0.50 to 0.78. Significant correlations were obtained between all six scales and intention in the development sample, and between five scales and intention in the validation sample. Significant correlations were obtained between social influence and self-efficacy barriers and physical activity in the development sample, and between social influences and physical activity in the validation sample.

Conclusions. Three scales to measure psychosocial determinants of physical activity were refined for use with rural, predominantly African-American, preadolescent children, and shown to be both reliable and valid. Factor analysis resulted in interpretable subscales that may be used as variables. These preliminary results provide support for using the scales to measure influences on activity in children. © 1997 Academic Press

Key Words: physical activity; psychosocial determinants; children; questionnaires; self efficacy; social influences; beliefs; intentions.

INTRODUCTION

Among adults physical inactivity contributes to increased risk for several chronic diseases, including coronary heart disease [1], hypertension [2], non-insulin-dependent diabetes [3,4], osteoporosis [5], obesity [6], and certain cancers [7]. Among youth the link between physical activity and health is not as well understood. However, physically active youth, compared with their less active counterparts, have more favorable cardiovascular disease risk factors, including blood lipids [8], fitness [9], obesity [10], body fat [11], and resting blood pressure [12]. Regular participation in physical activity or sport also appears to be associated with less substance abuse [13] and positive feelings toward school [14].

Youth are the most active segment of the U.S. population [15]. Yet, many youth are not as active as recommended by experts. In the 1990 National Youth Risk Behavior Survey, 25% of the girls and 50% of the boys reported participation in vigorous exercise three or more times per week [16]. Much more time is spent watching television, with 70% reporting watching television for more than 1 hr on a typical school day and approximately 40% watching 3 hr or more per day [16].

The literature on determinants of physical activity behavior among adults indicates that sedentary persons, compared with active persons, are more likely to be older, female, less educated, smokers, and overweight [17]. Family support, peer support, enjoyment of activity, perceived barriers to activity, and confidence in ability to be active appear to be important influences on physical activity among adults [17]. Among youth the determinants of physical activity behavior are less well understood. Factors that appear to be associated with physical activity among children and youth are hereditary factors [18], peer support [19], parental activity and support [20-22], personal physical fitness [9], time spent out of doors [18], and self-efficacy [19,22].

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One approach to promoting lifelong physical activity is to use theory-based research to determine influences on physical activity behavior. The failure of many adult physical activity promotion efforts may be due to the lack of identification of psychosocial determinants of physical activity, resulting in inappropriate program content and strategies [23]. Two prominent theoretical models used in physical activity/exercise determinants research among adults are the theory of reasoned action [24] and social cognitive theory, especially perceived self-efficacy [25]. Perceived self-efficacy, or confidence in one's ability to be successful at being physically active, is a correlate of physical activity among both adults and youth [17,19,22,26].

The theory of reasoned action and social cognitive theory have also been used to study determinants of physical activity among adolescents [19,27,28]. However, there are few theoretically derived tools to measure determinants of physical activity among pre-adolescent children reported in the literature [29]. Preadolescence marks the beginning of a critical developmental and transitional stage. During this transition into adolescence, many youth become sedentary [30]. A better understanding of psychosocial influences on physical activity during this period could assist efforts in school and community settings to promote lifelong physical activity. The purpose of this study was to develop and validate questionnaires used to measure psychosocial determinants of physical activity among fifth-grade children and to examine the relationships between these variables and intention to be physically active and current self-reported physical activity.

METHODS

Participants / Setting

All 558 fifth-grade students in two rural counties of South Carolina (composed of students from six schools in 23 classes) were invited to participate in the study. Approximately 76% of the population, or 422 students, participated with a racial breakdown of 69% African-American and 27% Euro-American (4% unknown), and 49% being male. Sixty-five percent were eligible for free or reduced lunch. An informed consent from parent or guardian was obtained for each participant.

Questionnaire Development and Pilot Testing

The theory of reasoned action and social cognitive theory provided the theoretical foundations for the instruments developed in this study. First, instruments previously used and tested with adolescents and adults were identified. The Beliefs scale was taken from the "beliefs about consequences of participating in" physical activity from the "attitude toward the behavior" component of the theory of reasoned action [24]. This component also corresponds to the "outcome expecta-

tions" component of social cognitive theory [25]. The Self-Efficacy scale, taken from social cognitive theory [25], includes confidence in overcoming barriers to physical activity in children [22]. The Social Influences scale included items addressing perceived expectations of others from the theory of reasoned action [24], as well as social modeling from social cognitive theory [25]. The sources of the original instruments, primary concepts being measured, and sample items of final instruments are presented in Table 1.

The original instruments went through a series of four pilot tests conducted in a classroom setting with fifth-grade students demographically similar to the study population. The initial pilot test indicated that the fifth-grade children had difficulty with understanding the 5-point scales, wording of some items, and administration length. Changes made to the original instruments during the first pilot test included selecting age-appropriate words, simplifying rating scales (from 5-point to 2-point scales), and putting instruments in a visually more appealing format (larger print, wider margins). Although the reduction from a 5-point to a dichotomous (Yes or No) scale sacrifices variance, such modifications may be necessary to obtain meaningful self-report data from preadolescents [33]. The subsequent three pilot tests refined and reduced the size of the instruments by eliminating items that children did not understand. Administration time of the final instrument was about 35 min.

Data Collection

The determinants instruments (Social Influences, Self-Efficacy, and Beliefs) and the Intention (to be physically active) scale were administered as part of a battery of questionnaires to classroom groups of about 24 students each. The questionnaire administrator read the instructions and questionnaire items to the class using a standardized script. The script included an introduction in which physical activity was defined as "any active games, active play, sports, or exercise that gets you moving, breathing faster, and your heart beating faster." This introduction was accompanied by poster pictures illustrating the range of possible physical activities (e.g., dancing, swimming, playing on playground, biking, cheerleading, walking, sports). An assistant moved about the room during questionnaire administration to answer questions and check for students having problems. The questionnaires were administered during the first class period of the day while the teacher remained in the classroom. The test-retest reliability data were collected 1 year after data collection for questionnaire development with a subset of the same sample ($n = 57$). The test-retest questionnaires were administered with the same protocol 1 week apart.

After-school physical activity was assessed using the

TABLE 1
Items for Measuring Psychosocial Determinants of Behavior

Scale	Theory	Source	Concept/sample items
Self-efficacy: Confidence in ability to be physically active ^a	Social cognitive theory	Reynolds <i>et al.</i> [19]; Sallis <i>et al.</i> [22]	I think I can: <ul style="list-style-type: none"> ● Be physically active no matter how tired I feel. ● Be physically active even if I have a lot of homework. ● Ask my parent or other adult to take me to a physical activity or sport. ● Be physically active most days after school. (17 items total)
Social influences: Influence of family and friends on physical activity ^a	Theory of reasoned action; social cognitive theory	Reynolds <i>et al.</i> [19]; Sallis <i>et al.</i> [31]	A friend/someone in my family: <ul style="list-style-type: none"> ● Thinks I should be physically active. ● Encourages me to be physically active. ● Has been physically active with me. (8 items total)
Beliefs: Beliefs about consequences of being physically active ^a	Theory of reasoned action; social cognitive theory	Saunders [32]	If I were to be physically active most days it would: <ul style="list-style-type: none"> ● Get or keep me in shape. ● Make me tired. ● Be fun. ● Be boring. (16 items total)
Intention: Intention to be physically active	Theory of reasoned action	Godin and Shephard [27]	Select one: During my free time on most days: <ul style="list-style-type: none"> ● I am sure I <i>will not</i> be physically active. ● I <i>probably will not</i> be physically active. ● I <i>may or may not</i> be physically active. ● I <i>probably will</i> be physically active. ● I am sure I <i>will</i> be physically active.

^a Measured on dichotomous scale (Yes or No).

previous day physical activity recall (PDPAR), a self-report standardized form with 30-min blocks beginning at 3:00 PM and continuing through 11:30 PM. Students completed the PDPAR for 3 consecutive days in the classroom under the guidance of trained questionnaire administrators. For each block the student selected the primary activity in which he or she participated from a list and rated the intensity of each selected activity. The PDPAR blocks are converted to METS based on level of intensity. After-school physical activity was defined as the number of PDPAR blocks with intensity greater than or equal to four METS. PDPAR has established validity based on concurrent observation with both motion sensors ($r = 0.77$) and heart rate monitors ($r = 0.63$) and established test-retest reliability ($r = 0.98$) with adolescents grades 7–12 [34].

Intention to be physically active was measured by participant selection of one of five sentences indicating

intention to be physically active on most days, with responses coded from 1 (“sure I will not be active”) to 5 (“sure I will be active”) (see Table 1).

Analysis

A cross-validation design was used in which the sample ($n = 421$) was randomly split into two subsamples consisting of 80% ($n = 336$; 171 males and 165 females) and 20% ($n = 85$) of the total sample. Data from the 80% sample were used in psychometric development of the scales. Factor analysis was employed to group these dichotomous items into scales [35]. All factor analyses employed principal components with varimax rotation. Analysis of Eigenvalues in the scree plot was used to help determine the number of factors to retain in a given instrument [36]. If more than 1 factor emerged, factor analyses forcing 1, 2, and 3 factors

were conducted for further assessment of fit. An item was assigned to a factor when its loading was at least 0.35 and it had no loadings at 0.30 or higher on another factor. Scale scores were created by summing the scores of items forming that factor.

Cronbach's α was employed to assess internal consistency [37]. The 20% sample was then used to reassess reliability and validity by correlating the factor scores with intention to be physically active and current self-reported after-school moderate and vigorous physical activity. Test-retest reliability was determined using Pearson correlations.

RESULTS

Factor Analysis

Social Influences. The Social Influences scale contained 8 items. A single factor emerged from this analysis. All items loaded at least 0.40 on the scale (see Table 2). The internal consistency reliability was 0.75 in the development sample ($n = 319$) and 0.72 in the validation sample ($n = 82$). The test-retest correlation coefficient was 0.78.

Self-Efficacy. This scale contained 17 items. Three factors emerged from this analysis: support seeking, barriers, and positive alternatives. All items loaded at least 0.35 (Table 3).

The internal consistency reliabilities for the support seeking, barriers, and positive alternatives scales were 0.71 ($n = 319$), 0.71 ($n = 323$), and 0.54 ($n = 321$), respectively. In the validation sample, the α 's were 0.52, 0.55, and 0.62, respectively. The test-retest reliability for the scales were 0.76, 0.82, and 0.61, respectively. The support seeking and barriers scale scores correlated weakly but significantly at 0.25; the support

TABLE 2

Principal Component Factor Analysis Using Varimax Rotation for the Social Influences Scale

	Factor 1
A friend has offered to be physically active with me in the past 2 weeks.	0.71
A friend has been physically active with me in the past 2 weeks.	0.70
Someone in my family has been physically active with me in the past 2 weeks.	0.63
Someone in my family has offered to be physically active with me in the past 2 weeks.	0.62
A friend has encouraged me to be physically active in the past 2 weeks.	0.62
My friends think I should be physically active.	0.57
Someone in my family has encouraged me to be physically active in the past 2 weeks.	0.56
My family thinks I should be physically active.	0.41
Eigenvalue	2.97
Percentage variance explained	37.17%

Note. $N = 160$ males plus 159 females = 319.

TABLE 3

Principal Component Factor Analysis, Using Varimax Rotation with Self Efficacy Items

	Factor 1 support seeking	Factor 2 barriers	Factor 3 positive alternatives
I think I can ask my parent or other adult to sign me up for a sport, dance, or other physical activity.	0.67	0.06	-0.11
I think I can ask my parent or other adult to take me to a physical activity or sport practice.	0.66	0.16	-0.18
I think I can ask my best friend to be physically active with me.	0.60	-0.08	0.34
I think I can ask my parents or other adult to do physically active things with me.	0.53	-0.08	0.38
I think I can ask my parent or other adult to get me the equipment I need to be physically active.	0.52	-0.01	0.17
I think I have the skills I need to be physically active.	0.46	0.15	0.07
I think I can be physically active most days after school.	0.40	0.31	0.29
I think I can be physically active no matter how busy my day is.	0.03	0.73	0.12
I think I can be physically active no matter how tired I may feel.	0.07	0.72	0.10
I think I can be physically active even if it is hot or cold outside.	0.19	0.70	0.00
I think I can be physically active, even if I have a lot of homework.	-0.07	0.61	0.31
I think I can be physically active after school even if I could watch TV or play video games instead.	-0.10	-0.17	0.56
I think I can be physically active even if I have to stay at home.	-0.02	0.17	0.54
I think I can be physically active even when I'd rather be doing something else.	0.14	0.33	0.53

TABLE 3—Continued

	Factor 1 support seeking	Factor 2 barriers	Factor 3 positive alternatives
I think I can be physically active even if my friends don't want me to.	0.14	0.24	0.52
I think I can be physically active after school even if my friends want me to do something else.	0.25	0.21	0.44
I think I can be physically active at least three times a week for the next 2 weeks.	0.24	0.11	0.36
Eigenvalues	3.64	1.80	1.32
Percentage variance explained	21.43	10.58	7.77

Note. *N* = 159 males plus 158 females = 317.

seeking and positive alternatives scales correlated significantly at 0.41; the barriers and positive alternatives scales correlated significantly at 0.38.

Beliefs. This instrument contained 16 items. While 3 factors emerged from the scree plot analysis, the 2-factor solution was selected because the 3-factor solution had several items with multiple loadings, and the 2-factor solution was more readily interpretable. The 2 factors were labeled social outcomes and physical outcomes (see Table 4).

The internal consistency reliabilities for the physical outcomes and social outcomes scales were 0.75 (*n* = 315) and 0.58 (*n* = 318), respectively. For the validation sample (*n* = 82), the α 's were 0.46 and 0.51, respectively. The test-retest correlation coefficients were 0.51 and 0.69, respectively. The two scale scores correlated weakly but significantly at 0.27.

Relationships among Psychosocial Variables, Intention, and Behavior

In the development sample the scores for all six scales were significantly correlated with Intention to be physically active (Table 5). Social Influence and Self-Efficacy barriers were correlated significantly, though not highly, with after-school physical activity. In the validation sample, all scales except the Belief social outcomes scale were significantly correlated with Intention to be physically active. The Social Influences scale correlated significantly with self-reported previous day physical activity in the validation sample.

DISCUSSION

Three scales to measure psychosocial determinants of physical activity were identified and refined for use

TABLE 4

Principal Component Factor Analysis, Using Varimax Rotation with Belief Items		
	Factor 1 physical outcomes	Factor 2 social outcomes
If I were to be physically active most days . . .		
. . . it would get or keep me in shape.	0.76	0.08
. . . it would be boring. No ^a	0.66	0.06
. . . it would make me better in sports.	0.63	0.22
. . . it would be fun.	0.62	0.23
. . . it would help me be healthy.	0.62	-0.08
. . . it would make me get hurt. No ^a	0.50	0.02
. . . it would help me control my weight.	0.50	0.21
. . . it would make me embarrassed in front of others. No ^a	0.48	-0.17
. . . it would give me energy.	0.45	0.14
. . . it would make me tired. No ^a	0.40	0.13
. . . it would cause pain and muscle soreness. No ^a	0.35	0.13
. . . it would help me make new friends.	0.03	0.76
. . . it would help me spend more time with my friends.	0.01	0.67
. . . it would help me look good to others.	0.16	0.61
. . . it would make me more attractive to the opposite sex.	0.05	0.52
. . . it would help me work out my anger.	0.15	0.37
Eigenvalues	3.77	1.73
Percentage variance explained	23.57%	10.84%

Note. *N* = 155 males plus 157 females = 312.

^a Reverse coded.

with preadolescent children. The Social Influences and Self-Efficacy barriers scales correlate significantly with both intention and physical activity, while the Self-Efficacy support-seeking, Self-Efficacy positive alternatives, and Beliefs scales correlate significantly with intention to be physically active.

Reliability

The internal consistency reliabilities for the Social Influences, Self-Efficacy support-seeking and barriers scales, and Beliefs physical outcomes scale were above 0.70 in the development sample. For the Social Influences and Self-Efficacy support-seeking and barriers scales the test-retest correlation coefficients ranged were also above 0.70 in the development sample. These levels are considered adequate [38]. The internal consistency reliability and test-retest correlation coefficients were somewhat lower for the Self-Efficacy positive alternatives and the Beliefs social outcomes scales.

For the Self-Efficacy scales the internal consistency reliabilities obtained in this study were lower than those in previous reports [19]. The Cronbach's α for

TABLE 5

Correlations between Factor Scores and Intention to Be Physically Active and Selected Measure of Self-Reported Physical Activity for Development and Validation Samples

Instrument	Correlation coefficients			
	Developmental sample (<i>n</i> = 336)		Validation sample (<i>n</i> = 82)	
	Intention	PDPAR ^a	Intention	PDPAR ^a
Social Influences	0.33***	0.13*	0.32**	0.20*
Self-Efficacy				
Support seeking	0.30***	0.09	0.32**	0.15
Barriers	0.39***	0.20***	0.36**	0.14
Positive alternatives	0.29***	0.08	0.31**	-0.03
Beliefs				
Physical activity outcomes	0.27***	0.09	0.27*	-0.02
Social outcomes	0.17**	0.09	0.20	0.15

^a Previous day physical activity recall.

* *P* < 0.05.

** *P* < 0.01.

*** *P* < 0.001.

each Belief scale was lower than reported in previous work [32]. However, the prior work used the theory of reasoned action with protocols developed by Ajzen and Fishbein [24] with adults, while this study used a modified approach more appropriate for children. Test-retest reliabilities were also lower than those obtained in previous work with older children that included beliefs about outcomes and evaluation of outcomes [27]. The test-retest reliability of intention to be physically active (0.63) was adequate, though not high. This is lower than test-retest reliability reported in prior work with older children [27]. It must also be noted that the test-retest study was conducted 1 year after the initial data collection, when the children were in the sixth grade.

Correlations with Intention and Physical Activity

The Social Influences scale had significant, though somewhat low, correlations with intention to be physically active and with moderate to vigorous after-school physical activity in the development and validation samples, providing some evidence of construct validity. These results are consistent with the findings of previous studies [19,22,27]. Previous studies have shown parents and peers to be significant influences on physical activity in children and adolescents [19-21,39]. Because a single scale measured influences from family and peers, it is not possible to assess the influences of family versus peers separately. In the preadolescent age group family and peer influences may be comparable; Godin and Shephard [39] reported a shift in strength from parent to peer in normative expectations

and motivations to comply as children progressed from grades 7 to 9.

Despite some scale weaknesses, the 3-factor solution for the Self-Efficacy scale was selected because of the important conceptual distinction between barriers to physical activity and positive alternatives to physical activity. Most barriers items originated from adult model scales, while the positive alternatives items were largely specific to youth. All three Self-Efficacy scales significantly correlated with Intention, but only the barriers scale correlated with after-school physical activity in the development sample. Correlations obtained between self-efficacy and intention were similar to and correlations between self-efficacy and behavior were lower than those obtained in earlier reports [19]. Although the association is stronger for intention than physical activity in this study, intention to be physically active has been shown to be associated with or predictive of physical activity in adolescents [19,27,28]. Both Beliefs scales had significant though low correlations with intention, which is consistent with prior work, although the correlation between beliefs and behavior are not statistically significant and are lower than those reported previously [27].

Limitations

The relationships between physical activity and the psychosocial variables were stronger in the larger development sample than in the validation sample. Because of the comprehension level of study participants, the rating scales in the psychosocial instruments were dichotomous (yes or no) rather than the more usual 3- to 5-point scales. This restriction in variability of responses may make it more difficult to detect relationships between the psychosocial variables and behavior. All information was self-reported, including intention and after-school physical activity.

CONCLUSIONS

Three psychosocial scales to assess determinants of physical activity behavior of rural, preadolescent, and predominantly African-American children were developed and validated in this cross-sectional study. Factor analysis resulted in interpretable subscales that may be used as variables. Internal consistency and test-retest reliabilities were adequate for most scales, though the Beliefs scales may require further development with this population. The reliabilities obtained with these scales are comparable with reliabilities obtained in scales to measure psychosocial correlates for dietary behavior in similarly aged children [40,41]. Results of this cross-sectional study are preliminary but provide support for the use of Social Influences, Self-Efficacy, and Beliefs scales to measure psychosocial determinants of physical activity in preadolescent children.

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