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Measuring Self-Efficacy: Development of the Physical Activity Assessment Inventory

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Abstract

Self-efficacy focuses on an individual's self-assessment of his or her ability to perform a particular behavior. Existing self-efficacy scales for physical activity address exercise, a subset of physical activity. The Physical Activity Assessment Inventory (PAAI) scale was developed to specifically address the broader paradigm of self-efficacy for physical activity, which includes all structured and unstructured energy expenditure. The purpose of this article is to describe the development and evaluation of the PAAI. Initial psychometric testing was conducted with a sample of 219 women. A second study of 73 women with breast cancer and 55 women without cancer confirmed reliability and validity

Keywords: Self-efficacy; physical activity; research instruments

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Introduction

The concept of self-efficacy, a key component within Social Cognitive theory,[1] has been widely used in social sciences and health-related research to predict behavior. Self-efficacy has been linked to smoking patterns,[2,3] alcohol consumption,[4] exercise,[5] and nutrition.[6] Self-efficacy has also been associated with coping[7-9] and quality of life.[10] Researchers have consistently reported a positive relationship between self-efficacy and health behavior maintenance and change.[11]

Self-efficacy refers to “beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments”.[12p3] Self-efficacy focuses on an individual’s self-assessment of his or her ability to perform a particular behavior, such as exercise or not smoking. Self-efficacy is not a general personality trait, but rather specific to a particular behavior. It is quite possible to have a low self-efficacy for walking two miles a day, three times a week and yet, at the same time, have a high self-efficacy for not smoking. Most studies of self-efficacy and physical activity have focused on exercise, a subset of physical activity. Fewer researchers have considered the broader paradigm of physical activity. Even though physical activity is distinctly different from aerobic exercise, researchers have often used a self-efficacy scale designed for exercise rather than physical activity.[13] The purpose of this article is to describe the development and initial testing of the Physical Activity Assessment Inventory (PAAI, Appendix A), a self-efficacy scale developed specifically for physical activity in women receiving treatment for cancer.

Measuring Self-Efficacy

Bandura[12] identified four principle sources of information that influence self-efficacy: enactive mastery experiences; vicarious experiences; verbal persuasion; and physiological and affective states. Enactive mastery experiences refer to one’s personal experiences and are considered the most dependable source of efficacy expectations, serving as indicators of capability. Vicarious experiences refer to those instances where one observes others successfully performing a threatening activity and becomes persuaded of his or her own ability to perform it. Verbal persuasion, which is used to influence others’ efficacy expectation that they possess certain capabilities, is not likely to be effective over a long period

of time, unless successful personal experiences reinforce the persuasion. The fourth source of information about one's self-efficacy are physiologic and affective states from which persons partially judge their capability, strength, and vulnerability to dysfunction. Physiologic and affective states can particularly influence efficacy expectations in threatening situations and the behaviors necessary to respond to specific situations. According to Bandura,[1,12] high arousal usually hinders performance. The diagnosis of cancer, its treatment, and accompanying symptoms of pain, fatigue, and nausea are all sources of physiologic and emotional arousal that may potentially inhibit self-efficacy. Therefore, even though one may have participated in regular physical activity prior to a diagnosis of cancer, the profound personal challenges of the diagnosis and treatment may impede continued participation in usual regular activities, such as physical exercise.

Though the definition of self-efficacy is seemingly simple, the concept has several dimensions. Bandura[12] labels these as level, strength, and generality. Efficacy beliefs vary in level, depending on the demand of the task. Strength refers to the how strongly people believe themselves capable of performing an action. Strength is an indicator of the perseverance of the individual. Generality refers to the range of activities an individual judges himself or herself capable of performing. Generality may be very specific within a domain of functioning or may cross a broad range of activities within a domain.

Self-efficacy reflects judgment of an individual's capability to perform specific behaviors under specific circumstances. For this reason, there is no single all-purpose self-efficacy scale available. Researchers must develop a self-efficacy scale for the specific population and/or concept under investigation. Haas[15] provided a summary of the guidelines recommended by Bandura[1,12] to assist in scale construction and to critique self-efficacy instruments reported in research studies. The level of efficacy may change under different circumstances, so the scale should reflect ability to be physically active under various conditions, such as when the individual is tired, busy, or not feeling well. Scale items should be worded as "can," indicating ability rather than "will," which signify intent. A wide range of scores should be available to adequately capture strength. Bandura[12]recommended that strength be measured on a 100-point scale, "ranging in 10-unit intervals from 0 ("Cannot do"); through intermediate degrees of assurance, 50 ("Moderately certain can do"); to complete assurance, 100 ("Certain can do")".[12p43-44]

Development and Testing of the PAAI

The PAAI was developed in consultation with, and according to, the guidelines suggested by Bandura.[12] Item selection was theoretically derived from the literature. Two expert reviewers were consulted for content validity, and revisions in wording were made based on their evaluations. One item was deleted as it was deemed confusing and repetitive. The

resulting PAAI is a 13-item, numeric scale that asks respondents to rate how confident they are that they can perform their usual physical activity in a variety of circumstances. Usual physical activity refers to all activity at work, home, or leisure. Response choices range from '0-cannot do at all' to '100-Certain can do' and are summed to yield a score ranging from 0 to 1300. A low score indicates low self efficacy for physical activity and a high score indicates high self efficacy for physical activity.

Initial Pilot Study

A pilot study of the instrument was conducted among adult women recruited from the general community. Of the 250 questionnaires distributed, 219 were returned for an 87.6% return rate. Demographic description of the instrument pilot sample is detailed in Table 1. Respondents completed a demographic profile, a single item of physical activity with four possible responses ranging from "not active at all" to "extremely active," the 13-item PAAI, and the 5-item Self- Efficacy for Exercise scale (SES) by Marcus et al.,[16] a commonly used scale with established reliability and validity. Respondents took an average of six minutes to complete the questionnaires. Analyses of the instrument included evaluation of the following criteria: (a) alpha for the total scale of at least .7, (b) factor loading of each item on at least one factor of at least .4, and (c) inter-item and item-total correlation of at least .3.[17] Reliability of the PAAI, measured by Cronbach alpha, was .95. Principal component analysis without rotation identified a single factor scale for the PAAI, accounting for 65% of the variance. Factor loading of the 13 items ranged from .75 to .83. Item-total correlations ranged from .70 to .79 and inter-item correlations ranged from .39 to .80. Spearman's correlation indicated the PAAI has convergent validity with the SES (rs = .54, p < .01) and self-reported level of activity (rs = .33, p < .01).

Analysis of variance was used to examine variation among PAAI scores in subgroups with limiting physical health conditions. The presence of a limiting condition was significantly related to PAAI scores (F = -6.61, p < .05). Of the 52 respondents who reported a limiting condition, 34 reported joint or mobility related problems. Other conditions listed included respiratory disorders, heart problems, fatigue, stroke, and being overweight. Thus, initial pilot testing of the PAAI supported both the internal consistency reliability and the ability of the instrument to discriminate between healthy and sick individuals and their expected differences in self efficacy for physical activity.

There was also a significant difference in PAAI scores among ethnic groups (F = 21.27. p < .01). In an effort to determine possible explanations for the ethnic differences, the demographic data for the two largest groups (African American and Caucasian/White) were compared. The African American participants were younger, less educated, and more likely to be

unmarried living with children. All of these variables, as well as ethnicity, have been associated with decreased physical activity.[18-20] The group of African Americans was also less active (36% minimally active or not active at all compared with 21% of Caucasians). Bandura[12] pointed out that it is not ethnicity or gender that determines self-efficacy, but rather socio-economic variables such as education that influence an individual's belief in personal abilities.

Study participants were also asked to identify confusing items. Three individuals identified the PAAI instructions as confusing. The directions were reworded and a stem was added for clarification.

Second Study with Clinical Population and Comparison Group

The second study (n = 128) included 73 women with breast cancer compared with 55 women with no history of cancer. As part of a larger study, self-efficacy for physical activity was measured using the PAAI, and physical activity was measured using the Human Activity Profile.[21] The Human Activity Profile (HAP) is a self-report instrument designed to measure energy expenditure based on estimated metabolic equivalents (METs) of 94 common human activities that people do in their daily lives. Respondents answered each item with one of three possible responses: "still doing this activity," "have stopped doing this activity," or "never did this activity." The HAP produces two primary scores. The Maximum Activity Score (MAS) reflects the highest oxygen-demanding activity that the respondent performs and is calculated by finding the highest item number that the respondent marked as "still doing." The Adjusted Activity Score (AAS) is a measure of usual daily activities and is calculated by subtracting the total number of "stopped doing" items below the MAS from the MAS. Reference norms have been established for adults in a sample of 654 individuals. Several research samples have contributed additional normative data for gender, age, and co-morbid conditions. Convergent validity was established by correlation of the MAS with VO2, an estimate of maximum oxygen consumption (r =.83). The AAS was correlated (r =.57) with FEV1 (forced expiratory volume in one second). MAS and AAS scores were found to correlate .80 and .83, respectively, with treadmill walking distances. Test-retest reliability coefficients for the MAS and AAS were reported as .84 and .79.

Participants in the second study sample were primarily Caucasian, educated, married, and postmenopausal women. With a mean age of 60.12 years (SD = 10.57), women in the treatment group were significantly older (t = 4.52, p < .001) than women in the comparison group, whose mean age was 48.98 (SD = 15.48). There was also a significantly greater percentage of postmenopausal women in the treatment group (83.6%) than in the comparison group (45.5%) (c2 = 20.66, p < .001). The other significant difference between the two groups was financial status (c2 = 8.78, p <. 01). Women in the

treatment group were more likely to report their financial status as “poor” or “marginal” than women in the comparison group. The demographic characteristics for the sample are described in Table 2.

The groups receiving treatment for breast cancer included 45 women (61.6%) receiving hormonal therapy and 28 (38.4%) receiving chemotherapy. All of the women receiving hormonal therapy were taking the drug Tamoxifen. The chemotherapy regimens differed among the women. The most common regimen consisted of Adriamycin and Cytoxan and was taken by 10 (36%) women. An additional ten (36%) were taking either Taxol or Taxotere. Seven (25%) of the women received regimens combining Taxol or Taxotere with Adriamycin, carboplatin, Cytoxan, or Herceptin. The remaining one woman was receiving Cytoxan, methotrexate, and fluorouracil.

Participants were asked to indicate if they had any conditions that limited their physical activity. For those who indicated “yes,” participants were asked to specify the condition that limited their activity. Of the 29 women who indicated a limiting condition, 19 were in the treatment group and 10 were in the comparison group. Within the treatment group, five women reported limiting conditions that were clearly related to cancer or its’ treatment. These conditions included limited arm use and lymphedema after mastectomy, decreased cardiac function secondary to Adriamycin administration, and bone metastases. An additional five women listed conditions that may or may not have been related to cancer treatment. Conditions included in this group were fatigue, deep vein thrombosis, and depression. The remaining nine women in the patient group reported conditions that included rheumatoid arthritis, back injuries, arthritis, asthma, and diabetes. The women in the comparison group also reported rheumatoid arthritis, back injuries, arthritis, asthma, and diabetes as limiting conditions. In addition, this group of women reported multiple sclerosis, emphysema, fibromyalgia, injuries from car accidents, and cognitive deficits secondary to brain surgery as interfering with physical activity.

As expected, there were significant differences in self-efficacy scores on the PAAI between women receiving treatment for cancer and women in the comparison group ($F = 16.78$, $p < .001$), with women in the comparison group reporting higher self-efficacy for physical activity. The differences were expected and further supported discriminant validity of the PAAI. Women receiving chemotherapy ($n = 28$) reported a mean of 55.87 ($SD = 23.78$) slightly higher than the women receiving hormonal therapy ($n = 45$; $x = 55.26$, $SD = 21.15$) but less than that of women in the comparison group ($n = 55$; $x = 70.40$, $SD = 17.95$). Reliability of the PAAI, measured by Cronbach alpha, ranged from .94 to women in the comparison group ($n = 55$) to .96 in women with cancer ($n = 73$).

Correlation between self-efficacy for physical activity and actual physical activity in women with breast cancer and women in the comparison group was significant and identical (r = .44, p <.001). Other significant correlations with self-efficacy included limitations to physical activity (rs = -.45, p <.001) and financial status (rs = -.36, p <.01). Those reporting physical limitations or lower socio-economic status reported lower self-efficacy scores. Unlike the pilot study, there was not a significant correlation between race and PAAI scores.

Discussion

The U.S. Department of Health and Human Services recommends 150 minutes of moderate-intensity or 75 minutes of vigorous exercise per week for all Americans.[22] Persons who are elderly or have chronic conditions that inhibit exercise should be as physically active as their condition and abilities permit. Self-efficacy has been determined to be a strong predictor of who will engage in exercise and self-efficacy measures have focused on that subset of physical activity. Development of the PAAI was undertaken to fill a gap in the literature by creating a tool specifically designed to measure self-efficacy for physical activity, which is different from structured exercise. The goal was to create a brief instrument amenable for use by women with breast cancer that yielded a sum score with wide variance. The PAAI was shown to be a valid and reliable measure of self-efficacy for physical activity in studies of both community-residing women and women receiving treatment for breast cancer.

The PAAI took participants less than five minutes to complete, rendering it an appropriate tool for use with persons at risk for fatigue. The instrument yields a sum score ranging from 0 to 1300 that is amenable to parametric statistical analysis. Initial psychometric testing of the instrument suggests that it is an appropriate tool to measure self-efficacy for physical activity. Content validity was established by initial review of the items by experts. Both the initial pilot study of community residents (n=219) and the second study of women with and without cancer (n=128) demonstrated high internal consistency reliability. Discriminant validity was supported by the PAAI's ability to discriminate between healthy individuals and those with physical limitations that undermined self-efficacy for physical activity.

Limitations

Testing of the PAAI was limited by small sample sizes. While large enough to establish reliability and validity and to conduct factorial analysis, the sample sizes precluded analysis of subgroups. Minority participants and persons from lower socio-economic status were underrepresented, particularly in the second study. The sample was entirely female,

preventing generalization to men. In addition, the physical activity measures used in both studies to correlate self-efficacy for physical activity were self-report instruments and may not accurately reflect energy expenditure.

Conclusion

The concept of self-efficacy is behavior specific, and physical activity is a broader concept than exercise. Thus, researchers interested in self-efficacy for physical activity should consider using an instrument specifically created for that purpose rather than the self-efficacy scales for exercise.

Initial psychometric testing of the PAAI suggests that it is a valid and reliable measure of self-efficacy for physical activity in community residing women with and without breast cancer. Further testing is necessary to establish whether the PAAI is appropriate for use with specific demographic groups or other chronic conditions. Larger studies with more well-defined samples with exclusion criteria delineated to remove or account for confounding variables are needed. Future studies should be designed to address specific limiting conditions. For example, a future design might compare only post-menopausal cancer patients with mastectomies and women who are post-menopausal, excluding women with other limiting conditions such as arthritis. Additional research is also need to refine the predictive ability of the PAAI.

Taking approximately five minutes to complete, the brevity and strength of the pilot testing suggest that the PAAI can serve as a reliable screening tool in clinical practice. Assessing self-efficacy for physical activity will enable nurses to develop targeted interventions to enhance self-efficacy, thus increasing activity levels, and subsequently improving quality of life.[23]

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Table 1. Demographic Characteristics of PAAI Instrument Pilot Study Participants (N = 219)

Age (years)	
18 - 19	2 (02%)
20 - 29	20 (09%)
30 – 39	24 (15%)
40 - 49	51 (23%)
50 - 59	50 (23%)
60 – 69	29 (13%)
70 - 79	27 (12%)
80 – 89	6 (03%)
Range 18-86	
M = 50.33	

Race/Ethnicity	
African American	49 (22%)
Asian	1 (01%)
Hispanic	8 (04%)
White / Caucasian	160 (73%)
Other	1 (01%)
Education Level	
Less than high school	9 (04%)
High school	40 (18%)
Some college	78 (36%)
College	47 (21%)
Post college degree	45 (21%)
Marital Status	
Single, lives alone	51 (23%)
Single, lives with children	24 (11%)
Married/Lives with adult	89 (41%)
Married, children at home	55 (25%)

Limits on Physical Activity	
No	167 (76%)
Yes	52 (24%)
Current Level of Physical Activity	
Not active at all	6 (03%)
Minimally active	47 (22%)
Moderately active	129 (59%)
Extremely active	36 (16%)

Note: Some demographic characteristic totals may be < 219 due to missing data. Percentages may not equal 100 due to rounding.

Table 2. Demographic Characteristics of Second Study Sample

	Women with Breast Cancer *n* (73) (%)	Comparison Group *n* (55) (%)	Total Sample *n* (128) (%)
Age			

18-19			1	(1.9)	1	(0.8)
20-29			5	(9.4)	5	(4.0)
30-39	1	(1.4)	10	(18.5)	11	(8.8)
40-49	12	(17.2)	13	(23.9)	25	(20.3)
50-59	19	(27.4)	12	(2.1)	31	(24.1)
60-69	21	(30.1)	7	(13.0)	28	(22.6)
70-79	14	(20.0)	4	(7.4)	18	(14.6)
80-89	2	(2.8)	1	(1.9)	3	(2.4)
90+			1	(1.9)	1	(0.8)
Missing		4		1		5
		M = 60.12		*M* = 48.98		*M* = 55.23
		SD = 10.57		*SD* = 15.48		*SD* = 14.04
Ethnicity						
African-American	8	(11.0)	5	(9.1)	13	(10.2)
Hispanic	2	(2.7)	1	(1.8)	3	(2.3)
White/ Caucasian	62	(84.9)	49	(89.1)	111	(86.7)
Other	1	(1.4)			1	(0.8)
Household						
Single, lives alone	18	(25.0)	8	(14.8)	26	(20.6)

Single, lives with children	5	(6.9)	5	(9.3)	10	(7.9)
Single, lives with s.o.	6	(8.3)	3	(5.6)	9	(7.1)
Single, lives with children/ s.o.	2	(2.8)	2	(3.7)	4	(3.2)
Married	29	(40.3)	22	(40.7)	51	(40.5)
Married, children at home	12	(16.7)	14	(25.9)	26	(20.6)
Missing		1				
Education						
Less than high school	6	(8.2)	2	(3.6)	8	(6.3)
High school	28	(38.4)	20	(36.4)	48	(37.5)
Some college	25	(34.2)	18	(32.7)	43	(33.6)
College graduate	14	(19.2)	15	(27.3)	29	(22.7)
Financial Status						
Poor	9	(12.5)	3	(5.5)	12	(9.4)
Marginal	11	(15.3)	1	(1.8)		13
Ok	16	(22.2)	19	(34.5)		(9.4)
Comfortable	30	(41.7)	28	(50.9)	35	(27.6)
Quite secure	6	(8.3)	4	(7.3)	58	(45.7)
Missing		1			10	(7.9)
						1
Limiting Conditions						

No	44	(60.3)	42	(76.4)	86	(67.2)
Yes	29	(39.7)	13	(23.6)	42	(32.8)
Menopausal status						
Pre-menopausal	12	(16.4)	30	(54.5)	42	(32.8)
Post-menopausal	61	(83.6)	24	(45.5)	86	(67.2)
Performance Status (ECOG scale)						
0	50	(68.5)	NA		NA	
1	19	(26.0)				
2	4	(5.5)				
Stage of breast cancer						
I	28	(38.4)	NA		NA	
II	27	(37.0)				
III	9	(12.3)				
IV	9	(12.3)				
Cycle of chemotherapy						
Fewer than six cycles	21	(70.0)	NA		NA	
Six or more cycles	9	(30.0)				
Months on hormonal therapy						
Less than six months	5	(12.5)	NA		NA	

Six or more months	35	(87.5)		
Type of Surgery				
None	3	(4.1)	NA	NA
Lumpectomy	20	(27.4)		
Mastectomy	46	(63.0)		
Bilateral mastectomy	4	(5.5)		
Radiation Therapy				
None	49	(67.1)	NA	NA
Less than or equal to 50	16	(21.9)		
Centigray	8	(11.0)		
Greater than 50 Centigray				
Relationship to Patient				
Friend	NA		26	(47.3) NA
Sister			6	(10.9)
Daughter			16	(29.1)
Daughter-in-law			5	(9.1)
Co-worker			2	(3.6)

Note: s.o. = Significant other; NA = not applicable.

Appendix A: PHYSICAL ACTIVITY APPRAISAL INVENTORY (PAAI)

Directions: Using the 0-100 scale below, please rate how sure you are that you can perform your usual physical activities **regularly** under the following conditions. Physical activity refers to **all** activity at home, work, or leisure.

0	10	20	30	40	50	60	70	80	90	100
Cannot do at all					Moderately certain can do					Certain can do

I am confident that I can perform my usual physical activities (includes **all** activity at home, work, or leisure): (0-100)

1. When I am feeling tired _____
2. When I am feeling pressure from work or school _____
3. During bad weather _____
4. During or after experiencing personal problems _____
5. When I am feeling depressed _____
6. When I am feeling anxious _____
7. When I feel physical discomfort with an activity _____
8. When I have too much work to do at home _____
9. When I/we have visitors _____
10. When there are other interesting things to do _____
11. When I don't have support from my family or friends _____
12. When I have other time commitments _____
13. When I do not feel well _____