

Adherence to Exercise Scale for Older Patients (AESOP): A Measure for Predicting Exercise Adherence in Older Adults after Discharge from Home Health Physical Therapy

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ABSTRACT

Purpose: To develop a measure of 3 social cognitive theory constructs (self-efficacy expectations, outcome expectations, and outcome expectancies) for predicting home exercise program (HEP) adherence in older adults after discharge from home health physical therapy. **Methods:** A questionnaire was developed, pilot-tested, and administered to 50 participants (mean age 79.9 years, range 65-91 years) who were being discharged from home health physical therapy on a HEP. Participants also completed the 12-item Short-form Health Survey (SF-12), Mini Mental State Examination, and short form of the Geriatric Depression Scale. Participants reported level of adherence to the HEP at 1 month. **Results:** There was a strong positive response bias for all 42 items comprising the questionnaire. Two constructs (self-efficacy expectations and outcome expectations) demonstrated test-retest reliability, while the third (outcome expectancies) did not. There was no association between any of the 3 constructs and the 2 scales of the SF-12. Participants' scores on the questionnaire did not predict HEP adherence. **Conclusion:** While previous studies have shown that questionnaires based on social cognitive theory constructs predict exercise adherence in community-dwelling older adults, the current study did not establish this relationship in older adults after discharge from home health physical therapy. Future research should address scaling issues.

Key Words: self-efficacy expectations, outcome expectations, outcome expectancies, exercise adherence, older adults

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INTRODUCTION

There are multiple lines of evidence indicating that community-dwelling older adults may benefit from a home exercise program (HEP).¹⁻⁷ For example, resistance training in older adults produces improvements in multiple factors that impact functional status, health, and quality of life.¹ These factors include markedly increased muscle mass, strength, and power; reduced difficulty in performing daily tasks; enhanced energy expenditure and body composition; and improved ability to participate in spontaneous physical activity.¹ More specifically, there is evidence in that an individually-prescribed HEP, consisting of strength and balance training exercises and developed by a physical therapist, reduces the risk of falling in community-dwelling older adults.²⁻⁷ This risk reduction has been observed in samples of persons who were receiving home health services,⁷ in samples of persons who were not receiving home health services,^{4,6} in samples for which the HEP was the sole intervention,^{4,6} and in samples for which the HEP was part of a multifactorial intervention.⁷

These findings are of key importance to home health physical therapists, for whom the HEP is the cornerstone of the plan of care.⁸ Another important implication of research demonstrating risk reduction in samples of well older adults is that simply returning the patient to the baseline level of functional mobility is not the optimal outcome. To further reduce the risk of falls after discharge, community-dwelling older adults who have regained independence with functional mobility must continue to adhere to the HEP.

Unfortunately, some of the same research that has demonstrated the effectiveness of the HEP has also shown that long-term adherence is suboptimal, with adherence rates of 42% to 44% at 1 to 2 years after initiation.^{4,6} This problem is important because the benefits of the HEP depend on continued participation.^{4,5} Thus, this finding has enormous implications for patients, health care providers, and the health care system. In geriatric home health patients, for example, a lack of adherence to the discharge HEP could lead to a cycle of short-term gains in functional mobility during an episode of physical therapy, followed by a subsequent decline culminating in further adverse events (eg, falls and re-entry into the health care system). Clearly, efforts to maximize adherence to the HEP are needed, having the potential to both improve patient outcomes and decrease utilization of the health care system.

Social cognitive theory (SCT), and particularly the construct of self efficacy, has been used to investigate exercise adherence in older adults.⁹⁻¹⁶ Self-efficacy expectations are the belief that one can successfully perform a given behavior. A related construct is outcome expectations. Outcome expectations are the belief that performing the target behavior will lead to the desired outcome.¹⁷⁻²⁰ Both self-efficacy expectations and outcome expectations can be used to predict adherence to the target behavior. While Bandura has suggested that outcome expectations are largely a function of self-efficacy expectations and thus may not account for additional variance in adherence,¹⁷⁻²⁰ other work has implied that outcome expectations directly influence exercise adherence in older adults.⁹⁻¹⁴ Resnick developed separate scales for measuring exercise self-efficacy expectations and outcome expectations in older adults and provided evidence to support their reliability and validity.^{13,15,16} These measures can be used to identify those at risk for poor adherence, allowing for the implementation of interventions that are designed to maximize adherence.

Another SCT construct is outcome expectancies. Outcome expectancies are the importance that the individual places on the expected outcome of the target behavior.^{18,21} This construct may also be important in investigating exercise adherence in older adults. For example, an individual may believe that he can successfully continue the HEP (self-efficacy expectations) and that doing so will maximize independence with functional mobility (outcome expectations), but if he does not value this outcome (outcome expectancies), then he may not adhere to the HEP.

Resnick's work involved general exercise in community-dwelling older adults. Her self-efficacy scale, the Self-Efficacy for Exercise (SEE) scale, focuses on aerobic exercise, specifically walking, swimming, biking, or jogging.^{13,15} Resnick's outcome expectations scale, the Outcome Expectations for Exercise (OEE) scale, is not specific to any particular type of exercise.¹⁶ To date, there have been no measures of SCT constructs designed for use with community-dwelling older adults who are undergoing physical rehabilitation (eg, home health physical therapy). We sought to address this gap in the literature by applying Resnick's work to a sample of older adults who participated in home health physical therapy and adding outcome expectancies as a measure. The purpose of this study was to create a single measure, the Adherence to Exercise Scale for Older Patients (AESOP), of the SCT constructs of self-efficacy expectations, outcome expectations, and outcome expectancies for predicting adherence to the HEP in community-dwelling older adults after discharge from home health physical therapy.

While the primary purpose of this study was instrument development, additional purposes were: (1) to investigate the reliability and validity of the AESOP and (2) to simply describe adherence to the HEP in community-dwelling older adults after discharge from home health physical therapy. We hypothesized that the AESOP would demonstrate test-retest reliability. To demonstrate construct validity, criterion validation was attempted by examining the degree to which scores on the 3

scales of the AESOP were correlated with scores on the 12-item Short-form Health Survey (SF-12v2), a generic health status measure.²² We hypothesized that scores on the 3 scales of the AESOP would be mildly to moderately correlated with the SF-12v2 mental component summary scale (MCS-12) and physical component summary scale (PCS-12) and more strongly correlated with the MCS-12 than with the PCS-12. This hypothesis was based on findings reported by Resnick and Jenkins from the validation of the SEE scale.¹⁵ Predictive validity was assessed by examining the degree to which scores on each of the 3 scales of the AESOP predicted adherence. We hypothesized that the AESOP would predict adherence.

Finally, this study sought to describe adherence to the HEP in community-dwelling older adults after discharge from home health physical therapy. In several studies involving samples of older adults who were not undergoing physical rehabilitation, the clinician maintained contact with participants to encourage adherence.⁴⁻⁶ We hypothesized that the level of adherence in the current study would be lower than that observed in samples of well older adults both because of the increased incidence and severity of disease in samples of older adults who require physical rehabilitation and because of the lack of ongoing contact between the physical therapist and the participant.

METHODS

Participants

Participants were patients of North Mississippi Medical Center Home Health Agency, a component of a large, not-for-profit, integrated regional health care system, who were being discharged from home health physical therapy. Participants were identified to the first author by the treating physical therapists. The study was approved by the North Mississippi Health Services Institutional Review Board and the University of Alabama at Birmingham Institutional Review Board. Inclusion criteria were: (1) participation in home health physical therapy, (2) age of at least 65 years, (3) discharge on a HEP that included lower extremity exercises, (4) independence with the HEP (as determined by the treating physical therapist), and (5) provision of informed consent. Exclusion criteria were: (1) auditory impairment to the extent that the prospective participant was unable to understand the purpose of the study during the initial telephone contact, (2) visual impairment to the extent that the prospective participant was unable to take written tests, (3) inability to communicate in English, (4) presence of factors making the home environment unsafe for the examiner, (5) ongoing contact with a physical therapist (eg, by being transitioned from home health to outpatient physical therapy), and (6) acute changes in medical status since being identified as a prospective participant by the treating physical therapist. Withdrawal criteria were acute changes in medical status, including hospitalization, and participant request to be withdrawn. Ten participants pilot-tested the AESOP, and 50 participants completed all measures. As patients of a home health agency, participants were homebound as compared to community-dwelling older adults who are mobile in the community.

Instrument development

Item generation and refinement

The method of test development was a modified Delphi process patterned after LaClair et al.²³ The Delphi process is a method of eliciting group opinion that is characterized by anonymity, multiple iterations, and feedback.^{24,25} Initial test development consisted of item generation and refinement. First, an expert panel was formed, consisting of 3 physical therapists who were identified as being experts in geriatrics, exercise, and home health. They were initially contacted by e-mail, introduced to the project using a pre-prepared letter, and asked if they were willing to participate. Next, the members of the expert panel were presented by e-mail with all of the items from Resnick's scales (SEE and OEE) and asked if they believed that these items were sufficient for use with older adults who would be performing a HEP consisting primarily of strength and balance training exercises. They were asked to suggest modifications to these items, delete items, and write new items as needed. The source of the items was not identified at this point. This strategy allowed for the possibility that the members of the expert panel might believe that the existing scales were sufficient for use with older adults who were undergoing physical rehabilitation. For the construct of outcome expectancies, no existing scale was available to present to the members of the expert panel, so they were asked to write their own items.

The members of the expert panel suggested modifications to Resnick's items, deleted items, and wrote new items, so these changes were used to form new item pools for the constructs of self-efficacy expectations and outcome expectations. Also, the items written by the members of the expert panel for the construct of outcome expectancies were compiled to form an initial item pool. At this point, we also contributed to the process of item generation and refinement by changing items and writing new items. Items that we contributed were added to the item pools for each of the 3 constructs, and these new lists were provided to the members of the expert panel, who then repeated the process of suggesting modifications to these items, deleting items, and writing new items as needed. This strategy allowed the members of the expert panel to have the opportunity to consider items that were written by their colleagues and by us.

Pretesting of items

New item pools were again compiled for each of the 3 constructs using the most recent round of input. We made final changes to these items as needed (eg, to resolve contradictory feedback from different members of the expert panel), and the items were then pretested to ensure that they were comprehensible to the target population and unambiguous and asked only a single question. Items that did not meet these criteria were rewritten or eliminated. Techniques that were used to test participants' understanding of the items included the double interview, asking people to think aloud, and verbal probing.²⁶

Participant feedback was also used to determine whether there should be 5 or 7 response options for each item and how the response options should be labeled. Five to 9 is considered to be the optimal range, with an odd number preferred so as to permit a neutral response option, and there is an approximately 12% loss of reliability with the use of 5 response options,²⁶ so 7 was chosen initially as the number of response options to be presented. However, this number was reduced to 5 based on participant feedback during pilot testing. The initial label used for the neutral response option, neither agree nor disagree, was changed to no opinion for simplicity. The response options, then, were strongly disagree, disagree, no opinion, agree, and strongly agree.

Pilot testing began with a group of 5 participants who took only the AESOP. Based on the feedback from this group, changes were made, and pilot testing was repeated with a new group of 5 participants. Participants in the second group did not suggest any further changes, so the item pool at that point was used to form the AESOP, which consisted of 42 items (Table 1).

A 43rd item was added as an indicator of yea-saying (acquiescence bias)²⁶: "Exercise makes me wealthier." This item was written in an attempt to present a statement that would seem, at face value, to be clearly false. Thus, a high score (ie, agree, strongly agree) for this item would indicate the possibility that the participant tended to indiscriminately give positive responses for all items.

Method of administration

The AESOP was administered verbally during a face-to-face interview. The examiner used a standardized introduction for the AESOP (including an operational definition of the term *home exercise program*) as well as standardized definitions and scripting for answering participants' questions. Participants recorded their answers on a written answer sheet after each item was read aloud by the examiner.

Scoring

For each item, a score of 1 was given for strongly disagree, 2 for disagree, 3 for no opinion, 4 for agree, and 5 for strongly agree. All items were weighted equally in scoring. The 3 scales of the AESOP were scored separately since each scale represented a distinct construct. The self-efficacy expectations scale contained 15 items, the outcome expectations scale contained 16 items, and the outcome expectancies scale contained 11 items. The range of possible scores for each scale was as follows: 15-75 for self-efficacy expectations, 16-80 for outcome expectations, and 11-55 for outcome expectancies.

Timing of administration

The AESOP was administered within 14 days of discharge from home health physical therapy (ie, on the day of discharge or during the preceding 7 days or the following 6 days). For all but 1 participant, the AESOP was administered after discharge.

Table 1. Items Comprising the AESOP

1. I would continue my home exercise program even if the weather were bothering me.
2. Exercise makes me feel more healthy (makes me feel good all over).
3. Improving my overall sense of health and well-being is important to me.
4. I would continue my home exercise program even if I were bored by the exercises or activities.
5. Exercise makes my mood better in general (puts me in a better mood).
6. Improving the amount of work that I can do without tiring easily is important to me.
7. I would continue my home exercise program even if I felt tired or uncomfortable when exercising.
8. Exercise helps me feel less tired (gives me more energy).
9. Improving my strength is important to me.
10. I would continue my home exercise program even if I had to exercise alone.
11. Exercise helps keep me strong.
12. Improving my ability to do my normal daily activities is important to me.
13. I would continue my home exercise program even if I were busy with other activities.
14. Exercise is an activity that I enjoy.
15. Strengthening my bones is important to me.
16. I would continue my home exercise program even if I did not enjoy it.
17. Exercise makes me feel proud that I did it.
18. Improving my balance and safety is important to me.
19. I would continue my home exercise program even if I felt tired.
20. Exercise helps me think more clearly.
21. Decreasing the risk of injury due to a fall is important to me.
22. I would continue my home exercise program even if I felt anxious (worried).
23. Exercise helps keep me able to do my normal daily activities.
24. Being able to walk better is important to me.
25. I would continue my home exercise program even if I felt sad or unhappy.
26. Exercise helps strengthen my bones.
27. Improving my stability or security when I am bathing is important to me.
28. I would continue my home exercise program even if I were not sure how to do the exercises.
29. Exercise helps me keep my balance.
30. Improving my stability or security when I am getting dressed is important to me.
31. I would continue my home exercise program even if the exercises were hard to do.
32. Exercise helps keep me from falling.
33. Improving my stability or security when I am getting something to eat or drink in the kitchen is important to me.
34. I would continue my home exercise program even if I just weren't feeling as good as usual.
35. Exercise helps me feel safer when I am doing my normal daily activities.
36. I would continue my home exercise program even if I didn't receive encouragement or reminders.
37. Exercise helps me walk better.
38. If I had to stop my home exercise program because I became ill, I would resume it when I was feeling better.
39. Exercise makes me feel more stable or secure when I am bathing.
40. If I had to stop my home exercise program because I was out of town for a week or two, I would resume it when I got home.
41. Exercise makes me feel more stable or secure when I am getting dressed.
42. Exercise makes me feel more stable or secure when I am getting something to eat or drink in the kitchen.
43. Exercise makes me wealthier.

Other measures

After completing the AESOP, participants completed the SF-12v2, Mini Mental State Examination (MMSE),^{27,28} and short form of the Geriatric Depression Scale (GDS).²⁹⁻³² Finally, demographic and descriptive data were collected. The order of test administration was the same for all participants, and all testing sessions occurred in participants' homes and were conducted by the first author. The AESOP was administered again 14 days later to a subset of 28 participants to establish test-retest reliability.

Other patient characteristics of interest included age, gender, race, marital status, presence of a caregiver in the home (spouse, child, other relative, or paid caregiver), number of years of formal education completed, number of falls with and without injury (total, within the past year, and within the past month), whether a written HEP had been issued by the treating physical therapist, the number of exercises that comprised the HEP, perceived income, medical diagnoses and comorbidities (by checklist), reason for the referral for home health physical therapy (by checklist), and prior experience with exercise. Perceived income was assessed using the following scale: "All things considered, would you say your income: (1) is not enough to make ends meet, (2) gives you just enough to get by on, (3) keeps you comfortable, but permits no luxuries, or (4) allows you to do more or less what you want?"³³ To determine prior experience with exercise, patients were asked a series of questions, including, "Have you ever in your life participated in a regular exercise program? If so, at what ages? What types of exercise did you perform? How long did you usually spend exercising? How many times per week did you exercise?"

Participants also kept a daily home exercise log showing whether or not they exercised. This log was in the form of a monthly calendar that was mailed to the first author at 1 month following the initial testing session. Participants simply indicated performance or nonperformance of the HEP for each date on the calendar by marking an "e" on the dates on which they performed the HEP and leaving blank the dates on which they did not. To avoid overemphasis on the variable of interest (ie, adherence), a distracter variable was added: participants were given an operational definition of the term *fall* and instructed to record falls in addition to exercise sessions. Participants who did not return their home exercise logs were called by an employee of North Mississippi Medical Center Home Health Agency who was not a physical therapist and given a reminder. Participants who still did not return their home exercise logs were treated as reporting non-adherence. Adherence was defined as performing the HEP at least 3 times weekly.

We chose the report period of 1 month for several reasons. First, it has face validity as an early indicator of adherence postdischarge. Also, we hypothesized that adherence to the HEP at 1 month might be clinically significant in older adults who have recently required physical rehabilitation and thus presumably have poorer health status and may be at greater risk for functional decline than the general population of older adults. Furthermore, we hypothesized that older adults who

have recently required physical rehabilitation are at greater risk than the general population of older adults for changes in medical status resulting in re-entry into the health care system (eg, acute care hospitalization) and cessation of the HEP.

Finally, an overall appraisal of exercise was included: "Overall, how do you feel about exercise?" Response options for the overall appraisal comprised a 5-point Likert scale ranging from strongly dislike to strongly like. This item was included as a descriptive variable.

Analyses

Descriptive statistics were generated for scores on the SF-12v2, MMSE, and GDS, as well as the other characteristics of interest. Endorsement frequencies for all 5 response options for the 42 AESOP items were analyzed, with the goal of eliminating items that were endorsed by very many or very few participants.²⁶ Endorsement frequencies for all 5 response options for the yea-saying indicator and the overall appraisal of exercise were also analyzed. Since the AESOP scores were on the ordinal scale, the intraclass correlation coefficient (ICC), Model 3, was used to analyze test-retest reliability.

The Spearman rho was used to examine the degree to which total scores on the 3 scales of the AESOP were correlated with scores on the 2 scales of the SF-12v2. The point biserial correlation was used to examine the degree to which total scores on the 3 scales of the AESOP were correlated with adherence.

RESULTS

Participant characteristics are summarized in Table 2. The mean number of medical diagnoses was 5.9 (range 1-12, sd 2.5) out of a list of 27 as determined by review of the available medical records for each participant (Table 3).

For the MMSE, scores of 23 or less for those with a 9th grade education or greater and 17 or less for those with an 8th grade education or less were used to define cognitive impairment. Education-adjusted scores on the MMSE indicated cognitive impairment in 10 participants (mean score 25.4, range 14-30).³⁴ Geriatric Depression Scale scores of greater than 5 indicate probable depression, and 12 participants met this criterion (mean score 4.0, range 1-14). In comparing scores on the SF-12v2 to normative data by age and sex,²² 43% of PCS-12 scores fell within 1 standard deviation (sd) of the mean, 37% fell between 1 and 2 sd below the mean, 18% fell between 2 and 3 sd below the mean, and 2% fell between 3 and 4 sd below the mean. Fifty-five percent of MCS-12 scores fell within 1 sd of the mean, 20% fell between 1 and 2 sd below the mean, 6% fell between 2 and 3 sd below the mean, 16% fell between 1 and 2 sd above the mean, and 2% fell between 2 and 3 sd above the mean (because 1 participant omitted an item on the SF-12v2, n=49).

Thirty-six participants (72%) reported adherence at 1 month, 6 (12%) were excluded, and 8 (16%) did not return their home exercise logs and were therefore treated as reporting non-adherence. Of the 6 participants who were excluded, 3 withdrew for medical reasons (acute care admission for elec-

Table 2. Participant Characteristics

Demographic and health status variables (N=50)	% or mean (sd)
Age (years)	79.9 (7.1)
Sex (female)	72%
Race	
Caucasian	94%
African-American	6%
Marital status	
Widowed	54%
Married	34%
Divorced	8%
Separated	2%
Presence of caregiver in the home	56%
Level of education (years of formal education completed)	12.2 (2.5)
History of falls	80%
History of injurious falls	50%
Average number of injurious falls (among fallers)	2.0
% with injurious fall within past year (among fallers)	76%
% with injurious fall within past month (among fallers)	4%
History of non-injurious falls	58%
Average number of non-injurious falls (among fallers)	3.2
% with non-injurious fall within past year (among fallers)	48%
% with non-injurious fall within past month (among fallers)	21%
Written HEP issued	86%
No. of exercises comprising HEP	8.8 (3.6)
Perceived income	
Is not enough to make ends meet	6%
Gives you just enough to get by on	40%
Keeps you comfortable, but permits no luxuries	32%
Allows you to do more or less what you want	22%
Number of verified medical diagnoses	5.9 (2.5)
Reason for referral	
Functional decline post general medical hospitalization	32%
Functional decline post general medical surgery	2%
Functional decline post cardiac hospitalization (e.g., MI, CHF)	4%
Functional decline post cardiac surgery (e.g., CABG)	4%
Functional decline post elective joint replacement	10%
Functional decline post ORIF or joint replacement due to fracture	14%
Functional decline post hospitalization for acute CVA	10%
Functional decline associated with degenerative neurologic disorder	0%
Gait abnormality/unsteady gait/frequent falls	4%
Other	20%
Prior experience with exercise	82%
Cognitively impaired	20%
Depressed	24%
Adherence at 1 month	
Adherent	72%
Withdrawn	12%
No report	16%

Table 3. Verified Medical Diagnoses

Diagnosis	n	%
Hypertension	44	88
Angina	4	8
Myocardial infarction	5	10
Heart failure	11	22
Cardiac arrhythmias	15	30
Peripheral arterial disease	5	10
Stroke	15	30
COPD or asthma	11	22
Diabetes	16	32
Arthritis or gout	3	6
Osteoporosis	14	28
Fractures		
Lower extremity	13	26
Vertebral	5	10
Degenerative discs	3	6
Spinal stenosis	4	8
Gastrointestinal disease	28	56
Gall bladder disease	17	34
Liver disease	1	2
Kidney disease	18	36
Seizure disorder	3	6
Dementia	4	8
Parkinson's disease	3	6
Anemia	11	22
Eye disease		
Untreated cataracts	1	2
Glaucoma	2	4
Other	1	2
Cancer, non-skin	11	22

tive joint replacement, resumption of chemotherapy, and acute care admission for pulmonary embolus), 1 was excluded because her responses on the home exercise log indicated that she did not understand how to use it (MMSE score of 17, low for her 12th grade education), and 2 withdrew by personal request (including 1 participant who reported that her significant other was terminating their relationship, causing her great emotional distress, and 1 participant with a verified medical diagnosis of dementia).

There was little variability in participants' responses to the items that comprised the AESOP. According to Streiner and Norman, items for which 1 alternative has a very high (greater than 95%) or low (less than 5%) endorsement rate are eliminated.²⁶ For all but 4 items, the endorsement rate for the response option strongly disagree was 0%. For the other 4 items, the endorsement rate for the response option strongly disagree was 2%. Thus, all 42 items of the AESOP failed this psychometric criterion. Endorsement rates for the response option disagree ranged from 0% to 8%, and for only 6 items was the endorsement rate for this response option 5% or greater. By contrast, endorsement rates for the response options agree and strongly agree were high, ranging from 24% to 68% for agree and 24%

to 74% for strongly agree. Considering the response options of agree and strongly agree together, the range of the sum of the endorsement rates for these 2 response options was 74% to 100%. Thus, most participants agreed or strongly agreed with all of the items of the AESOP, and the trend was so strong that there was little to be learned by knowing how an individual participant actually responded.

For the yea-saying indicator, 20 participants endorsed agree and 5 participants endorsed strongly agree, suggesting that fully half of participants demonstrated a yea-saying effect. Two participants endorsed strongly disagree, 11 participants endorsed disagree, and 12 participants endorsed no opinion. The yea-saying item demonstrated test-retest reliability (ICC [3,1]=0.651), suggesting that the yea-saying trait was marginally stable. For the overall appraisal of exercise, 19 participants endorsed like and 21 participants endorsed strongly like, indicating that most participants (80%) viewed exercise positively. Four participants endorsed dislike, and 6 participants endorsed no opinion.

Two constructs (self-efficacy expectations and outcome expectations) demonstrated test-retest reliability (ICC [3,1]=0.796 and 0.771, respectively), while the third (outcome expectancies) did not (ICC [3,1]=0.328). There was no association between any of the 3 constructs and the 2 scales of the SF-12v2 (Table 4).

Table 4. Spearman Correlations Between 3 Social Cognitive Theory Constructs and the SF-12v2 Physical Component Summary Scale (PCS-12) and Mental Component Summary Scale (MCS-12)

Variables	Correlation	p value
Self-efficacy expectations and PCS-12	0.13	0.38
Self-efficacy expectations and MCS-12	0.01	0.97
Outcome expectations and PCS-12	-0.01	0.93
Outcome expectations and MCS-12	-0.06	0.68
Outcome expectancies and PCS-12	-0.04	0.78
Outcome expectancies and MCS-12	-0.09	0.55

Scores on the self-efficacy expectations and outcome expectations scales of the AESOP did not predict exercise adherence. Though scores on the AESOP tended to be high (mean 62.1, range 31-75, sd 8.9 for the self-efficacy expectations scale; mean 67.7, range 53-80, sd 7.4 for the outcome expectations scale), there were low scorers. Excluding participants who were withdrawn, the 24 lowest scorers on the self-efficacy expectations scale adhered. Likewise, the 16 lowest scorers on the outcome expectations scale adhered. All 8 non-adherers scored above the mean for the self-efficacy expectations scale. Thus, the low scorers adhered, and the non-adherers came from among the higher-scoring participants. Analysis using the point biserial correlation revealed a significant negative

correlation between self-efficacy expectations scale scores and adherence ($r_{pb}=0.370$, $p=0.014$) and outcome expectations scale scores and adherence ($r_{pb}=0.434$, $p=0.003$).

DISCUSSION

A major problem with interpreting the results of this study lies in the overwhelming positive response bias of participants. The positive skew toward the upper end of the scale meant that the response options at the lower end of the scale (ie, strongly disagree, disagree) were rarely used. To compensate for positive skew, Streiner and Norman suggest a different scaling approach in which the number of response options at the lower end of the scale is reduced and the number of response options at the upper end of the scale is increased in the hopes of distributing the positive responses over a greater number of response options.²⁶ Another scaling consideration is that the items themselves are biased in the same direction, which may have contributed to the positive skew. However, Streiner and Norman assert that it is undesirable to word some questions positively and some negatively because of research demonstrating problems with negatively-worded items (eg, reversing the polarity of an item does not necessarily reverse the meaning).²⁶ Using a scaling approach in which the response options available at the upper end of the scale are expanded may address this issue as well. Unintentional examiner influence during testing sessions may have been another contributing factor to the positive response bias of participants since the examiner could often see the answers being marked during the administration of the AESOP. This problem may have contributed to the yea-saying effect and could be addressed in future studies by structuring the testing environment such that the examiner is unable to see participants' answer sheets (eg, the use of a hooded clipboard).

There were other limitations of the study as well. The sample was not diverse, composed largely of Caucasian women. Also, there was potential for a selection effect in this sample, in 2 ways. First, the physical therapists who identified prospective participants to the first author may have preferentially identified patients whom they judged to be adherent despite having received repeated instructions to identify all prospective participants who met criteria. Second, prospective participants with negative attitudes towards exercise may have preferentially declined to participate in this study on exercise adherence. Indeed, 14 prospective participants refused to participate; however, this number represents a relatively small percentage (13.7%) of the overall pool of prospective participants who were not converted to participants (102). (Other reasons for lack of conversion from prospective participant to participant included failure to meet all inclusion criteria [29, 28.4%], having met at least 1 exclusion criterion [16, 15.7%], inability to be contacted by phone [14, 13.7%], inability of the first author to schedule the testing session for the prospective participant [11, 10.8%], failure of the treating physical therapist to identify the prospective participant to the first author within the 14-day testing window [10, 9.8%], inability of a willing prospec-

tive participant to schedule the testing session or prospective participant cancellation of a scheduled testing session [7, 6.9%], and inability of the first author to test a willing prospective participant due to inclement weather [1, 1.0%].) Thus, the impact of any selection effect due to prospective participant refusal was likely only modest. This finding is especially significant because of participants' high scores on the 3 scales of the AESOP, high adherence, and positive overall appraisal of exercise.

The attempt to create a new measure for exercise outcome expectancies was unsuccessful since that scale of the AESOP did not demonstrate test-retest reliability, suggesting that this construct is not stable in older adults after discharge from home health physical therapy. While the self-efficacy expectations and outcome expectations scales did demonstrate test-retest reliability, they did not demonstrate construct validity since there was no association between them and the 2 scales of the SF-12v2, nor did they demonstrate predictive validity. Because low scorers adhered and some high scorers did not adhere, it is possible to infer that self-efficacy expectations and outcome expectations are not important in exercise adherence in older adults after discharge from home health physical therapy. Even if those participants who did not return their home exercise logs (and were therefore treated as reporting non-adherence) actually did adhere, it remains problematic that low scorers adhered. Also, if high scorers' scores were inflated by a yea-saying effect, it again remains problematic that low scorers adhered. However, any inference that self-efficacy expectations and outcome expectations are not important in exercise adherence in older adults after discharge from home health physical therapy must be tempered by the positive response bias of participants.

The reported adherence rate of 72% at 1 month (81.8%, adjusted for participants who were withdrawn) was unexpectedly high given the lack of ongoing contact with a physical therapist for encouragement that characterized other studies.⁴⁻⁶ However, the report period in these studies was longer at 1 to 2 years. It is possible that adherence in this sample declined after 1 month. It is also possible that, at 1 month, there was a positive effect due to participants' knowing that they were enrolled in a study on exercise adherence. Furthermore, self report may lead to higher scores through 2 mechanisms. First, participants can report adherence at a falsely high rate (eg, by reporting that they performed the HEP on a given date when in fact they performed only part of it). Second, the reporting method for adherence to the HEP (ie, self monitoring by diary) may itself enhance adherence. However, the method of self report used in this study was consistent with that used in other studies.⁴⁻⁶ The fundamental issue was likely the short length of time over which adherence was assessed. The low number of non-adherers indicates the need for extending the assessment of adherence to 6 to 12 months, when presumably the number of non-adherers would increase.

It must also be considered that other health behavior constructs are important in rehabilitation-based exercise. There was evidence to support the selection of self-efficacy expectations and outcome expectations as constructs to examine in the cur-

rent study, as Resnick found that they predicted exercise adherence in community-dwelling, more mobile older adults.^{13,15,16} Also, Forkan et al noted that outcome expectations did predict exercise adherence in a rehabilitation sample of older adults who attended hospital-based outpatient physical therapy programs to address a history of falls or near-falls, an increased risk of falls, or restricted activity levels due to fear of falling.³⁵ It is likely that participants in the current study were more medically involved and less mobile than those in the Forkan study since participants in the current study were homebound (ie, unable to access physical therapy services as outpatients). Indeed, in the current study, scores on the PCS-12 tended to be low, suggesting that participants tended to view their physical functioning lower than the general population of older adults. In more medically involved, less mobile older adults, other health behavior constructs may be more useful. Forkan et al found that barriers appeared to predict adherence to a HEP in older adults with impaired balance.³⁵ Health behavior constructs that involve barriers include the construct of perceived barriers from the Health Belief Model and the constructs of control belief and perceived power from the Theory of Planned Behavior.

There is evidence that exercise adherence in more medically involved older adults is influenced by different factors than that in well older adults or the general population of older adults. Poor health status is an important correlate of physical inactivity in older adults. Specific predictors include poor perceptions of overall health, presence of chronic diseases, depressive symptoms, injuries, activity and mobility limitations, pain, and fear of pain.³⁶ While poor health status negatively impacts exercise adherence, there may also be unique facilitating factors present in older adults who are undergoing physical rehabilitation. For instance, the exercise is prescribed as part of their medical care, so they may be more likely to feel compelled to exercise. Also, older adults who are undergoing physical rehabilitation may be biased to believe that exercise will benefit them because they have been told so by their health care providers. Finally, they may feel confident that they can perform the HEP because it was customized to their level of function.

Zinn discusses 3 factors that make adherence in rehabilitation unique: the presence of an acute phase as well as a chronic phase, both of which involve distinct characteristics; high rates of physical or cognitive impairments; and the social stigma attached to handicap. She also discusses the epidemiology of disability and risk factors for non-adherence, including demographic characteristics, personality factors, mood disorders, frailty, and social support.³⁷ The current study underscores the need for future research to explore factors that are uniquely important to exercise adherence in older adults who are undergoing physical rehabilitation.

Other variables to assess in future research on exercise adherence with rehabilitation samples of older adults include such exercise parameters as level of difficulty of exercises, number of repetitions, frequency, and number of exercises comprising the HEP. Finally, it should be noted that we did not assess

whether participants continued to receive other home health services (eg, nursing) and thus remained homebound after discharge from physical therapy, whether participants were discharged from the home health agency but continued to meet criteria for homebound status, or whether participants were discharged from the home health agency and no longer met criteria for homebound status. These variables illustrate the inherent complexity of conducting research involving both exercise and older adults who require home health services.

CONCLUSIONS

Overall, this sample reported high exercise self-efficacy expectations, outcome expectations, and outcome expectancies, high adherence, and a positive overall appraisal of exercise, though there was evidence of a yea-saying effect. However, while the self-efficacy expectations and outcome expectations scales of the AESOP demonstrated test-retest reliability, the outcome expectancies scale did not. Furthermore, participants' scores on the AESOP did not predict adherence. Thus, while previous studies have shown that questionnaires based on SCT constructs predict exercise adherence in samples of community-dwelling older adults, the current study did not establish such a relationship in older adults after discharge from home health physical therapy. Though the findings are essentially negative, the overwhelming positive response bias of participants makes it impossible to determine whether other factors are involved in rehabilitation samples of older adults or whether there were simply methodological problems in the current study that prevented the desired relationship from being demonstrated. To maximize the ability of questionnaires based on health behavior constructs to predict adherence, future studies should address scaling issues, attain more diverse samples, and increase sample size and time of follow up.

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