Improved Fall-Related Efficacy in Older Adults Related to Changes in Dynamic Gait Ability

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Background. Low fall-related efficacy is associated with the number and severity of future falls in older adults with balance disorders.

Objective. The purpose of this study was to examine whether improvements in clinical measures of balance after an intervention program were associated with changes in efficacy.

Design. A prospective, nonexperimental, pretest-posttest design was used.

Methods. Sixty-three people (43 men, 20 women; mean [±SD] age=76.6±4.9 years) with a history of at least 2 falls in the previous 12 months were enrolled between 2004 and 2008 to participate in a 12-week home exercise program. Balance deficits were identified using the Berg Balance Scale (BBS) and the Dynamic Gait Index (DGI), and participants were evaluated monthly. Hierarchical linear regression was used to assess the relationship between measures of balance (BBS and DGI) and efficacy (Falls Efficacy Scale) before intervention. A second model examined the relationship between changes in balance and changes in efficacy after participation in the program.

Results. Preintervention scores of efficacy were significantly associated with age, depression, and BBS and DGI scores. After controlling for age, depression, and strength (force-generating capacity), BBS and DGI scores together accounted for 34% of the variance in preintervention efficacy. Significant improvements were noted in efficacy, BBS and DGI scores, and depression after intervention. When controlling for preintervention efficacy and changes in depression, the changes in DGI and BBS scores together explained 11% of the variance in the change in fall-related efficacy; however, only DGI scores contributed uniquely.

Limitations. These results are tempered by the absence of a control group to examine the role of time on changes in efficacy.

Conclusions. The results suggest that increased emphasis on mobility during rehabilitation leads to improved confidence to perform activities of daily living without falling.

Approximately one third of adults over 65 years of age fall each year.[1] Many older adults have psychological consequences after falling,[1-4] and these consequences may be as disabling as the fall itself.[5] A commonly expressed psychological consequence is loss of confidence,[6] which may lead to decreased mobility and activity restriction.[7] Such reduction in activity results in physical deconditioning,[8] social isolation,[9] depression,[9,10] and reduced quality of life.[9,10]

Loss of confidence is closely related to self-efficacy.[4,11] When related to falls, *self-efficacy* is defined as "perceived self-efficacy or confidence at avoiding falls."[(p P239)] Fall-related efficacy has been associated with older adults' functional status.[5,12] According to longitudinal studies, low levels of initial fall-related efficacy were associated with self-reported performance of activities of daily living (ADL) over a 1-year period.[5,11] Myers et al[11] indicated that fall-related efficacy is related to older adults' current activities rather than to their past falls experience. They also reported that lower fall-related efficacy was related to decreases in self-reported performance of ADL tasks such as bathing, grooming, dressing, eating, transfers, and using a toilet and in perceived quality of life, especially physical functioning, over a 1-year period.[11] In addition, balance confidence has been shown to be associated with both the rate of future falls[5,11,13] and fall severity in older community-dwelling adults.[13]

In contrast, studies examining associations between fall-related efficacy and specific measures of balance are less common. Those studies relating confidence to static posturography[11] and single-leg stance[14] showed that higher confidence was associated with lower amounts of postural sway. Hatch et al[15] reported that Berg Balance Scale (BBS) scores accounted for 57% of the variance in balance confidence, with better BBS scores associated with higher confidence.

Consequently, changes in fall-related efficacy would be a desirable consequence of an intervention program. A recent systematic review[16] identified 13 studies in which fall-related efficacy was the primary outcome measure used. Of those 13 studies, 67% of those using a single exercise intervention showed a positive result, and 71% of studies using a multifactorial approach showed significant improvements in fall-related efficacy. Improvements in mobility and balance, however, may not always translate into improvements in fall-related efficacy.[4]

There were 2 primary goals of this study. First, we wanted to extend previous work to determine the relationships between fall-related efficacy and commonly used clinic-based measures of balance performance not previously reported. We hypothesized that greater scores on tests of balance would be associated with greater levels of confidence that ADL tasks could be performed without falling. We believed that this relationship would be apparent after accounting for other factors associated with efficacy, such as depression,[12] and for physical and demographic characteristics.

Second, we hypothesized that improvements in balance performance after a rehabilitation intervention would be associated with increases in confidence that activities could be performed without falling. We were specifically interested in changes in clinical balance measures. Consequently, we examined the relationship between changes in balance and fall-related efficacy after 12 weeks of participation in a rehabilitation intervention program.

Method

Setting and Participants

Participants were recruited using fliers posted in the offices of geriatricians and at community and fitness centers in north Florida. Additionally, presentations were given through county extension offices and health fairs, recruitment began in 2004, and the final participant completed the program in 2008. Inclusion criteria were: having fallen at least twice in the previous 12 months, the ability to walk 6.1 m (20 ft) with or without an assistive device, the ability to follow simple commands, clearance to exercise from the participant's primary care physician, and a score of 24 or higher on the Mini-Mental Status Examination (MMSE). Prospective participants were excluded if the primary cause of falling was determined to be related to polypharmacy, orthostatic hypertension, dementia, or vestibulopathy. These patients were referred to the appropriate medical professional. All participants read and completed an informed consent form approved by the University of Florida Institutional Review Board and the VA Subcommittee for Clinical Investigation.

Procedure

All participants were examined by a physical therapist using a standardized battery of tests and measures. These tests and measures are listed in Table 1. The initial examination and exercise prescription took approximately 2 hours for each participant. Follow-up examinations were

Table 1.
Tests and Measures (With Range of Possible Scores) Performed During the Initial Examination

Psychological Measures	Performance Measures
Mini-Mental Status Examination[33] (0–33)	Berg Balance Scale[34] (0–56)
Geriatric Depression Scale[19] (0–15)	Dynamic Gait Index[35] (0–24)
Visual analog scale for pain[36] (0–100 mm)	Timed Movements Battery[37] (time in seconds)
Falls Efficacy Scale[2,12] (0–100)	Timed Up and Go[38] (time in seconds)
	2-minute walk[39] (distance in meters)
	Isometric strength measures[21] (force in kilograms)

shorter and generally took between 1 and 1½ hours. After the initial evaluation, patients received instruction in a home exercise program tailored to the individual. Each patient then performed the home exercise program and returned to the clinic for monthly follow-up evaluations. The final evaluation occurred after 12 weeks. The same physical therapist performed all of the participant evaluations. This therapist performed each of these evaluations masked to the results of the previous evaluation. The therapist also determined the home exercise program and progressed it according to the findings of the monthly evaluations.

Intervention

Home exercises were developed using a decision tree model. If the patient demonstrated problems with stabilization (assessed using items from the BBS) or weakness in the hip abductor, quadriceps, plantar-flexor, or dorsiflexor muscles, specific strengthening exercises were developed for those muscle groups. If the patient was unable to walk farther than 152.4 m (500 ft) in 2 minutes, he or she was placed on both an endurance training program for walking and an interval training program focused on the goal of achieving the ability to walk for at least 20 minutes without stopping.

The Bottom Line

What do we already know about this topic?

Fall-related efficacy describes how confident a person is that he or she can complete an activity without falling. This type of efficacy is related to the number and severity of future falls that an older adult will experience. Fall-related efficacy also is related to balance in general.

What new information does this study offer?

Improvements in fall-related efficacy that occur during rehabilitation appear to be strongly related to improvements in dynamic abilities, such as walking with head turns and changes in walking speed and direction.

If you're a patient, what might these findings mean for you?

These findings might mean that practicing dynamic activities, such as walking and changing your posture while you are walking, will improve your confidence more than practicing simpler balance activities.

During interval training, participants were trained in walking agility, including fast and slow walking, walking backward, walking and turning in various directions, stopping and starting frequently, and walking while carrying objects. Feedback-based balance control was progressed by having participants train while standing on hard and foam surfaces with eyes open and closed and progressing the difficulty of balance by reducing the base of support on these surfaces and increasing the movement of the head and arms. The programs also were progressed by requiring walking on a variety of uneven surfaces, inclines, and stairs. The exact exercises taught to the participants varied; however, each home exercise program was progressed such that the amount of time required to perform the exercises was approximately the same for all participants.

Measures

The primary measures of interest for this study were the Falls Efficacy Scale (FES), the BBS, and the Dynamic Gait Index (DGI). Secondary measures were the short-form Geriatric Depression Scale (GDS) and lower-extremity strength (force-generating capacity). The FES was administered by a research assistant who did not participate in the BBS, DGI, or strength measurements. The GDS was completed independently by each participant.

Fall-related efficacy was assessed using the FES.[2,12] The FES is a 10-item scale used to assess an individual's confidence in performing various activities without falling. Examples of the items include hurrying to answer the telephone, walking one block, climbing a flight of stairs, and reaching into a cabinet. Participants were asked to rate on a scale of 0 ("no confidence") to 10 ("complete confidence") how confident they were that they could perform a variety of common tasks, such as preparing a meal or dressing themselves without falling. The reliability and validity of FES scores have been demonstrated previously.[12] Higher scores indicate more confidence that activities can be performed without falling.[12]

The BBS is a widely used tool developed to assess balance in elderly patients within a clinical setting. The test consists of 14 items that are rated by the evaluator using a 5-point Likert scale, ranging from 0 (indicating the lowest level of function) to 4 (the highest level of function). Total scores range from 0 to 56 points. The higher the score, the more independent the patient is in tasks of balance. The BBS has been found to be internally consistent and to have a high degree of interrater and intrarater reliability.[17] Some examples of the tasks are: sit-to-stand, standing unsupported with eyes open, standing unsupported with eyes closed, picking an object up from the floor, and standing on one leg.[17]

The DGI is an 8-item index created by rating the participant's performance on the following tasks: walking on a level surface, changing speed while walking, turning the head to the side and up and down while walking, sudden turns, and obstacle and stair negotiation. The total score ranges from 0 to 24, with higher scores indicating greater independence in dynamic gait-related activities. For patients with balance disorders, the intraclass correlation coefficients for gait-related parameters of the DGI range from .75 (turn and stop) to .98 (negotiating obstacles), indicating that patients perform these tasks reliably.[18]

The GDS is a survey instrument used to rate depression in elderly patients that consists of 15 questions. The GDS has been shown to have a high internal consistency.[19,20] Any participants who scored greater than 7 out of 15 were counseled to seek formal evaluation from a local area mental health professional.

Isometric testing of lower-extremity strength of the hip abductor, knee extensor, and ankle plantar-flexor and dorsiflexor muscles was done bilaterally using a handheld dynamometer. For strength testing of the hip abductors, each participant was positioned supine while holding the edge of a plinth table, with the dynamometer immediately cephalad to the lateral malleolus and with the hip in neutral. During testing of the ankle plantar flexors, the participant was positioned supine with a towel roll under the posterior calf and the dynamometer placed against the plantar aspect of the first and second metatarsal heads. To test the quadriceps muscles, the participant sat at the edge of the plinth table with the knee in 90 degrees of flexion. The dynamometer was placed midline between the malleoli on the anterior surface of the distal leg. Ankle dorsiflexor muscles also were tested with the participant in a sitting position so that the knee was maintained at 90 degrees of flexion and the feet were flat on the floor. The dynamometer was placed on the dorsal surface of the foot and the participant was asked to push up into the dynamometer.[21] Three repetitions of each test were performed, and the average of the peak isometric test was recorded. Reliability of handheld dynamometry has been reported as greater than .90 at the hip,[22] knee,[23] and ankle.[24]

Data Analysis

Eight strength measurements were collected for each participant. A principal component factor analysis with Varimax rotation was performed to reduce the number of strength variables. Eigenvalues greater than 1 were considered the threshold to retain as a factor for further analyses.

The association among preintervention demographic variables, psychological contextual variables, and balance variables with preintervention FES scores was examined using Pearson product moment correlations. Multicollinearity among all of the potential predictors (demographic and balance variables) was assessed by first examining the correlation coefficients. Any pair of variables with a correlation coefficient of .85 or higher was considered collinear.

The relationship of preintervention DGI and BBS scores to preintervention FES scores was tested using hierarchical linear regression. We chose this analysis so that we would be able to determine the unique contributions of each variable block to the total variance explained by the model. The first block accounted for demographic factors associated with the FES. The second block included the baseline measures of the BBS and DGI.

To examine predictors of change in FES scores over time, we built a second hierarchical regression model using the change in FES scores as the dependent variable. Changes in depression and DGI and BBS scores were assessed using the Wilcoxon rank sum test, and variables with significant pretest-posttest changes were used to build the regression model. Preintervention scores on the FES and change scores in depression were entered as the first block, followed by change scores on the BBS and DGI in the second block.

Both models also were run in reverse order to assess the impact of the order of entry. Additionally, variance inflation and tolerance were examined to test for effects of collinear variables. Type 1 error was maintained at 5%. All calculations were done using SPSS version 15.*

* SPSS Inc, 233 S Wacker Dr, Chicago, IL 60606.

Table 2.
Demographic Variables and Psychological and Performance Measures (n=63)

Variables/Measures	Preintervention	Postintervention	P
Age (y), X̄ (SD)	76.0 (6.9)		
Sex			
Female	20		
Male	43		
Falls Efficacy Scale, X̄ (SD)	68.1 (23.9)	72.5 (23.9)	.028
Geriatric Depression Scale, X̄ (SD)	3.0 (3.7)	0.7 (0.3)	.026
Berg Balance Scale, X̄ (SD)	37.1 (9.6)	42.4 (10.1)	<.001
Dynamic Gait Index, X̄ (SD)	11.8 (4.7)	14.5 (6.1)	<.001

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Results

Seventy-four individuals were screened and enrolled in this study. Of these individuals, 11 were not eligible to participate, as they did not meet our inclusion criteria for the study. The most common reasons for screening failure were that the individual did not meet the minimum score of 24 on the MMSE and that the individual had not fallen twice in the past 12 months. Sixty-three participants (43 men, 20 women; mean [±SD] age=76.6±4.9 years) were enrolled and completed at least 2 examinations over the course of this experiment. Thirty-one participants completed an evaluation at 12 weeks. We used a last-value-forward intention-to-treat approach for analyses related to intervention. Preintervention measures and demographic data are summarized in Table 2.

The 8 limb strength variables were reduced to 3 factors, which accounted for 65% of the cumulative variance in strength measurements. In factor 1, the quadriceps and ankle dorsiflexor muscles had weights greater than 0.7. In factor 2, the hip abductors had weights greater than 0.7. In factor 3, the ankle plantar flexors had weights greater than 0.8. These factors were not correlated with each other, suggesting separate loading for each combination of strength variables.

Preintervention FES scores were significantly associated with age, depression, BBS scores, and DGI scores but not limb strength. These data are summarized in Table 3. Based on the results of the simple correlations, the regression model examining the relationships of the preintervention measures to FES was built using age and depression as the first block and the BBS and DGI scores as the second block. Demographic and psychological variables alone accounted for 18% of the variation in FES scores. The addition of BBS and DGI

Table 3.
Bivariate Pearson Product Moment Correlations Among the Preintervention Variables[a]

Variable	Age	BBS	DGI	GDS	Quadriceps/ Dorsiflexor Muscle Factor	Hip Abductor Muscle Factor	Plantar-Flexor Muscle Factor
FES	.287	.538	.638	−.416	.158	.267	.222
	.050	<.001	<.001	.003	.331	.096	.169
Age		−.065	−.14	−.077	.03	−.507	.023
		.637	.318	.569	.847	.001	.884
BBS			.790	−.364	.278	.288	.497
			<.001	.006	.064	.055	.001
DGI				−.224	.275	.450	.184
				.103	.071	.002	.233
GDS					−.005	−.124	−.232
					.973	.423	.130
Quadriceps/dorsiflexor muscle factor						.000	.000
						1.000	1.000
Hip abductor muscle factor							.000

[a] BBS=Berg Balance Scale, DGI=Dynamic Gait Index, GDS=Geriatric Depression Scale, FES=Falls Efficacy Scale.

scores into the model accounted for an extra 34% of the variance in FES scores; however, only DGI scores contributed significantly. The total model explained 52% of the variance in preintervention FES scores. Variance inflation and tolerance measures suggested that including both DGI and BBS scores in the model did not inflate error estimates for the model parameters. This model is shown in Table 4.

Given the strong association between preintervention scores on the BBS and DGI, we made a *post hoc* decision to use hierarchical regression techniques to test 2 additional models. Demographic variables remained in the first block for both regression models. Next, we entered BBS and DGI scores in their own separate blocks. In the first model, we entered BBS scores and then DGI scores. We reversed the order of this entry in the second model. These models also are shown in Table 4. In the first model, adding information from the DGI explained 15% of the variance, after accounting for the variance in FES scores explained by age, depression, and BBS scores. In the second model, adding BBS scores after already accounting for age, depression, and DGI scores did not explain any additional variance in FES scores.

After intervention, significant improvements were noted for the FES (P=.028), the BBS (P<.001), the DGI (P<.001), and depression (P=.026). A change of 8 points or greater on the BBS has been reported as an indicator of functional change in community-dwelling older adults.[25] Sixteen participants demonstrated such increases on the BBS. In addition, 19 participants increased at least 3 points on the DGI. This value represents the minimal detectable change in community-dwelling elderly people.[26]

Table 4.
Hierarchical Regression Model Predicting Preintervention Levels of Fall-Related Efficacy[a]

Model	Variable	Standardized Coefficient	t	P	Adjusted R^2 Change	Significant F Change
Total model						
Step 1	Constant		0.605	.549	.182	.005
	Age	.211	1.536	.132		
	GDS	−.379	−2.765	.008		
Step 2	Constant		−0.969	.338	.338	>.001
	Age	.272	2.573	.014		
	GDS	−.262	−2.359	.023		
	DGI	.626	3.692	.001		
	BBS	−.035	−0.201	.842		
Model A						
Step 1	Constant		−1.009	.319	.376	.005
	Age	.253	2.100	.042		
	GDS	−.230	−1.824	.075		
	BBS	.469	3.784	.000		
Step 2	Constant		−0.969	.338	.145	.001
	Age	.272	2.573	.014		
	GDS	−.262	−2.359	.023		
	BBS	−.035	−0.201	.842		
	DGI	.626	3.692	.001		
Model B						
Step 1	Constant		−1.095	.280	.531	<.001
	Age	.272	2.607	.013		
	GDS	−.256	−2.414	.020		
	DGI	.600	5.742	.000		
Step 2	Constant		−0.969	.338	.001	.825
	Age	.272	2.573	.014		
	GDS	−.262	−2.359	.023		
	DGI	.626	3.692	.001		
	BBS	−.035	−0.201	.842		

[a] These models include all of the participants' preintervention examination results (n=63). The total model includes the Dynamic Gait Index (DGI) and Berg Balance Scale (BBS) as a single modeling block. Models A and B enter these constructs separately and in reversed order. All models explain 52% of the variance in fall-related efficacy. GDS=Geriatric Depression Scale.

To examine these relationships after intervention, a regression model was built with change in FES scores as the dependent variable. Changes in depression over 12 weeks and in preintervention FES scores were entered as the first block, and changes in BBS and DGI scores were added as the second block. In this model, changes in DGI and BBS scores explained 11% of the variance beyond that explained by the preintervention FES scores and change in depression alone; however, only DGI scores contributed uniquely (P=.012). This complete model is shown in Table 5.

When the primary regression analyses were performed using the re-

Table 5.
Hierarchical Regression Model Predicting Change in Fall-Related Efficacy[a]

Model	Variable	Standardized Coefficients	t	P	Adjusted R^2 Change	Significant F Change
Step 1	Constant		3.037	.004	.153	.060
	Age	.059	0.398	.692		
	Change in GDS scores	.101	0.731	.468		
	Preintervention FES scores	−.365	−2.635	.012		
Step 2	Constant		2.929	.005	.119	.021
	Age	.030	0.212	.833		
	Change in GDS scores	.035	0.263	.794		
	Preintervention FES scores	−.368	−2.794	.008		
	Change in BBS scores	−.229	−1.353	.183		
	Change in DGI scores	.448	2.618	.012		

[a] The total model explains 27% of the variance in change in fall-related efficacy (n=63). GDS=Geriatric Depression Scale, DGI=Dynamic Gait Index, BBS=Berg Balance Scale.

versed order of entry, DGI scores, age, and depression remained significant predictors of preintervention FES scores, and change DGI scores and preintervention FES scores predicted change in FES scores after intervention, confirming the forward-entry models. Therefore, the parsimonious model predicting preintervention FES scores included DGI scores (β=0.6, P<.001), age (β=0.27, P=.013), and depression (β=−0.26, P=.020). The parsimonious model predicting change in FES scores after intervention included only the preintervention FES scores (β=−0.23, P=.046) and the change in DGI scores (β=0.44, P=.001).

Discussion

We had originally hypothesized that fall-related efficacy would be related to measures of balance. The primary finding of this study was that, when considered together, fall-related efficacy was statistically related to performance on the DGI but not the BBS. This finding was true for fall-related efficacy in this group of community-dwelling adults prior to participating in the exercise program, and improvement in DGI scores was a statistically significant predictor of improvement in fall-related efficacy.

These relationships might be due to several factors. The first factor that might explain these relationships is the strength of the association between BBS and DGI scores in our participants. Although this association did not violate any of the collinearity metrics that we used in our analyses, there remains the strong possibility that the fall-related efficacy is simply related to the general construct of balance rather than either piece individually. To examine this association in more detail, we built additional models in which we entered BBS and DGI scores separately. Our interpretation of the results is that, although there is overlap between the measures, it appears that DGI performance can contribute additional information to fall-related efficacy above that of the BBS alone. In contrast, if DGI performance is already considered, there is little extra variance in FES scores that is explained by adding information from the BBS. Preintervention associations suggest that the BBS and DGI share approximately 62% of the variance. Our results indicate that of the variance in BBS and DGI scores that is not shared, a greater proportion of the DGI scores is related to FES scores.

A second factor to explain the relationship of fall-related efficacy to DGI scores alone could be the types of items on the tests of balance and the measure of fall-related efficacy used in this study: the FES. The FES asks how confident a person feels that he or she can perform an ADL task without falling. Examples of these activities are walking around the house, answering the door or telephone, and getting in and out of bed. The BBS contains several dynamic items, the majority of which involve the participant remaining within a finite area. For example, during the BBS assessment, participants perform tasks such as sitting and standing unsupported on different surfaces and with eyes open and closed, reaching to retrieve an item from the floor, and other tasks such as looking over a shoulder and turning a full circle. In contrast, the DGI consists of a series of tasks that require more walking and movement, including stair climbing, crossing and negotiating obstacles, and walking while turning to look to the side, as well as up and down. We speculate that as the items on the FES could be argued to be predominantly mobility related, the association with the DGI is one that makes sense.

This argument also should be valid when considering change in fall-related efficacy and change in scores on measures of balance. In this case, improvement in DGI performance was the only statistically significant predictor of change in FES scores (other than the preintervention FES scores). That is, improvement in tasks related to gait and mobility should improve confidence in performing ADL tasks requiring mobility. The results suggest that when individuals are asked to rate their confidence in performing daily activities without falling, they use dynamic activities as a reference to judge their ability. These findings suggest that emphasis on gait- or mobility-related items during rehabilitation might improve efficacy to a greater extent than less dynamic activities.

From a measurement perspective, the BBS and DGI are ordinal scales, although they are routinely analyzed as interval scales, as has been done in our analyses. This important distinction may have influenced the results of this investigation. In an ordinal scale, the contribution of each item to the final score is unknown. Averaging ordinal scores can result in a poor representation of the true measure of the group. Further investigation is needed to determine the contribution of each of the BBS and DGI items to a global measure of balance. Additionally, the relationship between fall-related efficacy and improvement of balance, in general, has not been determined. Could a certain amount of change in balance be needed to alter fall-related efficacy? People with low balance might exhibit low self-efficacy, and balance improvements should be matched with improvement in self-efficacy to determine the relationship. This relationship probably is not linear, and after a certain point increases in balance will not cause similar increases in self-efficacy.

In our current study, fall-related efficacy was moderately and negatively associated with scores on our measure of depression: the GDS. This association between fall-related efficacy and depression should be expected, based on prior work examining self-efficacy. For example, Bandura[27] suggested that a low sense of self-efficacy to control a situation can lead to depression. Additional work reports that "global" self-efficacy is related to depression and stressful life events.[28] Social self-efficacy is related to depression in older adults and adolescents. These links, however, may not all be unidirectional, with prior depression increasing the risk of experiencing stressful life situations and stressful events provoking depression.[29]

Interestingly, although depression significantly decreased over the course of treatment, for the group in our study, the change in depression was not related to improvements in FES. Depression is a complex disorder that is related to changes in the inflammatory state of the body and immune system[30] and to hormones such as serotonin and leptin.[31] Potentially, participation in an exercise program could lead to physiological changes that reduce depression. Given this association, we had speculated that individuals who participated in an exercise program also would experience a change in depression. The duration of this experiment may not have been long enough or the exercise intensity may have been too low for physiological changes to occur. Alternatively, the changes in participants' depression could have been the result of other factors (eg, social, financial) not at all linked to efficacy.

Although our preintervention model explained 52% of the variance in fall-related efficacy, the final model explained only 26% of the variance in the change in fall-related efficacy, suggesting additional factors should be considered. Bandura[32] suggested that efficacy is influenced by experience (personal and modeled), social influences, and physiological factors. Although we assessed several physiological factors and participants were able to experience changes in exercise and balance performance, we did not examine social support or the influence of peer opinion of the participants' performance. Additionally, we did not assess the expected or desired outcomes of the participants in this study. A future area of exploration for our group will be to examine the interaction among expectation, desire, and fall-related efficacy.

The primary limitation to this work was that a control group who did not participate in the program was not included. Our data indicate that changes in DGI scores are statistically related to changes in fall-related efficacy, not that participation in a physical therapist-designed intervention program will cause these changes. Additionally, the physical therapist performing the examinations also was the therapist who developed the home exercise program, potentially introducing bias into the results. Nonetheless, we suggest that addressing mobility and gait-related balance activities during an intervention program to remediate falling may improve fall-related efficacy.

Dr Bishop, Dr Patterson, and Dr Light provided concept/idea/research design and project management. All authors provided writing. Dr Bishop, Dr Patterson, and Dr Romero provided data collection. Dr Bishop provided data analysis. Dr Bishop and Dr Light provided fund procurement and facilities/equipment. Dr Light provided institutional liaisons. Dr Patterson, Dr Romero, and Dr Light provided consultation (including review of manuscript before submission).

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