A Home-Based Intervention to Improve Balance, Gait and Self-Confidence in Older Women

By: Kathleen Williams, Diane L. Gill, Brian Butki. and Byoung J. Kim

Williams, K., Gill, D.L., Butki, B. & Kim, B.J. (2001). A home-based intervention to improve balance, gait and self-confidence in older women. Activities, Adaptation and Aging, 24, 57-70.

Abstract:
Much of the current research focusing on the physical function of the elderly involves closely monitored interventions in group settings. Although home-based programs might be more appropriate for many older adults, little research is available. In this investigation, the authors tested a home-based exercise program targeting balance and mobility, and assessed concomitant changes in psychological well-being in healthy, active elderly. Twenty women (Mage = 83.2 years, range = 73-92 years) volunteered, with 6 non-exercise controls, 7 completing the 8-week program, and 7 dropping out. The three groups did not differ on any measures at pre-test. At post-test, exercisers and non-exercisers did not differ on balance, mobility, or psychological measures, but differences for preferred walking speed and step length approached significance. Pre-post comparisons indicated that exercisers significantly increased their activity levels, walked faster and were stronger following the intervention. Although large differences did not occur for outcome measures, participants reported that the training tasks were helpful. They became more proficient and confident, and provided useful information for modifying the tasks and improving efficacy of the training. Results suggest that home-based interventions have potential for improving and maintaining physical function in elderly adults.
KEYWORDS. Aging, exercise, balance, mobility

Article:
Exercise interventions to maintain or improve physical strength and functional abilities in older adults have been widely examined. Fiatarone et al. (1990, 1994) demonstrated increases in leg strength over 100%, gait velocity improvements around 12%, and some 80-90 year- old participants reported less reliance on walking aids. Ettinger et al. (1997) found that 18 months of aerobic or resistance exercise improved physical performance of elderly individuals with knee osteoarthritis. Participants also experienced less pain and physical disability.

Much of this work has been in organized, group exercise settings, with access to sophisticated exercise equipment, trained personnel and social support. Group programs might be inaccessible to some elders lacking transportation or availability; others may prefer not to exercise in groups. These elders might benefit from home-based exercise. Few of these interventions are reported in the literature. Several reasons are cited, including less cost-effective supervision of home-based programs, difficulty verifying the intensity level at which participants work, and cost constraints that limit the sophistication of equipment (King, Haskell, Taylor, Kraemer, & DeBusk, 1991). Despite limitations, home-based programs may be more accessible and appropriate for those interested in maintaining adequate activity and independence while exercising alone (Tinetti et al., 1994). At the least, home-based programs are a potential alternative for interested elders. This project investigated a home-based exercise program, which focused on balance and gait training, with concomitant assessments of psychological well-being. Improvements in balance might decrease the likelihood of falling, or reduce the magnitude of an injury once a fall occurs. Falling or fear of falling can lead to self-imposed restrictions in activity level (Gill, Williams, Williams, & Hale, 1998; Powell & Myers, 1995; Tinetti, Richman, & Powell, 1990). Billions of health-care dollars are spent each year on hospital and nursing home stays resulting from injuries due to falls. Programs that reduce the number or severity of falls can reduce health care costs and improve quality of life (MacRae, Dowling, Lachenbruch, & Tobis, 1993; MacRae, Feltner, & Reinsch, 1994).

Previous research focused on frail elderly residing in nursing facilities. Their initial low fitness nearly guarantees significant change. Interventions with elders living independently often yield non-significant results (MacRae et al., 1994; Reinsch et al., 1993), perhaps because most individuals over 65 are relatively healthy and continue to live independently.

A home-based, light- to moderate-intensity exercise intervention may meet physical and health needs while encouraging continuing participation by older adults. King et al. (1991) cite moderate to high exercise intensity levels as a cause of typical low retention and compliance rates and failure to complete exercise programs. Recent reports (Pate et al., 1995) recommend a lifestyle approach with moderate physical activity to maintain health and fitness.

Most interventions have focused on motor function, but psychological function and self-efficacy also are important (Gill et al., 1998; Tinetti et al., 1990). Considerable research demonstrates that self-efficacy or confidence in one's capabilities relates to performance of varied physical tasks as well as to preventive health behaviors (Bandura, 1986). Sallis et al. (1986) note a relationship between efficacy and physical activity in a community sample. We demonstrated earlier that self-efficacy was an important factor discriminating older women who had fallen from those who had not (Gill et al., 1998).

Continued research with healthy, community-dwelling elders has potential to improve quality of life and savings of health care dollars. Gill, Williams, and Tinetti (1995) and Guralnik, Ferrucci, Simonsick, Salive, and Wallace (1995) demonstrated that simple measures helped identify individuals at risk for loss of independence. The next challenge is to identify these individuals early, and provide interventions to minimize declines that can result in lengthy hospital stays or extended nursing care. Light- to moderate-intensity exercise, targeting systems related to functional independence (i.e., balance, mobility), may reduce or minimize declines often observed. The two goals of this 8-week intervention study were: (1) to pilot test exercises aimed at helping participants improve or maintain their balance and mobility; and (2) to examine the influence of balance and mobility training on self-efficacy and general well-being.

METHODS

Participants

Twenty women (M_{age} = 83.2 years, range = 73-92 years) participated in this investigation. Fourteen began as exercise participants (M_{age} = 82.2 years, SD = 5.2 years); six were non-exercise controls (M_{age} = 85.3 years, SD = 4.7 years).

Women were recruited from two senior residences in the Triad region of North Carolina. They read and signed a consent form verifying they were free of cardiovascular, orthopedic or other diseases that would preclude their safe participation.

Testing and Training Protocol

All participants were tested in the Biomechanics Laboratory at the University of North Carolina at Greensboro. Pre- and post-tests consisted of a series of motor tests and psychological inventories. Participants in the exercise group were visited in their homes by an assistant who taught them a series of low-to-moderate intensity balance and mobility exercises. They were encouraged to perform the exercises at least once a day, five days/week for eight weeks.

Motor Measures. The 14-item Berg Balance Test (Berg, Wood-Dauphinee, Williams, & Maki, 1992) was used to evaluate balance and mobility. Items include qualitative evaluations of unsupported standing, transfer, and reaching, with a maximum score of 56. Preferred and fastest walking speeds were measured as participants walked down a 3.15 m runway, breaking two photocell beams separated by 2 m. Three trials of each walking speed were recorded and averaged. Two trials of a composite mobility test including getting into and out of a chair, walking, and stair climbing and descent (Imms & Edholm, 1981) were timed and averaged. To measure step length and width, participants' shoes were moistened with a non-slip fluid and they walked across an absorbent runway, 3.15 m in length. Individual footprints were outlined and step length and width were calculated for three intervals and averaged. Two additional balance measures were taken, using a Kistler force platform. Participants performed two 15-second trials in which stationary sway was assessed and two additional trials where voluntary leaning was measured. For stationary sway, center of pressure was measured as participants stood quietly on the platform for 15-seconds.

For voluntary leaning, participants began in a neutral position, and leaned as far as possible in four directions (front, back, left, right), flexing only from their ankles, without falling, and without taking a step. Deviations (in centimeters) of the center of pressure from the initial position were computed in each direction and averaged across the four directions for each trial. The two trials for stationary sway and voluntary leaning then were averaged separately.

Psychological Measures. Self-efficacy was measured using the Activities-specific Balance Confidence (ABC) Scale (Powell & Myers, 1995), which assesses self-confidence in completing common, yet challenging tasks (reaching at eye level, walking in a crowd, etc.) without a loss of balance. The ABC Scale is particularly suitable for assessing loss of balance confidence in high functioning seniors.

We used two measures of psychological well-being. First, respondents used a set of ratings adapted from King et al. (1991) to evaluate their ability to concentrate, their satisfaction with body, mood, energy level, health, physical fitness, and sense of confidence using a 5-point scale (1 = poor, 5 = excellent). Ratings were summed for an overall health/well-being rating score. Life satisfaction was measured using the Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985). The SWLS includes five items, all of which assess global life satisfaction. Respondents indicated agreement with each item (1 = strongly disagree; 7 = strongly agree), and ratings were summed for a life satisfaction score.

Along with self-efficacy and well-being, we assessed participants' physical activity levels using O'Brien-Cousins (1996) Older Adult Exercise Status Inventory (OA-ESI). For the OA-ESI, respondents indicate how much time (in minutes) they spent in each of five work categories and 38 exercise/sport activities during the last week. The OA-ESI was administered in interview format during the testing sessions. Time in activity is weighted by exercise intensity to yield a weekly energy expenditure score.

Task Evaluation Measures. After the training tasks were explained, participants rated how confident they were they could perform the highest level (Table 1) of each of the 11 exercises (1 = not at all confident; 5 = very confident) and how difficult the exercise would be to perform (1 = not at all difficult; 5 = very difficult). These evaluations were completed after the tasks were demonstrated and again at post- testing. Finally, after completion of the post-test, we asked participants

TABLE 1

Example of Task Instructions and Progression for Home Exercise Program
Task: One Foot Stand

Instructions for Level 1: Stand behind a sturdy chair. Place your hands on the chair back. Bend your right knee behind you, as close to the buttocks as possible. Lean forward, slowly straightening your right knee as you lean. Return to upright standing position. Repeat 5 times. Switch to the left side.

Level 2. Place your hands on the chair back. Bend your right knee behind you, as close to the buttocks as possible. Lean forward, slowly straightening your right knee as you lean. Once extended, move your right leg out to the side as far as possible (like a scissors) and then return it to the starting position. Return to upright standing position. Repeat 5 times. Switch to the left side.

Level 3. Repeat the first exercise. This time, however, only touch the chair back lightly. Repeat 5 times. Switch to the left side.

Level 4. Repeat the second exercise. This time, however, only touch the chair back lightly. Repeat 5 times. Switch to the left side.

Level 5. Repeat the first exercise. This time, however, do not touch the chair as you lean. Repeat 5 times. Switch to the left side.

Level 6. Repeat the second exercise. This time, however, do not touch the chair as you lean. Repeat 5 times. Switch to the left side.

to evaluate the training tasks. Participants rated how helpful they found each task (1 = not at all helpful; 5 = very helpful). We also asked for comments and suggestions for improving the training program.

Balance and Mobility Intervention Tasks. The exercises were 11 activity progressions, graded from less to increasingly more challenging (specific exercise progressions are available from the authors–see Table 1). Mobility tasks included tandem and backward walking, and foam (an uneven, compliant) surface walking. Balance tasks included reaching to pick up objects from seated and standing positions and standing on one foot while moving the other leg. Participants also performed actions combining balance and mobility requirements, like getting into and out of a chair, followed by walking a short distance.

An assistant visited each participant in her home to provide training. Participants were given an illustrated notebook with exercise descriptions. The assistant explained and demonstrated each exercise and helped participants determine the appropriate level for their balance and mobility ability. Participants were asked to maintain a record of the specific exercises they completed during practice sessions using log sheets. The assistant contacted participants once per week to answer questions, clarify instructions and offer encouragement. They were visited in their homes every other week to make certain they were completing the exercises correctly, and to encourage them to increase their level of challenge.

RESULTS

Seven of the 14 exercise intervention participants completed the 8-week program; seven dropped out. One woman cited health problems, two preferred group exercise, and the remaining dropouts said the exercises required more time than they anticipated. Participants who completed the exercise intervention reported it took them an average of 40 minutes to complete the exercises and log sheets.

Members of the control group were invited to participate in the 8-week exercise program following their initial post-test. Five of the six control participants entered the exercise intervention (the sixth declined for health reasons). All five completed the 8-week program, reporting an average of 22 minutes per day to complete the exercises.

Motor and Psychological Measures. Because of the small *n* and exploratory nature of the study, we did not combine variables into a multivariate design. Instead, we examined each measure in a three-stage process. First, we compared the three groups, including the drop outs (*n* = 7), along with the treatment (*n* = 7), and control (*n* = 6) groups at pre-test. We then compared the treatment and control groups at posttest on each measure. Also, we combined the original treatment group with control participants who became a treatment group in the following 8 weeks. We compared pre- and post-treatment scores on all measures for this combined (*n* = 12) treatment group.

The comparison of three groups at pre-test yielded no significant differences on any motor task or psychological measure, and no comparisons approached significance. Because groups did not differ at pre-test, we compared the training and control groups at post-test on all measures (Table 2). Although we did not find any large differences, post-test group differences approached significance for preferred walking speed: $F(1,11) = 4.62$, $p = .055$ and for step length: $F(1,11) = 4.63$, $p = .054$.

We examined pre- and post-test differences within the combined training group. We found significant improvements in activity level:

TABLE 2. Post-Test Group Averages (SD) for Motor and Psychological Measures

Measure	Exercise Intervention (SD) *n* = 7	Non-Exercise Control(SD) *n* = 6	*Fs*
Activity Level	37.0 (18.0)	52.2 (17.9)	2.31
Berg Balance	50.7 (4.0)	47.8 (3.8)	1.72
Well-Being Ratings	23.6 (5.4)	22.3 (3.6)	0.23
Satisfaction	24.7 (7.4)	26.0 (8.3)	0.09
Self-Efficacy (ABC)	66.7 (17.6)	63.5 (20.9)	0.09
Mobility Test(s)	19.2 (5.8)	24.3 (6.6)	2.24
Walk Speed–Fast (m/s)	1.38 (.35)	1.15 (.22)	1.95
Walk Speed–Preferred (m/s)	1.13 (.27)	0.86 (.17)	4.62
Directional Lean (cm)	7.4 (1.2)	6.8 (1.8)	0.55
Stationary Sway (cm)	1.0 (0.3)	1.0 (0.3)	0.22
Step Length (cm)	50.1 (11.4)	39.1 (5.5)	4.63
Step Width (cm)	8.0 (4.0)	11.4 (3.0)	2.73
Grip Strength (ft-lbs)	16.3 (4.1)	16.4 (4.8)	0.01

$t(11) = 3.19$, $p < .01$, preferred walking speed: $t(11) = 4.78$, $p < .01$, and grip strength: $t(11) = 2.57$, $p < .05$ (Table 3). Several balance and mobility measures (i.e., mobility test, fast walking speed, directional lean, stationary sway, stride length, stride width) improved and balance self-efficacy increased, but these changes were nonsignificant. We also found changes in average ratings of training task confidence: $t(9) = 2.01$, $p = .08$, and difficulty: $t(9) = 2.84$, $p < .05$. Participants were more confident they could do the tasks and found them less difficult at post-testing. Because we were interested in evaluating specific tasks for future intervention programs, we examined changes in task ratings separately for each of the 11 tasks (Table 4). The overall trend held for most tasks, with significant increases in confidence for foam walking and rolling pin roll. Confidence declined slightly for the lateral lean. Confidence was moderately high with little change for several tasks (chair rise, flex step, object pick-up, direction change, and shoulder reach) and was low to moderate with little change for

TABLE 3. Combined Training Group: Pre and Post-Test Averages (SD) for Motor and Psychological Measures

Measure	Pre-Intervention Mean(SD)	Post-Intervention Mean(SD)	Paired *t*
Activity Level	35.9 (23.6)	48.1 (21.4)	□3.19*
Berg Balance	50.8 (3.1)	50.7 (3.3)	0.93
Well-Being Ratings	23.6 (3.9)	23.8 (4.2)	□0.38
Satisfaction	25.6 (5.8)	26.8 (6.3)	□0.13
Self-Efficacy (ABC)	68.1 (15.3)	70.4 (15.7)	□2.02
MobilityTest(s)	21.6 (5.5)	20.3 (5.2)	1.82
Walk Speed–Fast (m/s)	1.28 (.30)	1.31 (.31)	□1.42
Walk Speed–Preferred (m/s)	0.96 (.23)	1.05 (.24)	□4.78*
Directional Lean (cm)	6.9 (1.9)	7.3 (1.2)	□1.09
Stationary Sway (cm)	1.1 (0.3)	0.9 (0.3)	1.30
Step Length (cm)	43.8 (8.6)	46.0 (10.4)	□1.11
Step Width (cm)	9.8 (4.3)	8.2 (3.3)	1.65
Grip Strength (ft-lbs)	14.5 (3.8)	16.0 (3.7)	□2.57**
Task Confidence	3.5 (0.5)	4.1 (0.6)	□2.02
Task Difficulty	3.1 (0.7)	2.1 (0.7)	2.84**

*$p < .01$
**$p < .05$

tandem walk, sideward tipping and one-foot stands. Most tasks were rated as less difficult after 8 weeks of practice, with significant changes for chair rises, foam walking, object pick-up, direction changes, and rolling pin roll. Most of the other exercises were viewed as only moderately difficult, with little change.

At post-testing, we asked participants to rate how helpful they found each task (Table 4). Despite the failure to find changes for most outcome measures, participants rated the tasks as helpful. Nearly all tasks were rated at least moderately helpful on the 5-point scale, with flex step, tandem walk, and one-footed stand rated as especially helpful. Participants were interviewed informally after they completed

TABLE 4. Task Difficulty and Confidence and Task Evaluation Ratings (SD) for 11 Intervention Exercises

	Difficulty		Confidence		Evaluation
Exercise	Pre	Post	Pre	Post	
Chair Rise	2.1 (1.3)	1.2 (0.4)**	4.6 (0.9)	5.0 (0.0)	3.0 (1.5)
Flex Step	3.4 (1.2)	2.7 (1.6)	3.4 (0.9)	3.6 (1.4)	3.7 (1.2)
Tandem Walk	3.3 (1.2)	3.4 (1.5)	2.8 (0.9)	2.8 (1.5)	3.8 (1.6)
Foam Walk	3.4 (1.3)	1.5 (0.7)**	3.1 (1.2)	4.8 (0.5)*	2.9 (1.7)
Object Pick-up	3.2 (1.6)	1.6 (1.2)*	3.8 (1.2)	4.7 (0.8)	2.3 (1.5)
Direction Chg	3.8 (0.8)	1.5 (1.0)*	3.9 (0.9)	4.5 (1.2)	2.7 (1.0)
Lateral Lean	2.2 (1.3)	2.7 (1.4)	4.5 (0.5)	3.8 (1.0)**	3.2 (1.4)
Shldr. Reach	2.0 (1.3)	2.3 (1.2)	4.6 (0.7)	4.3 (1.0)	2.8 (1.2)
Side Tip	3.3 (1.2)	2.1 (1.1)	3.1 (0.9)	3.8 (1.3)	3.3 (1.5)
1 Foot Stand	4.1 (1.3)	3.0 (1.2)	2.1 (1.3)	3.1 (1.1)	3.8 (1.3)
Rolling Pin	3.5 (1.5)	1.7 (1.2)	2.9 (1.2)	4.3 (1.2)**	2.7 (1.5)

*p < .01
**p < .05

their post-testing and their comments consistently confirmed their positive evaluations of the training. Several planned to continue doing some of the training tasks. Many felt their balance had improved and they were more confident. Participants suggested their increased confidence extended beyond performance of the exercises to other daily activities.

DISCUSSION

It was not surprising that neither motor nor psychological performance improved dramatically following this relatively short duration low-to-moderate intensity exercise program. Interestingly, training and control differences for preferred walking speed and step length at post-test approached significance and several balance training measures improved from pre- to post-treatment. The exercise group tended to walk faster, using longer steps than the control group. Clinicians (e.g., Tinetti, 1997) often interpret changes in walking speed as a rough indicator of overall system integrity. The observed increases in walking speed, although limited, suggest that improvements in function can occur in even relatively healthy, active individuals with rather minimal effort. Previous study by Blair et al. (1989) revealed positive effects to cardiovascular function following low to moderate intensity training, and King, Oman, Brassington, Bliwise, and Haskell (1997) reported positive sleep benefits following moderate intensity exercise. Additional interventions, over longer periods, may determine whether improvements in walking speed and other measures occur consistently using low to moderate intensity exercise.

No significant changes were observed for the psychological measures in this investigation, but anecdotal reports suggested participants were more confident, and several stated that their balance improved. The psychological and motor tests used in this investigation may have been insufficiently sensitive to detect the relatively small changes that might occur for these healthy, active participants. Much of the intervention research with older adults has focused on inactive or frail groups. Recently, Shumway-Cook, Woollacott, Kerns, and Baldwin (1997) used a divided attention task to examine balance in elderly fallers and non-fallers. Even elderly non-fallers swayed more when they were required to divide their attention between quiet stance and a cognitive task. Similarly, Lundin-Olsson, Nyberg and Gustafson (1997) found that individuals who stopped walking when they began talking with a companion were at higher risk for falling. More complex tests, like those used by Shumway-Cook et al. (1997), may be necessary when healthy elderly are tested for the subtle changes occurring as a result of interventions.

Although the ABC Scale (Powell & Myers, 1995) was intended to discriminate levels of self-efficacy among healthy, older adults, our groups demonstrated no improvements following the intervention period (despite their anecdotal accounts). In a previous study, we used Tinetti's Falls Efficacy Scale (Tinetti et al., 1990) with healthy elderly (Gill et al., 1998) and found no differences between fallers and nonfallers, largely because *all* participants scored very high. In this study, there was no similar ceiling effect, but all participants were highly confident.

One major goal was to determine whether active, older women would find a low intensity balance and mobility exercise program sufficiently helpful and feasible to fit into their daily lives. Despite the lower intensity level of the exercises, 50% of the initial enrollees dropped out, which is comparable to that reported in other investigations (King et al., 1991). Some reasons cited by our dropouts differ from other studies, however. The 14 participants initially enrolled were asked to maintain a log related to the exercises they performed. Several women found the combination of exercises and record keeping difficult and confusing, possibly contributing to their failure to complete the program. All five control group participants completed the program using modified logs and took only half the time to complete the exercises.

Because we were pilot testing a training program, we were interested in participants' perceptions of the tasks. Their perceptions of task difficulty and confidence in performing the most complex version of each graded task sequence was important for determining the likelihood that individuals would persist in performing the exercises. Tasks perceived as too difficult or where participants have little confidence in their ability to complete them might be avoided. Tasks seen as too easy might be unappealing or avoided because they are not helpful for improving balance and seem a waste of time. Most tasks were perceived as no more than moderately difficult by the end of the intervention. Those exercises perceived as moderately challenging, like tandem walking and one-footed standing were reported as most useful for improving or maintaining balance and mobility.

One important feature of this investigation was the use of a home- based exercise program. Our results demonstrated that participants would perform individually tailored and low to moderate intensity activities. Anecdotal reports from participants and the assistant who monitored the training program suggested the activities were properly performed and many were perceived to be beneficial. Performing the exercises several times per week resulted in improved performance on several balance and mobility tests. In short, although dramatic increases did not occur, evidence demonstrates the efficacy of a low to moderate intensity, home-based exercise intervention for relatively active and healthy elders.

In conclusion, results of this pilot investigation demonstrate the potential usefulness of a low to moderate intensity balance and mobility exercise regimen for improving functional status. An intervention of longer duration with more sensitive assessments is necessary to determine whether general improvements might accrue. Comparing exercisers to non-exercising controls over a longer period may confirm that the primary benefits are *maintenance* of function rather than general *improvements*. Delaying the onset of decline for these relatively healthy elders may be as important as improvements in performance for less active individuals.

REFERENCES

Bandura, A. (1986). *Social foundations of thought and action.* Englewood Cliffs, NJ: Prentice-Hall.

Berg, K., Wood-Dauphinee, S., Williams, J., & Maki, B. (1992). Measuring balance in the elderly: Validation of an instrument. *Canadian Journal of Public Health, 83*, S7-S11.

Blair, S., Kohl, H., Paffenbarger, R., Clark, D., Cooper, K., & Biggons, L. (1989). Physical fitness and all-cause mortality: A prospective study of healthy men and women. *Journal of the American Medical Association*, *262*, 2395-2401.

Diener, E., Emmons, R., Larsen, R., & Griffin, S. (1985). The Satisfaction With Life Scale. *Journal of Personality Research*, *49*, 35-89.
Ettinger, W. H., Burns, R., Messier, S. P., Applegate, W., Rejeski, W. J., Morgan, T., Shumaker, S., Berry, M. J., O'Toole, M., Monu, J., & Craven, T. (1997). A randomized trial comparing aerobic exercise and resistance exercise with a health education program in older adults with knee osteoarthritis: The fitness arthritis and seniors trial (FAST). *Journal of the American Medical Association*, *277*, 25-31.
Fiatarone, M., Marks, E., Ryan, N., Meredith, C., Lipsitz, L., & Evans, W. (1990). High-intensity strength training in nonagenarians. *Journal of the American Medical Association*, *263*, 3029-3034.
Fiatarone, M., O'Neill, E., Ryan, N., Clements, K., Solares, G., Neson, M., Roberts, S., Kehayias, J., Lipsitz, L., & Evans, W. (1994). Exercise training and nutritional supplementation for physical frailty in very elderly people. *New England Journal of Medicine*, *330*, 1769-1775.
Gill, D., Williams, K., Williams, L. & Hale, W. (1998). Psychological and motor correlates to falls in older women. *International Journal of Aging and Human Development*, *47*, 35-51.
Gill, T., Williams, C., & Tinetti, M. (1995). Assessing risk for the onset of functional dependence among older adults: The role of physical performance. *Journal of the American Geriatrics Society, 43*, 603-609.
Guralnik, J., Ferrucci, J., Simonsick, E., Salive, M., & Wallace, R. (1995). Lower-extremity function in persons over 70 years of age as a predictor of subsequent disability. *New England Journal of Medicine, 332*, 556-561.
Imms, F., & Edholm, O. (1981). Studies of gait and mobility in the elderly. *Age and Ageing*, *10*, 147-156.
King, A., Haskell, W., Taylor, C., Kraemer, H., & DeBusk, R. (1991). Group- vs. home-based exercise training in healthy older men and women. *Journal of the American Medical Association*, *266*, 1535-1542.
King, A., Oman, R. F., Brassington, G. S. et al. (1997). Moderate-intensity exercise and self-rated quality of sleep in older adults. *Journal of the American Medical Association, 277*, 32-37.
Lundin-Olsson, L., Nyberg, L., & Gustafson, Y. (1997). "Stops walking when talking" as a predictor of falls in elderly people. *The Lancet*, *349*, 617.
MacRae, P., Feltner, M., & Reinsch, S. (1994). A 1-year exercise program for older women: Effects on falls, injuries, and physical performance. *Journal of Aging and Physical Activity*, *2*, 127-142.
O'Brien-Cousins, S. (1996). An older adult exercise status inventory: Reliability and validity. *Journal of Sport Behavior, 19*, 288-306.
Pate, R. R., Pratt, M., Blair, S. N., Haskell, W. L., Macera, C. A. Bouchard, C., Buchner D., Ettinger W., Heath G. W., & King A. C. (1995). Physical activity and public health: A recommendation from the Centers for Disease Control and Prevention and American College of Sports Medicine. *Journal of the American Medical Association*, *273*, 402-407.
Powell, L., & Myers, A. (1995). The activities-specific balance confidence (ABC) scale. *Journal of Gerontology: Medical Sciences*, *50A*, M28-M34.
Reinsch, S., MacRae, P., Dowling, M., Lachenbruch, P., & Tobis, J. (1993). Three- year community-based intervention to prevent falls: Older adults fell frequently but rarely sought medical care. In E. Beregi, I. A. Gergely, & K. Rajczi (Eds.), *Recent advances in aging science* (pp. 1231-1234). Bologna, Italy: Monduzzi Editore.
Sallis, J., Haskell, W., Fortmann, S., Vranizan, M., Taylor, C., & Solomon, D. (1986). Predictors of adoption and maintenance of physical activity in a community sample. *Preventive Medicine, 15*, 331-341.
Shumway-Cook, A., Woollacott, M., Kerns, K. A., & Baldwin, M. (1997). The effects of two types of cognitive tasks on postural stability in older adults with and without a history of falls. *Journals of Gerontology: Medical Sciences, 52*, M232-240.
Tinetti, M. (1997, September). *Functional assessment among older persons: How and why?* Presented at the International Conference on Aging and Physical Activity, Austin, TX.
Tinetti, M., Richman, D., Powell, L. (1990). Falls efficacy as a measure of fear of falling. *Journal of Gerontology: Psychological Sciences, 45*, pp. 239-243.