Evaluating the components of the Exercise Plus Program: rationale, theory and implementation

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Abstract

Recovery following a hip fracture is facilitated by participation in regular exercise. Despite the benefits of exercise, it is difficult to get older adults to initiate and adhere to regular exercise programs. The Attribution Theory of Achievement Motivation suggests that an individual's future involvement in an activity is based on assessments of prior experience with the activity. Conversely, the Theory of Self-efficacy states that self-efficacy expectations and outcome expectations are not only influenced by behavior, but also by verbal encouragement, physiological sensations and exposure to role models or self-modeling. These expectations then determine the individual's willingness to initiate and engage in a given activity. Using a 2×2 factorial design, the primary aim of this study is to compare these two theories. The effectiveness of the Exercise Plus Program will be compared to the individual components of the program (Exercise Training and Plus components) on both self-efficacy and outcome expectations, exercise behavior, activity, and specific physical and psychological outcomes. A total of 240 older women post hip fracture will be recruited from five different acute care facilities. This study will add to current knowledge by examining the impact of a combined exercise training/social learning intervention approach versus either alone.

Introduction

Hip fracture is a major public health problem with striking consequences for the older adult, particularly older females, their families and the health care system. Approximately 340 000 older adults have hip fractures in the US each year (Cumming and Klineberg, 1994). Of these older hip fracture patients 18–33% will die within the first year of their fracture and 35% will have reduced functional performance (Fox et al., 1996; Young et al., 1997; Magaziner et al., 2000; Hannan et al., 2001; Shah et al., 2001). Recovery following a hip fracture is facilitated by participation in a rehabilitation program (Kramer et al., 1997; Resnick, 1998; Tinetti et al., 1999; Giaquinto et al., 2000; Huuskio et al., 2000) and continued participation in a regular exercise program (Fiatarone et al., 1994; Farahmand et al., 2000; Taaffe and Marcus, 2000). Moreover, exercise can prevent future fractures (Fiatarone et al., 1994; Nelson et al., 1994; Farahmand et al., 2000; Taaffe and Marcus, 2000).

Despite the potential benefits of exercise, it is difficult to get older adults to initiate exercise activity and helping them adhere to an exercise regime is even more challenging (Boyyette et al., 1997; Clark, 1999; Resnick and Spellbring, 2000). It is essential, therefore, to establish successful ways to motivate these older women post hip fracture to exercise regularly.

Attribution Theory (Thibaut and Riecken, 1955; Weiner, 1985), or the study of perceived causation,
suggestions that individuals interpret behavior in terms of its causes and these interpretations play an important role in determining reactions to the behavior. Specifically, the Attributional Theory of Achievement Motivation postulates that outcomes are attributed by the individual based on his or her ability, effort and perceived task difficulty or luck (Weiner, 1979). The individual’s future expectations of success or failure depend upon ascriptions from prior experiences with a behavior. These attributions, based solely on the individual’s interpretation of his or her behavior, are incorporated into self-efficacy expectations (i.e. the individual’s beliefs in his or her ability to achieve a course of action). In contrast, prior research with older adults has supported the use of Social Cognitive Theory, specifically the Theory of Self-efficacy, to explain and improve exercise adherence (McAuley, 1993; Clark, 1999; Resnick et al., 2000b; Resnick, 2001). Social Cognitive Theory is based on triadic reciprocity suggesting that behavior, cognitive, and other personal factors and environmental influences all operate interactively as determinants of each other. There is mutual action between causal factors and behavior can be manipulated by these interactions. Most commonly the interventions developed from the Theory of Self-efficacy have involved person-to-person feedback related to behavior, verbal encouragement and counseling. Little research has been done to establish the difference between motivational interventions that incorporate manipulation of the person, the environment and behavior versus those that simply manipulate behavior. Interventions that focus on strengthening the individual’s beliefs about the benefits of a behavior (focus on the person), that alter the environment by providing cues to exercise (focus on the environment), and that also incorporate actual performance of the behavior and feedback related to performance (focus on behavior) are anticipated to be more likely to result in positive changes in behavior compared to a single focus on behavior. This has important implications with regard to implementing effective and efficient interventions to improve exercise behavior in older adults.

**Purpose**

The primary aim of this randomized controlled trial is to implement and evaluate the effectiveness of a home-delivered self-efficacy performance-based intervention (the Exercise Plus Program), and to compare the impact of different components of the intervention (Exercise Training component only; Plus component only) on self-efficacy and outcome expectations, exercise behavior, and overall activity of older women who have sustained a hip fracture. The secondary aim of the study focuses on evaluating the benefits that are expected to occur when older women post hip fracture exercise regularly: improved functional performance (i.e. bathing, dressing, gait and balance) and strength, decreased fear of falling, falls and fall-related injuries, and improved overall health status and well-being.

**Theoretical approach**

The study intervention was developed using the two different theoretical frameworks previously identified: (1) the Attributional Theory of Achievement Motivation and (2) the Theory of Self-efficacy, which was developed from Social Cognitive Theory (Bandura, 1977, 1986, 1995, 1997). The Attributional Theory of Achievement Motivation focuses on the individual’s interpretation of behavior, and the impact of that on self-efficacy expectations and future performance. Individuals who believe their successes with a particular behavior are due to personal capabilities and their failures to insufficient effort will undertake difficult tasks and persist in the face of failure. In so doing, self-efficacy expectations related to the behavior will be strengthened. This is because they see their performance as influenced by how much effort they expend. Conversely, individuals who believe their failures are due to deficiencies in their ability and successes due to situational factors, or factors beyond their control, will not strengthen self-efficacy expectations related to the behavior and may readily give up the activity.
Initial research (Resnick, 1994, 1996, 1998; Resnick and Daly, 1997) exploring motivation in older adults admitted to rehabilitation programs following orthopedic events and those participating in exercise programs (McAuley, 1993; Jette et al., 1998; Clark, 1999; Resnick and Spellbring, 2000; Resnick et al., 2000a; Resnick, 2001) indicated that motivation is multidimensional. In addition to the impact of actual performance of the behavior, motivation in older adults was influenced by: (1) beliefs, both self-efficacy and outcome expectations; (2) social supports; (3) individualized care including activities such as verbal encouragement and flexible scheduling; (4) identification of goals; (5) spirituality; (6) physical sensations such as pain, or fatigue; (7) underlying personality, described as ‘self-determination’; and (8) self-modeling or seeing role models. Findings from these studies were consistent with the Theory of Self-efficacy (Bandura, 1977, 1986, 1995, 1997). Specifically, the Theory of Self-efficacy states that the stronger individuals believe in their ability to perform a course of action, and in the positive outcomes of those actions, the more likely they will be to initiate and persist in a given activity. Bandura also identified four sources of information that influence self-efficacy expectations (and presumably outcome expectations), all of which were identified by the older adults studied as influencing motivation and behavior (Bandura, 1977, 1995). These include performance of the activity, verbal encouragement, exposure to role models and physiological feedback or physical sensations experienced during the activity. These prior studies do not, however, establish the impact of behavior (exercise performance with a trainer) alone versus other motivational interventions alone (the Plus component: verbal encouragement, exposure to self-modeling and cueing, and physiological feedback) and/or whether there is an additive effect when behavior is combined with the additional motivational interventions (The Exercise Plus Program).

Actual performance of the activity of interest has been the most common intervention used to strengthen self-efficacy expectations in older adults and thereby alter behavior (Kaplan and Atkins, 1984; Resnick, 1998; Gulanik, 1991; Kelly et al., 1991; Downs et al., 1992; McAuley, 1993; Steward et al., 1993; Cohen et al., 1994; McAuley et al., 1995). Resnick, however, compared the effectiveness of performance of functional activities in a rehabilitation setting against additional self-efficacy theory-based interventions (Resnick, 1998). Results of that study indicated that, although both groups improved with regard to self-efficacy expectations and performance of functional activities, outcome expectations (beliefs that performing a certain behavior will lead to specific outcomes) were stronger and participation in the rehabilitation activities were better in the group that received the additional self-efficacy theory-based interventions. It is possible, therefore, that adding additional self-efficacy theory-based interventions will strengthen outcome expectations as well as self-efficacy expectations and have a stronger impact on participation and adherence to an exercise program, particularly when considering adherence over time.

**Strategy or approach used to translate abstract constructs into a concrete intervention**

**Study methods**

This study is a 12-month investigation using a $2 \times 2$ design to test the impact of the Exercise Training component of the Exercise Plus Program alone, Plus component alone and full Exercise Plus Program on the initiation and adherence to a home-based exercise program for older women post hip fracture. A total of 240 older women will be included in the study and randomly assigned to one of the four groups defined by the $2 \times 2$ design (Table I): (1) Exercise Training component which includes regular home visits by an exercise trainer to implement an exercise program with participants; (2) Plus component which includes self-efficacy-based interventions given by an exercise trainer, and information about the exercise...
Table I. Descriptions of interventions by group

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<th>Group (theory tested)</th>
<th>Intervention provided (construct utilized)</th>
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| Exercise Training component (Attribution Theory of Achievement Motivation) | ● intervention implemented by an exercise trainer  
● intervention that combines a warm-up/cool-down, 2 days/week of resistive exercises and 3 days/week of aerobic exercise (self-efficacy; performance accomplishment)  
● a total of 42 supervised exercise sessions over a 12-month period |
| Plus component (Theory of Self-efficacy)                       | ● intervention implemented by an exercise trainer  
● trainer teaches the exercise intervention (a warm-up/cool-down, 2 days/week of resistive exercises and 3 days/week of aerobic exercise), and provides posters describing the program, written material and a audio-tape if desired (self-efficacy and outcome expectations; education/cueing)  
● trainer identifies weekly short-term goals and a long-term goal related to exercise, provides verbal encouragement related to goal achievement and a prize weekly if goals are achieved (self-efficacy; verbal encouragement)  
● trainer provides a calendar to remind individual of what exercises to do and when (self-efficacy, encouragement and cueing)  
● trainer teaches the individual, using the Exercise After Your Hip Fracture booklet about the benefits of exercise and how to overcome barriers (self-efficacy and outcome expectations, verbal encouragement and education)  
● trainer reviews any unpleasant sensations related to exercise and provides interventions to decrease these unpleasant sensations (self-efficacy, physiological feedback)  
● trainer takes a picture of the individual exercising at intervals over the 12 months focusing on progress (self-efficacy, self-modeling)  
● a total of 42 visits for face to face implementation of the motivational intervention  
● weekly telephone calls are made in months 7–12 when visits are decreased to once a month; weekly aspects of the motivational intervention are implemented via telephone contact (i.e. goal setting, verbal encouragement, education about exercise) (self-efficacy and outcome expectations, verbal encouragement) |
| Exercise Plus Program (Theory of Self-efficacy)               | ● intervention implemented by an exercise trainer  
● trainer exercises with the individual during visits and provides the Plus component (self-efficacy and outcome expectations; performance accomplishment, verbal encouragement, physiological feedback, cueing and self-modeling)  
● a total of 42 supervised visits are provided for face to face implementation of the motivational and exercise intervention  
● weekly telephone calls are made in months 7–12 when visits are decreased to once a month; weekly aspects of the motivational intervention are implemented via telephone contact (i.e. goal setting, verbal encouragement, education about exercise) (self-efficacy and outcome expectations, verbal encouragement) |
| Routine care                                                | ● participant receives physical and occupational therapy as prescribed by the individual’s orthopedist and/or primary health care provider |

Program, a single training session to learn about the recommended exercise program, but no performance of actual exercise activities during the visits; (3) the full Exercise Plus Program which includes the Exercise Training component and the Plus component; or (4) routine care. Five acute care facilities participating in the Baltimore Hip Studies will be used to recruit participants. Baseline testing will be done in the acute care setting and the intervention implemented in the home setting when traditional inpatient rehabilitation services are completed. The older women participating in
the study will be free of any medical conditions that might put them at risk for adverse events when exercising alone. The participants will be followed for 12 months following the fracture.

The following hypotheses will be tested:

(1) Participants who are exposed to the Exercise Training component of the intervention will have increased exercise behavior, more activity, and stronger self-efficacy expectations related to exercise compared to those who are not exposed to the Exercise Training component (those who receive routine care).

(2) Participants who are exposed to the Plus component of the intervention will have increased exercise behavior, more activity, and stronger self-efficacy and outcome expectations related to exercise compared to those who receive routine care or the Exercise Training component.

(3) Participants who are exposed to the combined Exercise Training component and the Plus component (the Exercise Plus Program) will have stronger self-efficacy and outcome expectations related to exercise, increased exercise behavior and more activity compared to those who receive the Exercise component only, the Plus component only, or routine care.

Variables of interest

All participants will be evaluated at 2, 6 and 12 months post hip fracture. The primary variables of interest are: (1) exercise behavior, evaluated using several assessment tools: exercise calendars, the Yale Physical Activity Scale (DiPietro et al., 1993), the CHAMPS physical activity questionnaire for older adults (Stewart et al., 2001) and the results from an electronic step counter—the Step Activity Monitor (Coleman et al., 1999); (2) self-efficacy expectations (Resnick and Jenkins, 1999); and (3) outcome expectations (Resnick et al., 2000b). Secondary variables of interest include measures of function (observed and reported) and muscle strength, overall physical activity (i.e. leisure activities, housework, meal preparation and social activities), fear of falling, falls and fall-related injuries, psychological well-being (mood and pain), and overall health status. The stages of change related to physical activity and exercise will be evaluated, and consideration given to a relationship between the effectiveness of the intervention and the individual’s stage of change.

**Intervention approach**

Based on the Attributional Theory of Achievement Motivation, a component of the intervention was developed to test the impact of performance of a specific exercise program. The Exercise Training component, which was developed by an exercise physiologist, incorporates both aerobic and resistive exercises focused on improving recovery for older women post hip fracture. The Exercise Training component includes exposure to an exercise trainer and focuses simply on participating in the home-based exercise program. Maximal participation entails performing five exercise sessions per week for 40 min duration each. Two sessions focus on flexibility and strength training, and three on aerobic exercise. All sessions begin with warm-up and cool-down exercises to increase flexibility. The participants are exposed to a combination of monitored sessions conducted by an exercise trainer in the participant’s home and an independent home exercise program (Table II).

The Plus component was developed based on the Theory of Self-efficacy. Unlike previous research

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<th>Months post-initiation of program</th>
<th>Home visits per month</th>
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<tr>
<td>1–3</td>
<td>8</td>
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<tr>
<td>4–6</td>
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<td>7–12</td>
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aProgram is initiated upon termination of post-fracture inpatient rehabilitation and continues until 12 months post-fracture.
bDuring months 7–12, trainers contact (telephone) participants once each week during the weeks they do not do a home visit. For Group 1 the telephone call is social. For Groups 2 and 3 telephone contact includes: reviewing the Exercise After your Hip Fracture booklet, providing verbal encouragement regarding progress towards goals and discussing any unpleasant sensations associated with exercise.

Table II. Visit schedule for the trainers (Groups 1, 2 and 3)
(King et al., 1991, 1997; Stenstrom, 1994; Ettinger et al., 1997; Rejeski and Brawley, 1997; Jette et al., 1998), that tested only one or two sources of self-efficacy enhancing information, all four sources of efficacy enhancing information (performance of the activity, verbal encouragement, role modeling or self-modeling, and physiological and affective states) are incorporated into the Plus component of the intervention. The focus of this component of the intervention is on strengthening both self-efficacy and outcome expectations.

Prior research has shown that verbal encouragement from a trusted, credible source in the form of counseling and education has been used alone, and with performance behavior, to strengthen efficacy expectations related to recovery following a cardiac event (Ewart et al., 1983; Gillis et al., 1993), in older adults with chronic obstructive pulmonary disease (Kaplan and Atkins, 1984) and in those recovering from an orthopedic event (Resnick, 1998). Other interventions, however, such as education focusing on the benefits of exercise (Lachman et al., 1997; Resnick, 2002), recognition of barriers and ways to overcome these barriers (Resnick, 1998; King et al., 1991; Stewart et al., 1993; Ettinger et al., 1997; Lachman et al., 1997; Rejeski and Brawley, 1997; Resnick and Spellbring, 2000), self-monitoring and goal-setting, and positive reinforcement attained through feedback from others (King et al., 1991, 1997; Stenstrom, 1994; Ettinger et al., 1997; Rejeski and Brawley, 1997; Jette et al., 1998; Resnick, 2002) have also been shown to successfully improve exercise behavior. The first aspect of the Plus component therefore was to provide education and encouragement. The exercise trainer (visits scheduled as per Table II for all treatment groups) uses an investigator developed the Exercise After Your Hip Fracture booklet to teach the participants the benefits of exercise post hip fracture and ways to overcome the barriers to exercising regularly. In addition the trainer helps the participant identify both short (weekly)- and long-term goals with incentive gifts given when weekly goals are achieved.

Unpleasant sensations associated with exercise such as pain, fear and fatigue have frequently been reported to decrease exercise activity for older adults (Melillo et al., 1996; Resnick, 1996; Sharon et al., 1997; Resnick and Spellbring, 2000) and influence self-efficacy expectations (Conn, 1998; Resnick, 1998). Consequently, consideration of unpleasant physical sensations was included as part of the Plus component of the intervention. This involves the exercise trainer asking the participants at each supervised exercise session if they experience pain, fear or fatigue associated with exercise that makes them not want to exercise. Specific techniques are then implemented to decrease those sensations (Table III).

Role modeling is included as one of the informational sources for self-efficacy expectations (Bandura, 1997). The actual impact of role models on older adults, however, is variable. In one study (Resnick, 1998) in which older adults in a rehabilitation program were exposed to both live role models and an investigator developed video tape of similar individuals who successfully participated in a rehabilitation program, it was noted that some participants found exposure to role models to be encouraging, some found exposure to role models to be discouraging and a third group were indifferent to exposure to role models. Role modeling did influence outcome expectations in that it helped individuals to see that if a behavior was performed there would be a certain outcome (Resnick, 1998). Self-modeling, in which people observe their own successful attainments achieved under specially arranged conditions, has also been used to strengthen efficacy expectations (Zimmerman and Bandura, 1994; Bandura, 1995) and was shown to have a greater influence on bathing behavior in older adults than role modeling (Downs et al., 1992). Exposure to self-modeling and providing visual cues to participants to exercise was incorporated into the Plus program. This includes providing participants with a picture of themselves exercising, an individually developed exercise calendar and a large print write-up of the exercises (individually tailored by adding posted notes to alter the degree of difficulty/intensity of the exercise). Also available for participants is an
Table III. Interventions to decrease unpleasant sensations associated with exercise

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<th>Problem</th>
<th>First-level intervention by trainers</th>
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| Pain    | 1. have participant take pain medication 30 min prior to exercise  
|         | 2. implement use of ice for 10 min prior to exercise  
|         | 3. educate/encourage that exercise will help reduce pain |
| Fear    | 1. educate/encourage that exercise will prevent future falls  
|         | 2. educate/encourage that they will not be asked to do exercise they are not capable of performing safely |
| Fatigue | 1. stress the importance of exercise to combat fatigue and improve sleep  
|         | 2. encourage 30-min rest period prior to exercise activity |

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<th>Problem</th>
<th>Second-level interventiona</th>
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| Pain    | 1. in conjunction with the primary care provider, alter current medication regime (as appropriate)  
|         | 2. implement use of ice/heat as appropriate prior to and following exercise  
|         | 3. implement relaxation techniques as appropriate  
|         | 4. implement guided imagery as appropriate |
| Fear    | 1. encourage verbalization of fears  
|         | 2. implement relaxation techniques as appropriate  
|         | 3. implement guided imagery as appropriate  
|         | 4. implement distraction techniques |
| Fatigue | 1. in conjunction with the primary care provider evaluate for other causes of fatigue including anemia, electrolyte imbalance, drug side effects, infection, dehydration or altered nutritional status  
|         | 2. establish appropriate rest/activity schedule  
|         | 3. educate regarding sleep patterns for older adults and ways to naturally facilitate sleep  
|         | 4. stress the importance of exercise to combat fatigue and improve sleep |

aDespite the use of these interventions, if the participant reports that she is not exercising because of these unpleasant sensations and has missed five consecutive exercise sessions (one full week), then she is referred to the consulting geriatric nurse practitioner (GNP) for additional interventions. Using a variety of techniques the participant and the GNP collaborate to develop ways to cope with the identified problems.

This section will describe how the different theories come together to guide the development of the intervention approach, the Exercise Plus Program, which incorporates the Exercise Training component and the Plus component. As noted by Resnick, it is anticipated that adding a self-efficacy-based intervention that focuses on strengthening both self-efficacy and outcome expectations to the exercise intervention with an exercise trainer will increase adherence to exercise, particularly over time and when the trainer is no longer visiting regularly (Resnick, 1998). This approach builds on the effectiveness of performance alone as suggested by the Attribution Theory of Motivation, and adds the techniques or sources of information from the Theory of Self-efficacy that will strengthen both self-efficacy and outcome expectations and ultimately influence exercise behavior.

Treatment fidelity of the intervention will be based on evaluation of randomly selected home-based visits of exercise trainers completing the Exercise Training component, Plus component and Exercise Plus Program. These evaluations will be done quarterly. In addition, monthly evaluation of each trainers exercise logs and visits will be done.

Control arm

All of the participants in this study will receive routine post hip fracture care that includes, rehabilitation services (i.e. physical and occupational therapy) and routine follow-up care as designated by their orthopedists and health care coverage. Participants randomized to the control group, however, will only receive routine care post hip fracture.

Proposed mediators and moderators of exercise behavior

The research model, incorporating the mediators of the proposed intervention effects is shown in Figure 1. It is anticipated that the Exercise Training component will impact self-efficacy expectations...
more than outcome expectations, the Plus component will impact both self-efficacy and outcome expectations, and the combined Exercise Plus Program is anticipated to have a stronger influence on self-efficacy and outcome expectations than either component alone (Bandura, 1997; Resnick, 1998, 2002). Self-efficacy and outcome expectations will mediate the relationship between the intervention and the study outcomes (exercise adherence, function, muscle strength, mood and health related quality of life) (Desharnais et al., 1986; Sallis et al., 1992; Sharpe and McConnell, 1992; Schwarzer and Fuchs, 1995; Schneider, 1997; Conn, 1998; King et al., 1998). Other potential mediators include social supports for exercise (Resnick et al., 2002; Sallis et al., 1986), pain (Resnick, 1996, 1998; Resnick and Spellbring, 2000) and fear of falling (Dishman, 1994; Tinetti et al., 1994; Resnick, 1998). The baseline moderators being considered that may influence outcomes include age (Conn, 1998; Clark, 1999; Cree et al., 2000), co-morbidities (Wolinsky et al., 1996; Jette et al., 1998; Benyamini et al., 2000), cognitive status (Resnick and Daly, 1997; Heruti et al., 1999) and stage of change related to exercise (Prochaska and DiClemente, 1982). While exemption criteria
will control some degree of potential influence of these moderators (i.e. only those with a MMSE score of 20 or greater or those who have no underlying medical problems that place them at risk for exercise at home will be entered into the study), it is still possible that these variables will impact study outcomes. Consequently, these relationships will be explored and used in the explanation of study findings.

**Conclusion**

Social Cognitive Theories, such as the Theory of Self-efficacy, and Attributional Theories, such as the Attributional Theory of Achievement Motivation, have been used to strengthen efficacy expectations and thereby alter behavior in older adults. Systematic consideration, however, of the impact of behavior (i.e. exercise training) versus the additional sources of information that influence both self-efficacy and outcome expectations delineated in the Theory of Self-efficacy (i.e. verbal encouragement, role-modeling or self-modeling and physiological feedback) has not been sufficiently evaluated. This study will help to determine if the combined effects of the two theories utilized in the development of the intervention will maximize outcomes and result in a more comprehensive theory. This has important implications with regard to best practices to motivate older adults, particularly those who have sustained hip fractures, to initiate and adhere to regular exercise.

The major hypotheses being tested in this study focus on the effectiveness of the use of a trainer providing training to complete the specific exercise intervention, a trainer providing the Plus component or the trainer providing the combined Exercise Plus Program. Consideration will also be given to individual differences that might impact the effectiveness of each intervention (i.e. cognitive status, mood, age and stage of change). Establishing the utility of the Exercise Plus program, both as a whole and its component parts, will help to establish the impact of these different interventions on self-efficacy as well as outcome expectations, adherence to exercise and the subsequent benefits of engaging in a regular exercise program. These findings are important in terms of allocating resources and will help to establish not only the most effective, but the most efficient intervention to help older women post hip fracture initiate and adhere to a regular exercise program.

**Acknowledgements**

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