Impact of a Multifaceted Community-Based Falls Prevention Program on Balance-Related Psychologic Factors

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Objective: To assess the impact of a multifaceted community-based falls prevention program including exercise and educational components on perceived balance and balance confidence among community-dwelling seniors.

Design: Quasi-experimental design.

Setting: Community-based organizations.

Participants: Two hundred community-dwelling adults aged 60 years and over recruited by community-based organizations.

Intervention: A 12-week multifaceted falls prevention program including 3 components; a 1-hour group exercise class held once a week, a 30-minute home exercise module to be performed at least once a week, and a 30-minute educational class held once a week.

Main Outcome Measures: Perceived balance and balance confidence.

Results: Multivariate analysis showed that the program was successful in increasing perceived balance in experimental participants. However, balance confidence was not improved by program participation.

Conclusions: A multifaceted community-based falls prevention program that was successful in improving balance performance among community-dwelling seniors also had a positive impact on perceived balance. However, the program did not improve participants’ balance confidence. These results suggest that balance confidence has determinants other than balance and that new components and/or modifications of existing components of the program are required to achieve maximal benefits for seniors in terms of physical and psychologic outcomes.

Key Words: Accident prevention; Accidental falls; Aged; Balance; Psychology; Rehabilitation.

SEVERAL STUDIES HAVE shown that falls prevention interventions including balance exercise component can improve balance and reduce falls incidence among community-dwelling seniors.1-8 Compared with the available evidence regarding the impact of these falls prevention interventions on physical outcomes, little is known about their impact on falls-related psychologic factors, such as fear of falling, self-efficacy, and balance confidence.9,10 Yet, several studies suggest that these factors can have adverse consequences on seniors’ functioning and QOL and thus should be targeted by falls prevention interventions.11-20

In response to this gap in the literature, this study examined the impact of a multifaceted community-based falls prevention program that includes balance exercise and educational components delivered to groups combined with a home exercise program on balance-related psychologic factors: balance confidence and perceived balance.

Integrating Falls-Related Psychologic Factors Into Preventive Interventions

The need to consider falls-related psychologic factors, such as fear of falling, balance confidence, and falls efficacy in preventive interventions with elderly people is increasingly recognized because evidence about the influence of these factors on seniors’ functioning and QOL is accumulating.11-20 A phenomenon such as fear of falling is often reported by elderly people,21,22 and self-imposed activity restriction or avoidance is one of the strategies that is frequently adopted by seniors to deal with this fear.22,23 Indeed, researchers who have documented rates of activity restriction as a response to fear of falling among community-dwelling seniors report proportions as high as 56%.17,20,21,23,24 However, although some level of fear of falling or a lack of balance confidence may be considered protective for seniors when it leads to avoidance of hazardous activities like walking outside when sidewalks are icy, fear can also lead to exaggerated activity avoidance or curtailment of activities that hinder the quality of life.

List of Abbreviations

- ABC: Activities-specific Balance Confidence
- ABC-S: ABC-Simplified
- OLS: one-leg stance
- QOL: quality of life
are within the range of a person’s capabilities). Excessive activity curtailment can lead to a physical deconditioning, which in turn can interfere with independence. Ultimately, such physical and functional decline can lead to an increase in falls risk. In fact, there is evidence from longitudinal studies that fear of falling and low falls self-efficacy are independent predictors of falls and QOL among community-dwelling seniors.11-14 Besides these adverse effects, fear of falling can also lead to social isolation and depression.25

Unlike the evidence that is available regarding the impact of falls prevention interventions that include a balance exercise component on balance performance and falls incidence among community-dwelling seniors, there is more limited evidence about the impact of these interventions on falls-related psychologic factors.26,27 Recent systematic reviews suggest that community-based Tai Chi programs delivered in groups, home-based individualized exercise interventions, and multifaceted home-based interventions combining education on several falls risk factors with exercise can have a positive impact on falls-related psychologic outcomes.28,29 However, more evaluative research is needed to provide evidence-based state-of-the-art guidelines to interventionists about the best strategies to adopt when targeting psychologic factors.26,27 In particular, more research is needed on the impact of community-based falls prevention interventions that include a balance exercise component delivered in groups. Indeed, the few studies that have examined the psychologic outcomes of such interventions do not provide evidence for concluding that they have a positive impact on falls-related psychologic factors among community-dwelling seniors.9,10

Another issue that has not been addressed in evaluative studies is whether changes in balance performance observed after balance exercise interventions are associated with changes in falls-related psychologic outcomes. Addressing this issue is relevant because it could provide valuable information about the processes underlying changes in falls-related psychologic outcomes.

In light of these considerations, the primary objective of this study was to examine the impact of a multifaceted falls prevention program including balance exercise and educational components on 2 psychologic factors related to balance: balance confidence and perceived balance. A secondary objective was to examine whether changes in balance performance after the intervention are associated with changes in these psychologic outcomes.

METHODS

Study Context

This study was conducted within the context of a larger investigation (referred to as the main investigation in the remainder of the article) of the impact of a community-based falls prevention program called Stand Up! on balance performance. In keeping with recent recommendations aimed at improving translation of public health research results into practice,28,29 this investigation was conducted in the real-world conditions of community-based organizations. Results of this investigation showed that Stand Up! was successful in improving balance performance among community-dwelling seniors.3

Given the positive impact of the program on participants’ balance and existing research showing that selected programs can improve falls-related psychologic factors, the working hypothesis of the current study was that Stand Up! would also increase participants’ balance confidence and perceived balance.

The Intervention

Stand Up! is a 12-week multifaceted program designed for community-dwelling seniors who have experienced at least 1 fall in the previous 12 months and/or are afraid of falling or concerned about their balance.8,32 The program includes 3 components: (1) group exercise classes (1h, twice a week); (2) a home exercise module (30min, at least once a week); and (3) group educational classes (30min, once a week). The program’s main goals are to improve seniors’ balance and strength in the lower limbs, and improve seniors’ ability to reduce hazards in their home and adopt safe behaviors. More specifically, the objectives of the exercise components of the program are: (1) to improve balance, lower limb strength, and ankle flexibility; (2) to stimulate proprioception; (3) to maintain bone density in vulnerable areas (eg, wrists, hips); and (4) to improve seniors’ capacity to get up after a fall. Exercise components were especially designed to stimulate all subsystems involved in balance (neuromuscular, vestibular, proprioceptive, and visual systems) and to be constantly challenging for participants to stimulate improvements in balance.33 Exercise classes unfold in 4 sequential steps: (1) warm-up exercises; (2) balance exercises; (3) strengthening exercises; and (4) stretching exercises. Figure 1 provides examples of each type of exercises.

The home exercise module includes 12 simple exercises to be practiced at least once a week during the program. These exercises are explained and practiced during the first group class of the program. They are illustrated on a small poster that can be used at home as a reminder and practice guide.

The program’s educational component consists of 10 classes of 30 minutes that address home environmental hazards and risky behaviors as well as strategies to avoid falls and fall-related injuries (eg, reducing hazards in home environment, wearing safe shoes, using medication with caution).

The program was designed to be offered by community-based organizations to groups of 10 to 15 seniors. Because the program targets seniors who have fallen and/or seniors who are concerned about their balance or falling, it is recommended that the program be led by rehabilitation or physical activity professionals. More information about the program can be found in a recent publication,32 and in a detailed program guide that is available to instructors.34,35

Study Design

Because the main investigation was aimed at examining the program’s effectiveness under real-world conditions (ie, when offered and implemented by community-based organizations), a quasi-experimental pre-post design was chosen. Therefore, randomization of participants was excluded to interfere as little as possible with the regular functioning (including regular recruitment procedures) of community-based organizations. Randomization of organizations was also rejected because this would have led to the exclusion of some organizations that were already providing a version of the program in their community, thereby creating an artificial situation.

To recruit organizations for the main investigation, an invitation was sent to the representatives of community-based organizations that provided services to older adults and had previously expressed an interest in the program. Representatives of 10 organizations were invited to recruit experimental participants and to offer the program in their community. No incentives (eg, transport, money) were offered for participating in the program. Moreover, 7 organizations agreed to recruit control participants and to wait until the end of the study’s...
To insure that experimental and control groups would be assessed under similar seasonal conditions, efforts were made to balance recruitment of experimental and control groups across seasons. Some groups entered the study in the spring (2 experimental and 2 control groups), and the other groups entered the study in the following fall (8 experimental and 5 control groups).

For inclusion in the study, participants had to be at least 60 years old, be able to participate in a group exercise program as assessed by a preselection grid especially designed for the program, be exempt from cognitive deficits and from disabling conditions (eg, Parkinson disease, multiple sclerosis), and be able to speak either English or French. Furthermore, in keeping with the program target population, recruitment was publicized as a search for persons with 1 or several of the following characteristics: (1) having fallen once or several times in the 12 previous months, (2) being afraid of falling, and (3) expressing a concern about balance. Each person recruited provided written informed consent before participating in the research project. The main investigation and the present study were both approved by the Montreal Regional Health and Social Services Board Ethics Committee.

Participants

Among a total of 212 eligible seniors living in the Montreal area (Quebec, Canada) who were initially recruited by community-based organizations to participate in the main investigation, 12 did not attend the baseline evaluation. Of the 200 registrants at baseline, 98 participated in the program (experimental participants) and 102 participated as control group members and did not receive any intervention. Control group participants were informed that they could participate in the program after completion of the experimental phase of the study. More detail regarding participants’ recruitment process can be found in a previous publication. A sample size of 200 was judged sufficient for the main investigation to have a power of 80% to detect a 15% difference in balance improvement.

Data Collection Procedures

Two strategies were used for data collection. Face-to-face interviews conducted by trained interviewers allowed collec-
tion of data about a range of variables including sociodemographic factors, balance-related psychologic variables, falls, and health-related variables. Balance performance tests were also administered by trained physical therapists. Interviewers and physical therapists were blind to participants’ group assignment. Each assessment lasted approximately 2 hours and took place in community-based organizations in participants’ residential neighborhoods. Data collected at baseline and at posttest were used in the present study.

**Measures**

**Dependent variables.** The dependent variables for this study were the 2 balance-related psychologic outcomes assessed at baseline and immediately after the intervention: balance confidence and perceived balance. Balance confidence was measured with a simplified version of the ABC Scale. The original ABC Scale is a questionnaire assessing a person’s confidence level in avoiding losses of balance during 16 tasks related to daily living. With its wide range of item difficulties, the ABC Scale seems well suited for populations presenting a diversity of levels of functioning, including high-functioning community-dwelling seniors. Despite good psychometric qualities, modifications to the ABC Scale were deemed necessary to improve the scale’s user-friendliness for use among seniors and to promote a better congruence of the scale with public health falls prevention strategies. The simplified version of the scale (ABC-S) has a more user-friendly cue question and response format and includes 15 items instead of 16. The modified cue question is, “Up to what point are you confident that you will maintain your balance when you do the following activities?” The original 0% to 100% response format for each item was replaced by a 4-category response format with descriptive anchors (ie, 0, not at all confident; 1, slightly confident; 2, moderately confident; 3, very confident). In a recent psychometric study, the ABC-S showed good internal consistency (reliability index, .86) and good convergent validity with balance performance, perceived balance, fear of falling, and falls history. The study also allowed establishment of the item hierarchy of the scale as a function of ascending difficulty. Furthermore, the study showed the cogency of using a global balance confidence score (range, 0–45) computed by the simple addition of scores obtained on the items of the simplified scale.

The second outcome measure considered in this study was participants’ perceived balance. It was measured with a single question (“Using the following scale, show me how good you think your balance is”) and a Likert-type rating scale with anchors ranging from 1 (poor balance) to 10 (excellent balance). Initial validation of this measure shows its convergent validity with the OLS test, eyes open (right and left sides); the OLS test, eyes closed (right side); the functional reach test; the tandem stance test; and the tandem walking test. Given the asymmetric distribution of participants’ global balance confidence scores (more scores toward the high balance confidence side of the scale), a square root transformation was applied to the data prior to multivariate analyses. Scores obtained for perceived balance did not require any transformation because their distribution was normal.

**Independent variables.** Group membership (0, control; 1, experimental) was the independent variable that allowed testing whether the falls prevention program had an impact on the 2 balance-related psychologic outcomes.

**Control variables.** Control variables included sociodemographics (age, sex, education level, perception of personal economic conditions, living conditions); falls history, perceived health, use of medications associated with falls, mental health, and balance performance.

Falls history was assessed by asking each participant how many times they had fallen in the previous 12 months. A fall was defined as an event that results in a person’s coming to rest inadvertently on the ground or other lower level. The recorded number of falls was dichotomized for analysis (0, no fall; 1, one fall or more). Perceived health was assessed with the following question: “Compared with other people your age, would you say that overall your health is...” and a 5-category response scale (recorded 1, bad or average; 2, good or very good; 3, excellent). Medication use was coded 1 if the person used 1 or more medications associated with falls (eg, sedatives) in the 2 previous days and 0 if the person did not. Mental health was measured with the mental health subscale of the Medical Outcomes Study 36-Item Short Form Health Survey. This subscale includes 5 items and produces a continuous global score ranging from 0 to 100, with higher scores indicating higher functioning.

Balance performance was assessed with a series of balance performance tests including the OLS test, the tandem stance test, the functional reach and lateral reach tests, and the tandem walking test. All these tests have shown good psychometric properties. The measurement protocol for these tests has been described in detail elsewhere.

All control variables included in the analysis were assessed at baseline, with the exception of change in balance performance. For the latter, balance performance measures collected at baseline and posttest were used to compute a residualized change score. Dummy variables were created for each categorical variable.

**Missing Data**

No data imputation was performed because most of the missing data occurred for participants who did not complete the ABC-S Scale or the perceived balance scale at posttest. The corresponding cases were simply deleted from data analysis. In the secondary analyses dealing with the association between changes in balance-related psychologic outcomes and changes in balance performance, we lost additional cases because of missing observations on some balance performance tests. However, these missing observations represented less than 5% of observations for all balance tests, with the exception of tandem walking. Thus, we felt that a complex data imputation procedure was not warranted.

**Statistical Analysis**

Data were analyzed on an intention-to-treat basis. First, descriptive analyses were performed to obtain a profile of participants’ characteristics at baseline and to examine the evolution in the 2 psychologic outcomes from baseline to posttest in both groups of participants. Bivariate analyses (including Student t tests and χ² tests) were carried out on baseline data to detect differences between experimental and control groups. Dropouts were also compared with participants who remained in the study.

Given the asymmetric distribution of participants’ global balance confidence scores (more scores toward the high balance confidence side of the scale), a square root transformation was applied to the data prior to multivariate analyses. Scores obtained for perceived balance did not require any transformation because their distribution was normal.

The program’s impact on balance confidence and perceived balance was examined using 3 series of linear regression models, 1 for each of the following dependent variables: (1) raw balance confidence scores, (2) transformed balance confidence scores, and (3) raw perceived balance scores. All regression analyses were performed by testing variables according to the following 5 steps: (1) inclusion of group membership and baseline scores obtained for balance confidence or perceived balance (taking into account initial scores is important because participants do not have the same range for improvement.
Among the 200 registrants at baseline, 197 were eligible for the present study (3 participants were excluded because they provided unusable responses to the ABC-S Scale; ie, 1 participant had slight communication problems and 2 others responded hurriedly). Table 1 presents baseline characteristics for the full study sample (n = 197) and for each group (96 experimental and 101 control participants). The 197 participants were aged on average 74 years and included mostly women (84.3%). Education levels were varied, and most participants (67.5%) were of average financial means. More than 80% of participants perceived their health as being good, very good, or excellent. Almost 40% of the sample had a history of falls in the previous year. The mean baseline balance confidence score on the ABC-S was 37.6 (maximal score, 45). The mean perceived health score was somewhat higher than the midpoint on a scale from 1 to 10. There was substantial heterogeneity in terms of balance performance reflected by large SD values obtained for balance performance scores. Residualized scores were entered in separate models for each balance performance test to maximize datasets. All analyses were performed using SPSS.*

Table 1: Participants’ Profile at Baseline in the Full Study Sample and in the Control and Experimental Groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Full Study Sample (n=197)</th>
<th>Control Participants (n=101)</th>
<th>Experimental Participants (n=96)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic, falls, and health characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (y)</td>
<td>73.9±7.4</td>
<td>74.1±7.4</td>
<td>73.7±7.4</td>
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<tr>
<td>Sex (female)</td>
<td>84.3</td>
<td>84.2</td>
<td>84.4</td>
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<tr>
<td>Living conditions (living alone)</td>
<td>57.4</td>
<td>59.4</td>
<td>55.2</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Elementary</td>
<td>24.9</td>
<td>20.8</td>
<td>29.2</td>
</tr>
<tr>
<td>High school</td>
<td>43.1</td>
<td>43.6</td>
<td>42.7</td>
</tr>
<tr>
<td>College/university</td>
<td>32.0</td>
<td>35.6</td>
<td>28.1</td>
</tr>
<tr>
<td>Economic conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>7.6</td>
<td>7.9</td>
<td>7.3</td>
</tr>
<tr>
<td>Average</td>
<td>67.5</td>
<td>66.3</td>
<td>68.8</td>
</tr>
<tr>
<td>Well off</td>
<td>24.9</td>
<td>25.7</td>
<td>24.0</td>
</tr>
<tr>
<td>Falls (1 or several falls in the 12 previous months)</td>
<td>38.1</td>
<td>37.6</td>
<td>38.5</td>
</tr>
<tr>
<td>Perceived health status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>2.0</td>
<td>1.0</td>
<td>3.1</td>
</tr>
<tr>
<td>Medium</td>
<td>17.3</td>
<td>11.9</td>
<td>22.9</td>
</tr>
<tr>
<td>Good</td>
<td>36.5</td>
<td>39.6</td>
<td>33.3</td>
</tr>
<tr>
<td>Very good</td>
<td>28.9</td>
<td>34.7</td>
<td>22.9</td>
</tr>
<tr>
<td>Excellent</td>
<td>15.2</td>
<td>12.9</td>
<td>17.7</td>
</tr>
<tr>
<td>Medication use (1 or several medications with falls in the 2 previous days)</td>
<td>68.0</td>
<td>70.3</td>
<td>85.6</td>
</tr>
<tr>
<td>Mental health (SF-36)</td>
<td>72.7±19.4</td>
<td>72.7±19.6</td>
<td>73.2±19.3</td>
</tr>
<tr>
<td>Balance-related psychologic factors</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Balance confidence</td>
<td>37.6±7.3</td>
<td>37.3±7.8</td>
<td>37.9±6.9</td>
</tr>
<tr>
<td>Perceived balance</td>
<td>6.4±2.1</td>
<td>6.4±2.2</td>
<td>6.5±2.0</td>
</tr>
<tr>
<td>Balance performance scores</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Static balance and mobility (s)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OLS, eyes open (right)</td>
<td>13.2±16.8</td>
<td>12.0±14.7</td>
<td>14.4±18.8</td>
</tr>
<tr>
<td>OLS, eyes open (left)</td>
<td>11.8±15.9</td>
<td>12.3±16.0</td>
<td>11.4±15.9</td>
</tr>
<tr>
<td>OLS, eyes closed (right)</td>
<td>2.6±2.1</td>
<td>2.5±2.2</td>
<td>2.7±1.9</td>
</tr>
<tr>
<td>OLS, eyes closed (left)</td>
<td>2.6±2.8</td>
<td>2.6±2.2</td>
<td>2.7±3.4</td>
</tr>
<tr>
<td>Tandem stance</td>
<td>28.0±24.1</td>
<td>28.2±24.1</td>
<td>27.9±24.2</td>
</tr>
<tr>
<td>Tandem walk</td>
<td>17.4±10.2</td>
<td>18.0±9.6</td>
<td>16.7±10.9</td>
</tr>
<tr>
<td>Stability limits (cm)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Functional reach</td>
<td>24.6±6.7</td>
<td>24.8±6.7</td>
<td>24.4±6.8</td>
</tr>
<tr>
<td>Lateral reach (right)*</td>
<td>14.2±4.7</td>
<td>13.5±4.0</td>
<td>14.9±5.3</td>
</tr>
<tr>
<td>Lateral reach (left)*</td>
<td>13.5±4.6</td>
<td>12.8±4.1</td>
<td>14.2±5.0</td>
</tr>
</tbody>
</table>

NOTE: Values are mean ± SD or percent.
Abbreviation: SF-36, Medical Outcomes Study 36-Item Short-Form Health Survey.
*Mean of experimental and control participants statistically different (Student t test, P<.03).
parison of baseline data in each group did not reveal any significant difference, except for lateral reach performances, which were somewhat higher in the experimental group ($P<.05$).

Among the 197 participants, 18 did not complete the ABC-S Scale at posttest (11 in the control groups, 7 in the experimental groups). These 18 participants lost to follow-up did not differ from participants remaining in the study for most of the data included at baseline, except that a larger proportion of dropouts lived alone and had poorer scores on the OLS performed with eyes open ($P<.05$), and a smaller proportion of dropouts had fallen in the previous year ($P<.05$).

**Group Attendance and Compliance With Home Exercises**

Participants in the experimental group attended an average of 78% of group classes. Compliance with home exercises was also satisfying, because 78% of experimental participants from this study reported performing the home exercise program at least once a week.

**Outcome Measures**

**Baseline and posttest profiles.** Outcome measures obtained at baseline and posttest are presented in table 2 for both groups of participants. As can be observed, mean perceived balance improved in experimental participants and decreased in control participants. However, mean balance confidence scores slightly decreased in both groups from baseline to posttest.

**Multivariate analyses.** Results of regression models testing the effect of the program on balance confidence and perceived balance are presented in tables 3 and 4, respectively. Models are presented according to the steps for variable inclusion (ie, inclusion of interaction terms in models) described in the methods. Results for the last step of variable inclusion (ie, inclusion of interaction terms in models) are not presented in the tables because they were not statistically significant.

Given the similarity observed in the results obtained with the raw and transformed balance confidence scores and for ease of interpretation, table 3 presents the results obtained with untransformed data only. Results of linear regression models showed a nonsignificant impact of the program on balance confidence. Indeed, regression coefficients for group membership were not significant in the first model and in subsequent models adjusting for an increasing number of variables. The only significant predictor of balance confidence at posttest was baseline balance confidence. The association was in the expected direction: higher balance confidence at baseline was associated with higher posttest balance confidence.

However, results presented in table 4 show a significant effect of group membership on perceived balance, reflecting a positive impact of the program on this variable. In the first model (controlling only for baseline perceived balance score), the regression coefficient associated with group membership was statistically significant (unstandardized $\beta = .83, P<.01$), indicating that overall, participants in the experimental group had a posttest score on perceived balance of .83 above the posttest score of the control group participants once baseline values were controlled for. As depicted in table 4, this result remained relatively unchanged with the addition of an increasing number of control variables (sociodemographic, health characteristics, residualized changes in balance performance). Besides group membership, 2 other variables predicted perceived balance at posttest: baseline perceived balance score and age. Associations were in the expected direction: higher perceived balance at baseline was associated with greater perceived balance at posttest, and higher age was associated with poorer perceived balance at posttest. Other control variables were not significant, including the indicators of change in balance performance tests.

**DISCUSSION**

The primary objective of this study was to examine the impact of a multifaceted falls prevention program (Stand Up!) that included balance exercise components combined with an educational component on 2 balance-related psychologic factors: balance confidence and perceived balance. This study is important because there is growing evidence that fear of falling or other related psychologic factors are independent predictors of falls and can have adverse consequences on seniors’ functioning and quality of life.$^{11-20}$ Compared with physical outcomes, few data are available regarding the falls-related psychologic outcomes of falls prevention interventions designed for community-dwelling seniors. More specifically, few studies have examined the psychologic impact of community-based falls prevention interventions that include a balance exercise component delivered in a group format.$^{9,10}$

Of initial interest is the positive impact of Stand Up! on participants’ perceived balance. This result is consistent with the positive changes observed in participants’ balance performance after the intervention. Indeed, a study of the program’s impact on balance performance showed that it improved seniors’ performance on the OLS performance (eyes open, both sides), the OLS (eyes closed, left side), the tandem stance, and the tandem walk tests.$^8$ These findings are also in line with other results obtained among this study sample that showed significant associations between seniors’ perceived balance and scores on a number of balance performance tests.$^7,8$ The improvement in perceived balance suggests that seniors acknowledge the positive changes that the program had on their balance.

A second result to discuss is the absence of an effect of Stand Up! on balance confidence. Obviously, the positive changes in participants’ balance performance and perceived balance that occurred after the program were not accompanied by similar changes in participants’ level of balance confidence. Given the association often observed between balance performance and balance confidence,$^{17,44}$ these results seem surprising at first glance.

Several plausible explanations could elucidate the lack of improvement in balance confidence after the program. First, balance confidence may have other determinants than balance

### Table 2: Scores on Balance-Related Psychologic Factors at Baseline and Posttest in Control and Experimental Groups

<table>
<thead>
<tr>
<th>Balance-Related Psychologic Factors</th>
<th>Control Participants</th>
<th>Experimental Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Posttest</td>
</tr>
<tr>
<td>Balance confidence ($n=179$)</td>
<td>37.3±7.6</td>
<td>36.9±7.9</td>
</tr>
<tr>
<td>Perceived balance ($n=183$)</td>
<td>6.4±2.2</td>
<td>5.8±2.2</td>
</tr>
</tbody>
</table>

NOTE. Values are mean ± SD.
Table 3: Results of Linear Regression Models Testing Group Effect on Balance Confidence After Adjustment for a Varying Number of Characteristics

<table>
<thead>
<tr>
<th>Model</th>
<th>Baseline balance confidence</th>
<th>Group (sex)</th>
<th>Age</th>
<th>Education (lower level)</th>
<th>Economic conditions (lower level)</th>
<th>Residual health (lower level)</th>
<th>Residual medication use</th>
<th>Residual balance performance</th>
<th>Intercept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>0.81 (0.05)</td>
<td>0.83 (0.06)</td>
<td>0.86 (0.07)</td>
<td>0.86 (0.08)</td>
<td>0.79 (0.09)</td>
<td>0.82 (0.09)</td>
<td>0.78 (0.09)</td>
<td>0.79 (0.09)</td>
<td>37.03 (0.53)</td>
</tr>
<tr>
<td>Model 2</td>
<td>0.79 (0.09)</td>
<td>0.79 (0.09)</td>
<td>0.82 (0.09)</td>
<td>0.81 (0.09)</td>
<td>0.79 (0.09)</td>
<td>0.82 (0.09)</td>
<td>0.78 (0.09)</td>
<td>0.79 (0.09)</td>
<td>37.03 (0.53)</td>
</tr>
<tr>
<td>Model 3</td>
<td>0.78 (0.09)</td>
<td>0.78 (0.09)</td>
<td>0.81 (0.09)</td>
<td>0.80 (0.09)</td>
<td>0.79 (0.09)</td>
<td>0.82 (0.09)</td>
<td>0.78 (0.09)</td>
<td>0.79 (0.09)</td>
<td>37.03 (0.53)</td>
</tr>
<tr>
<td>Model 4</td>
<td>0.77 (0.09)</td>
<td>0.77 (0.09)</td>
<td>0.80 (0.09)</td>
<td>0.79 (0.09)</td>
<td>0.78 (0.09)</td>
<td>0.81 (0.09)</td>
<td>0.78 (0.09)</td>
<td>0.79 (0.09)</td>
<td>37.03 (0.53)</td>
</tr>
</tbody>
</table>

Baseline balance confidence: 0.81* (0.05) 0.80* (0.06) 0.79* (0.06) 0.79* (0.06) 0.79* (0.06) 0.78* (0.06) 0.81* (0.06)

Variables included: Baseline balance confidence, Group (sex), Age, Education (lower level), Economic conditions (lower level), Residual health (lower level), Residual medication use, Residual balance performance, Intercept.

NOTE: Values are unstandardized βs (standard error) obtained for each model. Partial χ² change after addition of group membership in the model equals 0.02 (P = .85). Abbreviations: C, closed, left side; D, demo, demographic; E, experimental; I, intermittent; M, not included in model; O, one-leg stance; OL, eyes open, left side; O-R, eyes open, right side; res, residualized changes; SF-36, Medical Outcomes Study 36-Item Short-Form Health Survey.

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Table 4: Results of Linear Regression Models Testing Group Effect on Perceived Balance After Adjustment for a Varying Number of Characteristics

<table>
<thead>
<tr>
<th>Model</th>
<th>Variables</th>
<th>Baseline perceived balance</th>
<th>Age</th>
<th>Sex (female)</th>
<th>Education (lower level)</th>
<th>Economic conditions (lower level)</th>
<th>Living conditions (living alone)</th>
<th>Falls (1 fall or more)</th>
<th>Medication use</th>
<th>Mental health (SF-36)</th>
<th>Residualized change after addition of group membership in the model equals .04 (P &lt; .001).</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>demo data</td>
<td>0.38 (0.07)</td>
<td>0.06† (0.02)</td>
<td>0.05 (0.41)</td>
<td>0.30 (0.38)</td>
<td>1.02 (0.65)</td>
<td>0.24 (0.32)</td>
<td>0.09 (0.30)</td>
<td>0.03 (0.31)</td>
<td>0.0001 (0.01)</td>
<td>baseline perceived balance in other studies.37,48 Other researchers found that changes in balance confidence (as measured by the ABC Scale) after resistance or agility training in group sessions did not significantly correlate with changes in other factors such as postural stability and gait speed.55 These results indicate that even though balance performance, balance confidence, and perceived balance are associated cross-sectionally, these factors do not necessarily change according to similar patterns. These results also suggest that factors other than an improvement in balance performance are required to observe a corresponding change in balance confidence or perceived balance. The study of other potential factors associated with change in psychologic factors should be the focus of future investigations. In sum, findings suggest that different ingredients may be required in falls prevention interventions to achieve maximal benefits in terms of physical and psychologic outcomes.</td>
</tr>
<tr>
<td>2</td>
<td>demo data</td>
<td>0.33‡ (0.07)</td>
<td>0.06† (0.02)</td>
<td>0.13 (0.42)</td>
<td>0.29 (0.39)</td>
<td>0.95 (0.65)</td>
<td>0.07 (0.34)</td>
<td>0.07 (0.30)</td>
<td>0.06 (0.34)</td>
<td>0.0001 (0.01)</td>
<td>baseline perceived balance in other studies.37,48 Other researchers found that changes in balance confidence (as measured by the ABC Scale) after resistance or agility training in group sessions did not significantly correlate with changes in other factors such as postural stability and gait speed.55 These results indicate that even though balance performance, balance confidence, and perceived balance are associated cross-sectionally, these factors do not necessarily change according to similar patterns. These results also suggest that factors other than an improvement in balance performance are required to observe a corresponding change in balance confidence or perceived balance. The study of other potential factors associated with change in psychologic factors should be the focus of future investigations. In sum, findings suggest that different ingredients may be required in falls prevention interventions to achieve maximal benefits in terms of physical and psychologic outcomes.</td>
</tr>
<tr>
<td>3</td>
<td>demo data</td>
<td>0.31‡ (0.07)</td>
<td>0.06† (0.02)</td>
<td>0.16 (0.43)</td>
<td>0.31 (0.39)</td>
<td>0.95 (0.66)</td>
<td>0.07 (0.34)</td>
<td>0.04 (0.31)</td>
<td>0.05 (0.35)</td>
<td>0.0001 (0.01)</td>
<td>baseline perceived balance in other studies.37,48 Other researchers found that changes in balance confidence (as measured by the ABC Scale) after resistance or agility training in group sessions did not significantly correlate with changes in other factors such as postural stability and gait speed.55 These results indicate that even though balance performance, balance confidence, and perceived balance are associated cross-sectionally, these factors do not necessarily change according to similar patterns. These results also suggest that factors other than an improvement in balance performance are required to observe a corresponding change in balance confidence or perceived balance. The study of other potential factors associated with change in psychologic factors should be the focus of future investigations. In sum, findings suggest that different ingredients may be required in falls prevention interventions to achieve maximal benefits in terms of physical and psychologic outcomes.</td>
</tr>
<tr>
<td>4</td>
<td>demo data</td>
<td>0.31‡ (0.07)</td>
<td>0.06‡ (0.02)</td>
<td>0.14 (0.43)</td>
<td>0.32 (0.39)</td>
<td>0.95 (0.66)</td>
<td>0.07 (0.34)</td>
<td>0.06 (0.30)</td>
<td>0.06 (0.34)</td>
<td>0.0001 (0.01)</td>
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<td>5</td>
<td>demo data</td>
<td>0.32‡ (0.07)</td>
<td>0.06 (0.02)</td>
<td>0.16 (0.43)</td>
<td>0.32 (0.39)</td>
<td>0.95 (0.66)</td>
<td>0.07 (0.34)</td>
<td>0.06 (0.30)</td>
<td>0.05 (0.35)</td>
<td>0.0001 (0.01)</td>
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<tr>
<td>6</td>
<td>demo data</td>
<td>0.33‡ (0.07)</td>
<td>0.06 (0.02)</td>
<td>0.20 (0.44)</td>
<td>0.27 (0.40)</td>
<td>0.95 (0.66)</td>
<td>0.08 (0.35)</td>
<td>0.06 (0.30)</td>
<td>0.05 (0.35)</td>
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</tr>
</tbody>
</table>

One last explanation regarding lack of impact of the program on balance confidence despite improved balance performance might be that participants with improved balance may have become more active and thus may have put themselves at greater risk for losing their balance and falling. Such effects were observed in a study of the effects of a brisk walking program in postmenopausal women.53

The results of this study regarding balance confidence are consistent with other evaluations of community-based group programs including exercise delivered in a group format and educational components.1,54 Indeed, in these studies, improvements in seniors’ balance performance after community-based group exercise interventions were not accompanied by benefits on falls-related psychologic factors. The explanations mentioned for the lack of improvement in balance confidence after Stand Up! could also be applied to these programs.

Regarding the second objective of this study, the results show that changes in balance performance after the intervention were not associated with changes in balance-related psychologic outcomes, because the inclusion of residualized changes in balance in the regression models did not change findings. This is a little surprising given the correlations observed cross-sectionally between both psychologic factors and balance performance in other studies.37,48 Other researchers found that changes in balance confidence (as measured by the ABC Scale) after resistance or agility training in group sessions did not significantly correlate with changes in other factors such as postural stability and gait speed.55 These results indicate that even though balance performance, balance confidence, and perceived balance are associated cross-sectionally, these factors do not necessarily change according to similar patterns. These results also suggest that factors other than an improvement in balance performance are required to observe a corresponding change in balance confidence or perceived balance. The study of other potential factors associated with change in psychologic factors should be the focus of future investigations. In sum, findings suggest that different ingredients may be required in falls prevention interventions to achieve maximal benefits in terms of physical and psychologic outcomes.

Study Strengths and Limitations

This study responds to a need to examine the impact of interventions on falls-related psychologic factors among seniors.9,10,26,27 The study is also in keeping with recommendations of selected researchers that more public health studies should move beyond randomized controlled trials and use designs that allow examination of program effectiveness under more natural conditions. Indeed, such studies are required to allow a true transfer of research knowledge into public health practice.26,31 The use of a rigorous methodology (eg, blinding procedures, training of interviewers and physical therapists, and controlling for several variables in the analyses) is also a strength of the study. On the downside, the use of a nonrandomized design does not completely exclude the possibility that a confounding variable was not controlled for in the analysis. Also, although a recent psychometric study has shown that the ABC-S Scale is a valid and reliable assessment tool,37 other psychometric studies designed to examine its sensitivity to change are warranted. The perceived balance scale would also benefit from further psychometric studies.

Directions for Future Research

Future studies testing the aforementioned plausible explanations for the lack of improvement in balance confidence are warranted. Results of such studies would allow for improving...
falls prevention programs such as Stand Up! In addition, studies examining the impact of changes in balance confidence and perceived balance on QOL and activity restriction or avoidance would allow for a better depiction of the clinical significance of any changes in balance-related psychologic factors. Moreover, we note that falls prevention research tends to focus on the idea that fear of falling, low balance confidence, and low falls efficacy are always negative factors. It should not be forgotten that there is also a positive side to these emotional dimensions. They can be appropriate reactions to the presence of real environmental threats to the person’s balance. Indeed, some fear of falling or a low balance confidence may be appropriate under specific conditions (ie, when the person faces tasks that could be considered hazardous considering his/her physical capabilities) and could actually prevent falls. Thus, future studies that focus on distinguishing excessive psychologic reactions from those that could be considered realistic and protective are certainly warranted.

**CONCLUSIONS**

Falls prevention programs that include balance exercise and address multiple falls risks factors are among recommended strategies according to evidence-based practice guidelines.56,57 This study examined the impact of a multifaceted community-based falls prevention program that includes balance exercise and educational components on balance confidence and perceived balance. This study is important because evidence is growing that psychologic factors such as fear of falling, balance confidence, and falls efficacy are associated with seniors’ health and QOL and therefore should be included as important targets of falls prevention programs. Findings from this study showed that the program can not only achieve improved balance performance among seniors but also improve perceived balance. However, a similar improvement was not observed in balance confidence. These findings suggest that an increase in balance performance is not sufficient to impact balance-related psychologic factors, and that additional ingredients and/or modifications of existing components of the program are required to achieve maximal benefits in terms of physical and psychologic outcomes.

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**References**


Supplier
a. Version 11.5; SPSS Inc, 233 S Wacker Dr, 11th Fl, Chicago, IL 60606.