

Tai Chi: Moving for Better Balance— Development of a Community-Based Falls Prevention Program

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Background: This study was designed to develop an evidence- and community-based falls prevention program—*Tai Chi: Moving for Better Balance*. **Methods:** A mixed qualitative and quantitative approach was used to develop a package of materials for program implementation and evaluation. The developmental work was conducted in 2 communities in the Pacific Northwest. Participants included a panel of experts, senior service program managers or activity coordinators, and older adults. Outcome measures involved program feasibility and satisfaction. **Results:** Through an iterative process, a program package was developed. The package contained an implementation plan and class training materials (ie, instructor's manual, videotape, and user's guidebook). Pilot testing of program materials showed that the content was appropriate for the targeted users (community-living older adults) and providers (local senior service organizations). A feasibility survey indicated interest and support from users and providers for program implementation. A 2-week pilot evaluation showed that the program implementation was feasible and evidenced good class attendance, high participant satisfaction, and interest in continuing Tai Chi. **Conclusions:** The package of materials developed in this study provides a solid foundation for larger scale implementation and evaluation of the program in community settings.

Keywords: elderly, Tai Chi, falls

Falls are the leading cause of injury deaths among individuals over 65 years of age,^{1,2} making falling a major threat to their independence and quality of life, as well as imposing a significant burden on individuals, society, and national health systems.³⁻⁵ Although there are many falls prevention approaches, exercise has been

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shown to be the most effective single intervention to reduce falls and risk of falling among community-dwelling older adults.⁶⁻¹¹ One exercise approach is Tai Chi—an alternative exercise form that emphasizes weight shifting, postural alignment, and coordinated movements with synchronized breathing.

Two randomized controlled trials (RCTs) have shown the efficacy of Tai Chi training in improving functional balance, strength, and flexibility and, consequently, reducing fear of falling and the risk of falls (by about 50%) in sample populations of healthy community-dwelling older adults.¹²⁻¹⁴ Although shown to be effective, these RCTs were conducted under a set of predefined study conditions and specified inclusion and exclusion criteria. Consequently, whether such efficacious programs, devised for rigidly controlled trials, can be directly applied and disseminated in the diverse circumstances of public health practice to reach broader community-based senior service providers remains to be determined. Recently, the Centers for Disease Control and Prevention have emphasized the need for the translation, dissemination, and implementation of effective, empirically tested injury-prevention interventions to the field of community practice.¹⁵ To date, no nationally available Tai Chi-based falls prevention program developed from scientifically controlled studies is available.

The specific objective of this investigation was to address the research-to-practice gap by converting a proven falls prevention intervention into a community-based program, with the ultimate goal of having the program broadly disseminated and effectively implemented in community settings. To accomplish this overarching goal, the project consists of 2 phases: (1) developing a program package that is content appropriate, attractive to potential clients, and logistically practical; and (2) using RE-AIM as a framework¹⁶ to implement and evaluate the program in local communities. This article reports the completed work from phase 1.

Methods

Design

A mixed qualitative and quantitative approach was used to develop the program package. The major tasks involved (1) identifying program objectives and creating specific Tai Chi practice forms, (2) identifying end users and dissemination partners, (3) assembling a preliminary program package of materials, (4) evaluating program materials by experts, (5) evaluating the feasibility of program implementation, and (6) pilot testing the program package. Each of these task components is described in the following sections. All research protocols used in this investigation were approved by the Institutional Review Boards of the Oregon Research Institute and the Centers for Disease Control and Prevention. All data were collected between January and April 2006.

Program Objective, Practice Forms, and Practice Schedule

Objective. The main objective of the *Tai Chi: Moving for Better Balance* program is to improve functional ability (balance, physical function) and, consequently, reduce fall-related risks and falls frequency. Based on this objective, we adopted

previously successful Tai Chi intervention programs^{13,14,17,18} that contained essential movement features of small-to-large degrees of motion, postural alignment, progressive flexion of hips and knees, unilateral weight bearing, constant weight shifting, evenly paced and controlled movements, continuity of movement with balance control, attention and concentration, and synchronized natural breathing.¹⁹⁻²¹

Practice Forms. The Tai Chi program consists of a unique combination of 8 single forms, largely derived from the traditional 24-form Yang Style,²² which was modified and simplified for older adults.¹⁹ The movements of each form are based on fundamental principles of traditional Tai Chi that emphasize alternate single- and double-leg weight-bearing stances, postural alignment, and coordinated movements that are executed in a gentle, continuous, circular, and flowing manner. Although each single movement within a form traditionally requires a coordinated breathing cycle, natural breathing is encouraged to reduce participants' attention demands. The 8 individual forms are arranged in a sequence that progresses from easy to more difficult. Each form can be performed and practiced separately or practiced jointly in a set.

Training Schedule. To maintain the 3-times per week training schedule implemented in most RCTs, we decided to make full use of an instructional videotape and a user's guidebook to supplement in-class practice. Thus, the exercise schedule consisted of a 60-minute group-based practice session implemented on a twice per week in-class schedule, supplemented by a recommended 30-minute weekly home-based exercise session. The in-class practice protocol included 10 minutes of warm-up exercises, 40 to 45 minutes of core Tai Chi movements practice, and 5 minutes of cool-down exercises. This mixed in-class (twice weekly) and at-home exercise schedule was based on the pragmatic consideration that most community activity classes are offered on a twice weekly basis and was arrived at after consultation with program managers and/or activity coordinators of local senior service centers.

End Users and Community Program Implementers

The end users for this program are defined as community-living adults age 60 and over who are physically mobile with or without assistive devices. We selected this age group because previous research findings with this particular cohort indicated they benefited significantly from Tai Chi exercises and evidenced reduced falls frequency.^{13,14,17,18} The program is designed to be implemented by any community-based senior service provider or organization that offers community health resources and/or social services, including physical or recreational activities, as part of a comprehensive service program to local community-living adults. These settings might be considered most appropriate for falls prevention efforts because they capture socioeconomically, ethnically, and functionally diverse populations.

Program Package

The program package includes an implementation plan, an instructor's teaching manual, and supplementary materials (described later) that can be used for out-of-class practice.

Implementation Plan. This plan is designed for use by local senior service providers or agencies interested in implementing Tai Chi as a balance-enhancing and falls prevention program for their clients. The plan recommends procedures for program implementation, including major elements of (1) class requirements, (2) the use of class materials, (3) administrative preparation, (4) program safety, and (5) program monitoring and evaluation.

Instructor's Teaching Manual and Supplementary Materials. An instructional training manual was developed for class instructors, and a videotape and guidebook were produced for class participants. The manual is designed to serve as a general orientation to the program and provides instructors with a background to Tai Chi, outlines program content and objectives, familiarizes them with the basic movements, recommends a training schedule and protocol, and highlights important exercise safety issues. Similarly, the user's guidebook and videotape provide participants with general information on Tai Chi, research evidence, movement illustrations with step-by-step instructions, safety tips, and a visual demonstration of the 8-form program.

Evaluation of Program Package Materials

All program package materials were subjected to evaluation by a panel of experts in exercise/Tai Chi, physical or occupational therapy, senior service provision and evaluation, public health/epidemiology, and a group of intended users. In addition, information on 3 program-feasibility issues was sought: (1) the likelihood that the program would be acceptable to local community senior service providers, (2) the extent to which the program would appeal to older adults, and (3) the ease of program implementation. Details are presented in the Results section.

Community Setting

The work was conducted in the Eugene–Springfield area in Oregon, with a population of 190,757 (Census 2000). According to the local Senior Resource Directory for Lane County, Oregon, there are 5 major senior centers in this area. All centers provided services or activities to community-living adults, with an average of 25 physical activity classes offered per year, daily attendance (of various client programs) ranging from 76 to 200 people (mean = 162), and client program attendance rates ranging from 80% to 90% (mean = 85%), in any given month.

Results

Experts and End-Users Evaluation

Through an iterative evaluation process, components of the program package (ie, the implementation plan, instructor's teaching manual, videotape, and user's guidebook) were evaluated by a panel of experts ($N = 28$) from the fields of public health ($n = 2$), exercise science ($n = 2$), injury epidemiology ($n = 2$), service evaluation ($n = 2$), physical and occupational therapy (with Tai Chi training background; $n = 2$), Tai Chi instruction ($n = 12$; 2 international, 2 national, 8 local), and program managers and coordinators of local senior service providers ($n = 6$). The written evaluation

focused on program materials regarding their appropriateness, intelligibility, clarity, and logistical practicality. The Tai Chi instructors and experts were asked to evaluate only the content appropriateness and relevance of the teaching manual, videotape, and guidebook. Before approving the final version of the package materials, all panel members were asked, independently, to rate them on a 4-point Likert scale: 1 (*acceptable*), 2 (*somewhat acceptable*), 3 (*need some revisions*), or 4 (*need substantial revisions*). The a priori-determined evaluation criterion required a rating of *acceptable* by all members on the panel. This was achieved after 3 rounds of reevaluation by the panel with respect to modifying language or terminology in certain elements of the materials.

Evaluation of the videotape and user's guidebook was also conducted by a group of 20 older adults (mean age = 75.4) who were recruited through word of mouth and as volunteers from local Tai Chi classes. The purpose was to evaluate content appropriateness and usefulness of these materials as supplements to a class. Ten of these individuals were novices (no prior Tai Chi experience), and the remaining 10 were participants in ongoing community Tai Chi classes. In a 2-hour session, the volunteers were introduced to the specifics of these materials, given the opportunity to view the videotape and to read through the user's guidebook, and participated in a brief instructor-led practice session of all 8 forms. The principal investigator of the project conducted all evaluations. At the end of the session, participants were given a brief survey designed to evaluate the Tai Chi materials with respect to (1) appropriateness, (2) usefulness, (3) intelligibility, and (4) clarity of written information. Each of the survey questions was rated on a 4-point scale (1 = *yes*, 2 = *somewhat*, 3 = *not sure*, or 4 = *no*). Clarifications were sought and follow-up revisions were made for those who responded *not sure* on any item ($n = 5$). Final responses to this survey are presented in Table 1. Overall, the Tai Chi practice materials were well received and considered to be both appropriate and useful as supplementary resources for the class-based program.

Table 1 Responses to the Videotape and User's Guidebook (N = 20)

	Number responding "Yes"	Number responding "Somewhat"
1. The Tai Chi videotape is useful as a learning aid.	17	3
2. Movements in the videotape are appropriately and clearly presented and easy to follow.	15	5
3. The content of the user's guidebook is helpful and a useful complement to the videotape.	16	4
4. The user's guidebook is clearly written and easy to understand.	15	5
5. Overall, the videotape and user's guidebook are appropriate Tai Chi learning materials to supplement class practice or for personal use at home.	19	1

Market Assessment

To determine the likely reach of the program if offered at a local activity center, based on the number of days the program was offered, a survey was conducted in a sample of older adults attending classes at local community centers. Four local senior activity centers were chosen on the basis of study criteria and size. Volunteers at each center were sought through site visits. When individuals were approached in groups of 2 or more (usually friends or spouse), a coin flip was used to select interviewees. Of the 87 individuals approached, 81 agreed to be interviewed, resulting in a 93% response rate ($81/87 = .93$). Two individuals declined and 4 responded *not sure* that they wanted to be interviewed. Among the respondents who agreed to be interviewed and expressed interest in Tai Chi, 18% indicated that they would join a Tai Chi program that was offered “once a week,” 59% responded to “twice a week,” and 23% responded to “three times a week.”

A brief interview was also conducted with center managers and activity coordinators ($N = 7$). The purpose of the interviews was to determine receptivity to Tai Chi as a falls prevention program and the likelihood of implementing classes in local community senior activity centers. Before the interview, a short introduction to the program was given to center staff. Any questions raised during the meeting were clarified. The outcomes indicated that (1) all staff at the centers were interested in the Tai Chi falls prevention program described to them, (2) all staff at the centers believed that Tai Chi would be an appropriate exercise program to improve balance and prevent falls, (3) provision of such a program was in line with the center’s goals and mission, (4) the program was likely to be feasible with respect to implementation, and (5) there was room or space available large enough to hold a Tai Chi class of 15 to 25 people.

Pilot Testing

Design and Purposes. Following the market assessment, the program package was pilot tested with respect to program appropriateness and feasibility (logistical practicality). The design involved a 2-week class intervention, implemented in a local senior community center, followed by a postintervention evaluation (via an exit interview) of the program. The specific purposes of this pilot were to evaluate (1) program feasibility, (2) in-class practice protocol, and (3) the appropriateness of the Tai Chi supplementary materials.

Procedures. Initially, a local senior community center, which provided various senior services including physical activity, was contacted for program implementation. Because the contacted center expressed interest in participating, no other centers were approached. The implementation plan and program protocol were explained in detail to the center’s activity coordinator. An action plan was devised between the researcher and the activity coordinator for a 2-week, twice-weekly class using the center’s facility. At that time, the Tai Chi instructors were hired. A recruitment announcement was then made, by the center, 10 days before the class through the use of informational flyers and word of mouth. Participants who met the following inclusion criteria were recruited: (1) no clear cognitive deficits (eg, Alzheimer’s disease) and (2) ability to walk with or without canes. All participant recruitment and class registration took place at the center.

Pilot Outcomes. A total of 22 community-living adults responded to the class promotion and signed up for the class. Of those, 20 (mean age = 74) signed the informed consent and participated in this pilot work. Two individuals who signed up for the class did not show up for the class, citing illness ($n = 1$) or having a time conflict ($n = 1$). Two experienced Tai Chi instructors taught the class. On the first day of the class, participants were given an introduction to the nature of this program and signed the informed consent. Following this brief introduction, copies of the videotape, user's guidebook, and weekly practice logs were distributed among class participants who were encouraged to use the materials to practice forms learned in class at home during the non-class days of the week.

The attendance rate for this 2-week class was 92% with no dropouts. In addition, no physical discomfort or injury was reported during any class sessions. Exit surveys indicated that participants enjoyed the class, felt the Tai Chi movements were appropriate and safe to perform, and that class instruction was clear and satisfactory (see Table 2). Although the majority of participants responded *somewhat* on the item of "easy to learn and perform," their confidence in learning and practicing the 8-form Tai Chi was relatively high (mean = 7.5, assessed on a 0 to 10 scale, with 10 being *completely confident*). They also reported the videotape and user's guidebook as useful learning materials. All participants indicated an intention to continue Tai Chi if it was offered in the community. With respect to

Table 2 Responses to the Exit Interviews (N = 20)

Survey item	Number responding "Yes"	Number responding "Somewhat"	Number responding "Not sure"
1. Overall program enjoyment	19	1	0
2. Easy to learn and perform	3	17	0
3. Safe to perform	19	1	0
4. Movement appropriateness	19	1	0
5. Understanding teaching instructions	20	0	0
6. Usefulness of the user's guidebook in Tai Chi practice	15	5	0
7. Usefulness of the video in guiding Tai Chi practice	18	2	0
8. Help to maintain better balance	17	2	1
9. Recommend to local activity centers	20	0	0
10. Recommend to others (eg, friends)	19	0	1
11. Intend to continue	17	3	0

Note. The 2 responses in the "Not sure" category were from the same individual.

home practice, data were obtained on all but 4 participants (who did not have a videotape player). Of the 16 participants who used the videotape, 3 (19%) reported practicing 1 session at home each week (average time = 15 minutes per session), 8 (50%) reported 2 sessions per week (average time = 17 minutes per session), and 5 (31%) reported 3 or more sessions per week (average time = 16 minutes per session). All participants (n = 20) were contacted by telephone 3 weeks after the completion of the program and were asked about their current levels of Tai Chi practice. Fourteen reported continued practice of Tai Chi (once or twice per week) and continued use of the resource materials provided.

The class instructors were interviewed for their general reactions to the program, the appropriateness of the teaching manual, and their experiences teaching the class. Their responses indicated the need to consider appropriate verbal teaching cues and repeated movement demonstrations to better facilitate learning for this group of older adults. These comments were adopted into a final revision of the manual. Finally, the activity coordinator was also asked to provide a brief verbal evaluation of the implementation plan and the overall class implementation. It was felt that the class was successfully implemented and that the implementation plan and the procedures were appropriate and feasible. Several comments were made about the logistics of program implementation and costs related to class materials, and these were incorporated into the final draft of the plan. The center also expressed interest in conducting future Tai Chi classes of a longer duration.

Discussion

An evidence-based program, *Tai Chi: Moving for Better Balance*, was developed as a community-based falls prevention program to bridge the gap between research and practice. A fundamental shift in the concept of intervention research is underway that involves recognition that research doesn't end when a study demonstrates that an intervention is effective. Additional "translational" activities are necessary such as the development of appropriate materials for end users and program deliverers that guide them through adoption and implementation of the intervention.¹⁵ Our program was developed as a step in the direction of translating an effective RCT into a community-based program.

The program, devised through an iterative process, encompassed an implementation plan and class-related teaching materials. A formal evaluation, involving experts, implementers, and users, indicated that the package materials were appropriate for the target population and logistically practical for implementation. The outcome of this evaluation reflected a positive assessment of the programmatic aspects of *Tai Chi: Moving for Better Balance*. A preliminary market survey indicated interest and support for this Tai Chi program from all local senior centers with a high likelihood of implementing the program and reaching target users. Finally, in working with a local activity center, a small pilot study showed that it was feasible to implement the program in a community setting. Overall, the Tai Chi training protocol was successfully implemented, and the program was well received with a good in-class attendance rate, positive reactions, and high interest in continuing. There was also a good record of in-home practice, indicating feasibility of home-based practice and the application of the user's support materials (video

and guidebook). On completion, over half of the participants continued Tai Chi practice in their own time—demonstrating potential for sustainability.

Limitations

Despite generally positive outcomes, some issues remain to be resolved. First, most participants reported the program to be only “somewhat” easy to learn and perform (see Table 2), suggesting that there were aspects of the program that might have been perceived by the participants as not easy to learn or perform. However, this “somewhat” response might also be the result of the short (2 weeks) exposure to the program. Presumably, longer program participation and ample time for practice might change participants’ perception. This question is currently being evaluated via a 12-week program implementation. In addition, the fact that 20% of the volunteers (4/20) in the pilot study were unable to make use of the videotape as a learning and reinforcement tool because they did not have access to a video player in the home is an issue that needs to be considered. It is possible, however, for the videotape or DVD to be made accessible to interested individuals to allow out-of-class practice through local community centers because many of them are equipped with multimedia resources. Currently, we have made both formats available to accommodate as many individuals as possible. In addition, our developmental work was conducted in a single geographical region. Therefore, the extent to which the program is generalizable to a more diverse older adult population (eg, people with varying cultural and ethnic backgrounds) and senior centers across other regions (eg, those located in rural areas with limited resources) remains to be determined.

Conclusions and Future Research

The preliminary work presented in this article provides solid evidence that materials and a protocol derived from an empirically based falls prevention intervention can be effectively received, applied, and used in community settings. This evidence is critical for the more important question of adoption, implementation, and maintenance of any larger scale comprehensive falls prevention program.

Practicality and sustainability of delivery are critical if an intervention is to have a public health impact.^{16,23} These research-to-practice questions, however, are being addressed in the implementation of the program in 5 local communities (involving 6 senior centers) that cover both urban and rural areas.²⁴ Using the RE-AIM framework,¹⁶ we will focus on dimensions of “reach” (ie, the proportion and representativeness of local community-dwelling older adults who respond to the promotion and participate in the class), “adoption” (uptake; ie, the number of local community senior centers approached that agree to participate and implement the program), and “implementation” (ie, the extent to which senior centers successfully implement elements of the program, including the use of the implementation plan, with a 2-times per week program schedule, a class attendance rate of 75% or better over the 12-week class period, and an average of 30 minutes or greater in-home practice per week). This framework will provide us with a systematic way to evaluate our program and, ultimately, to estimate the potential impact of the program on public health. The end results of both phases of this project will thus provide the

final dissemination model for an effective, evidence-based falls prevention program that can be implemented in community settings to improve functional ability and reduce fall prevalence among community-dwelling older adults.

Acknowledgments

The authors would like to express their gratitude to all those who have helped to develop this Tai Chi exercise package. Special thanks go to Machiko Shirai, Don Hildenbrand, and Elizabeth Miles, as well as the many activity center managers/coordinators, staff, and participants who partnered with us in the development and evaluation of this program. The project reported in this manuscript was supported through a cooperative agreement provided by the Centers for Disease Control and Prevention (No. U49/CE000711). The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the CDC. There is no conflict of interest.

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