Self-Report Benefits of Tai Chi Practice by Older Adults

Nancy G. Kutner,1 Huiman Barnhart,2 Steven L. Wolf,1 Elizabeth McNeely,1 and Tingsen Xu3

1Department of Rehabilitation Medicine, School of Medicine, and
2Department of Biostatistics, Rollins School of Public Health, Emory University, Atlanta, Georgia.
3Wesley Woods Geriatric Center, Emory University.

Older persons who are willing to begin exercise programs are often not willing to continue them. At the Atlanta FICSIT (Frailty and Injuries: Cooperative Studies of Intervention Techniques) site, individuals aged 70+ were randomized to Tai Chi (TC), individualized balance training (BT), and exercise control education (ED) groups for 15 weeks. In a follow-up assessment 4 months post-intervention, 130 subjects responded to exit interview questions asking about perceived benefits of participation. Both TC and BT subjects reported increased confidence in balance and movement, but only TC subjects reported that their daily activities and their overall life had been affected; many of these subjects had changed their normal physical activity to incorporate ongoing TC practice. The data suggest that when mental as well as physical control is perceived to be enhanced, with a generalized sense of improvement in overall well-being, older persons’ motivation to continue exercising also increases.

Exercise is important for the health and functioning of older adults (e.g., Blair & Garcia, 1996; Ettinger, 1996). For example, clinical trials indicate a reduced risk of falls among older people who engage in exercise (Province et al., 1995). Older persons who exercise may also experience an enhanced sense of well-being (e.g., Hickey, Wolf, Robins, Wagner, & Harik, 1995). However, factors that can help to motivate older persons to maintain regular patterns of exercise and activity are not well understood (Ettinger, 1996).

Our research team participated in the FICSIT studies (Frailty and Injuries: Cooperative Studies of Intervention Techniques), an initiative sponsored by the National Institute on Aging. FICSIT consisted of randomized, controlled health-promotion intervention trials targeted at people aged 70 years and older (Ory et al., 1993). The protocol implemented at our site included investigation of outcomes associated with older subjects’ practice of Tai Chi Quan — a martial art form modified as a slow, dance-like exercise and practiced for centuries in oriental cultures.

Tai Chi (TC) combines deep diaphragmatic breathing and relaxation with slow, gentle movements, both isometric and isotonic. Participants step with full weight on both lower extremities, but the heel-strike is more gentle than in walking because of slow and deliberate foot placement (Kirsteins, Dietz, & Hwang, 1991). Although there are various TC schools, all emphasize three essential features: (1) the body is naturally extended and relaxed, giving priority to lissomeness; (2) the mind is tranquil but alert, with consciousness commanding the body (mind-body relationship); and (3) body movements are slow, smooth, and well-coordinated throughout the exercise period (Chinese Sports Editorial Board, 1986). Movements should be performed effortlessly and flow from one to another, without excess energy expenditure from unnecessary muscle contraction.

In order to perform TC correctly, the exercise should be learned under the supervision of an instructor who is trained to monitor students’ posture and movement. However, no special equipment is needed, and participants use only a small practice space. The exercise can be performed individually or in groups. Because TC is “a low technology approach to conditioning that can be implemented at relatively low cost in widely distributed facilities throughout the community” (Blair & Garcia, 1996, p. 599), TC is a promising exercise option for older persons.

Our FICSIT study indicated that TC reduced subjects’ risk of multiple falls (Wolf et al., 1996). Another FICSIT site found that TC helped to maintain balance and strength among older persons who participated in more intensive laboratory balance training (Wolfson et al., 1996). A recent report from China suggests that regular TC practice is beneficial for older persons’ aerobic capacity (Lai, Lan, Wong, & Teng, 1995).

The FICSIT trials also investigated the relation of exercise to subjects’ psychosocial well-being (Buchner et al., 1993; Wolf, Kutner, Green, & McNeely, 1993). Primary psychosocial outcomes that were investigated at the Atlanta site included: the Center for Epidemiological Studies-Depression (CES-D) scale (Radloff, 1977); fear of falling (Tinetti, Richman, & Powell, 1990); a mastery index (Pearlin & Schooler, 1978); respondents’ rating on a 5-point Likert scale of how well they were taking care of their own health and respondents’ perception of their control over their future health, rated on a 4-point scale (questions from the National Health Interview Survey, Supplement on Aging); and perceived ability to do all that one would like to do, or “intrusiveness,” rated on a 4-point scale (Devins et al., 1983–4).

When psychosocial well-being measures were investigated in our study, two beneficial outcomes for TC subjects

E X E R C I S E is important for the health and functioning of older adults (e.g., Blair & Garcia, 1996; Ettinger, 1996). For example, clinical trials indicate a reduced risk of falls among older people who engage in exercise (Province et al., 1995). Older persons who exercise may also experience an enhanced sense of well-being (e.g., Hickey, Wolf, Robins, Wagner, & Harik, 1995). However, factors that can help to motivate older persons to maintain regular patterns of exercise and activity are not well understood (Ettinger, 1996).

Our research team participated in the FICSIT studies (Frailty and Injuries: Cooperative Studies of Intervention Techniques), an initiative sponsored by the National Institute on Aging. FICSIT consisted of randomized, controlled health-promotion intervention trials targeted at people aged 70 years and older (Ory et al., 1993). The protocol implemented at our site included investigation of outcomes associated with older subjects’ practice of Tai Chi Quan — a martial art form modified as a slow, dance-like exercise and practiced for centuries in oriental cultures.

Tai Chi (TC) combines deep diaphragmatic breathing and relaxation with slow, gentle movements, both isometric and isotonic. Participants step with full weight on both lower extremities, but the heel-strike is more gentle than in walking because of slow and deliberate foot placement (Kirsteins, Dietz, & Hwang, 1991). Although there are various TC schools, all emphasize three essential features: (1) the body is naturally extended and relaxed, giving priority to lissomeness; (2) the mind is tranquil but alert, with consciousness commanding the body (mind-body relationship); and (3) body movements are slow, smooth, and well-coordinated throughout the exercise period (Chinese Sports Editorial Board, 1986). Movements should be performed effortlessly and flow from one to another, without excess energy expenditure from unnecessary muscle contraction.

In order to perform TC correctly, the exercise should be learned under the supervision of an instructor who is trained to monitor students’ posture and movement. However, no special equipment is needed, and participants use only a small practice space. The exercise can be performed individually or in groups. Because TC is “a low technology approach to conditioning that can be implemented at relatively low cost in widely distributed facilities throughout the community” (Blair & Garcia, 1996, p. 599), TC is a promising exercise option for older persons.

Our FICSIT study indicated that TC reduced subjects’ risk of multiple falls (Wolf et al., 1996). Another FICSIT site found that TC helped to maintain balance and strength among older persons who participated in more intensive laboratory balance training (Wolfson et al., 1996). A recent report from China suggests that regular TC practice is beneficial for older persons’ aerobic capacity (Lai, Lan, Wong, & Teng, 1995).

The FICSIT trials also investigated the relation of exercise to subjects’ psychosocial well-being (Buchner et al., 1993; Wolf, Kutner, Green, & McNeely, 1993). Primary psychosocial outcomes that were investigated at the Atlanta site included: the Center for Epidemiological Studies-Depression (CES-D) scale (Radloff, 1977); fear of falling (Tinetti, Richman, & Powell, 1990); a mastery index (Pearlin & Schooler, 1978); respondents’ rating on a 5-point Likert scale of how well they were taking care of their own health and respondents’ perception of their control over their future health, rated on a 4-point scale (questions from the National Health Interview Survey, Supplement on Aging); and perceived ability to do all that one would like to do, or “intrusiveness,” rated on a 4-point scale (Devins et al., 1983–4).

When psychosocial well-being measures were investigated in our study, two beneficial outcomes for TC subjects
as compared to ED subjects were found (Wolf et al., 1996). First, change from pre- to post-intervention scores on the fear of falling measure was significantly different for TC compared to ED group participants \( (p = .046) \). In addition, a slight trend toward significant change was also found for pre- to post-intervention scores on the intrusiveness measure for TC as compared to ED group participants \( (p = .058) \). Thus, subjects randomized to TC showed reduced fear of falling; the data also suggested an increased sense of being able to do all that they would like to do (i.e., reduced intrusiveness) for TC subjects.

In addition to the indicators of well-being that served as primary outcome variables in our research protocol, subjects were asked to complete a self-esteem scale (Rosenberg, 1965) and five of the health status scales that make up the Medical Outcomes Study Short-Form 36 (MOS SF-36; Ware & Sherbourne, 1992). Psychosocial well-being outcomes were also captured by subjects' responses at a 4-month follow-up evaluation to exit interview questions asking about the perceived effects of the interventions on their daily lives. These interview data, which we have not previously reported, reflect subjects' views of ways in which they had benefited from participating in the interventions to which they were assigned.

**METHOD**

**Subjects**

Study participants at our FICSIT sites were required to be 70 years of age or older, ambulatory, and community-living residents. Exclusion criteria included presence of debilitating conditions such as severe cognitive impairment, metastatic cancer, crippling arthritis, Parkinson's disease and major stroke, or profound visual deficits that could compromise balance or ambulation. Thus, subjects were predominantly healthy older adults, and their willingness to volunteer for the study indicated their personal interest in health promotion.

Eligible subjects who were willing to participate on a weekly basis in a 15-week intervention and to return for a 4-month follow-up evaluation were asked for consent to randomization. A total of 200 subjects were entered into the study and randomized. Subjects' mean age was 76.2 years; 81% of the sample were women. Approximately 80% of the subjects had at least a college education.

A total of 160 subjects returned for the 4-month follow-up evaluation. Data reported herein were supplied by the 130 subjects who gave responses to exit interview questions at the 4-month follow-up. No significant demographic or baseline differences were found between these 130 subjects and the remaining 70 subjects who participated in the study.

**Interventions**

Our study included two exercise interventions: (1) TC and (2) computerized center-of-mass feedback for balance training (BT). An education (ED) group was included as an exercise-control condition. Each intervention lasted 15 weeks, and each group had its own instructor. Although TC subjects met twice a week, the approximate individualized weekly contact time between instructor and subject was 45 minutes for all subjects.

Tai Chi Quan consists of 108 movements, or "forms." Our intervention included 10 modified forms that could be learned within 15 weeks. Details about the 10 forms and their probable therapeutic elements have been described by Wolf, Coogler, and Xu (1997). Briefly, these forms emphasize movement components that tend to become limited as people age, particularly axial rotation and knee flexion during limb loading. The forms progress to requiring a narrowed base of support and, ultimately, single limb support. Subjects learned these forms in groups of 12, under the supervision of an experienced instructor. They were encouraged to practice the forms they had learned before their next formal session, utilizing pictures and written descriptions of each form.

The computerized BT intervention involved placing subjects individually on a platform in which multiple force transducers were embedded. The summed output of these transducers appeared as a cursor on a screen placed at eye level. Subjects, who trained once a week for 15 weeks, were instructed to move the cursor into targets positioned at different locations on the screen. Each successive location required increased postural sway toward the limits of stability. In later sessions, the platform moved in linear or angular directions as subjects attempted to move their center of pressure into targets, first with eyes open and then with eyes closed. At no time, however, did these participants progress toward single-limb stance or body rotational movements.

Finally, subjects assigned to the control group met weekly to discuss topics of interest, e.g., polypharmacy, diet, sleep patterns, etc. These individuals were asked not to alter their existing exercise routines during the study.

Both TC and BT should improve participants' balance, by providing either intrinsic feedback of muscle activity (TC) or extrinsic feedback about center of pressure (BT) that can facilitate movement control. TC also incorporates an emphasis on concentration, calmness, and mind-body interaction. Participants are encouraged to develop "sensitivities to the body's inner energy ("Chi") and direct its flow with the mind from one part of the body to another," thus learning "to cope with outside forces by yielding to them, rather than opposing them" (Weeks, 1993).

Data reported in this article were supplied by 51 TC subjects (71%), 39 BT subjects (61%), and 40 ED subjects (62%). A total of 72 subjects participated in the TC intervention; a total of 64 subjects participated in the BT and ED interventions, respectively. More subjects were randomized to TC because the initial study design proposed including two separate TC instructors (due to teaching schedule constraints), and the research team anticipated intra-cluster correlation among subjects participating in the same small group with the same instructor. However, when the study was actually implemented, it became feasible for only one instructor to conduct all the TC group sessions.

**Outcome Variables**

The principal outcome variables of interest are exit interview questions that were asked at subjects' 4-month follow-
up evaluation. The six questions were: (1) Has participation in this program had any noticeable effect on your life? (2) Has participation in this program changed your sense of confidence in any area? (3) Are there any areas in which you feel less confident? (4) Has participation in the program affected your activities of daily life in any way? (5) Has your normal physical activity changed as a result of your participation in this study? (6) Do you feel that you benefited from participating in this program? The third question elicited "no" responses from all subjects, and it was therefore not useful for further analyses. The remaining five questions are the source of the binary outcome variables discussed below.

As noted above, subjects also completed a self-esteem scale (Rosenberg, 1965) and five scales (general health perceptions, role functioning-physical, role functioning-emotional, bodily pain, and social functioning) from the MOS SF-36 (Ware & Sherbourne, 1992), which is a well-validated generic health status battery.

**Data Analysis**

Logistic regression was used to analyze binary responses to the exit interview questions. Analyses were adjusted for covariates that differed significantly between intervention groups at baseline or that were considered potential risk factors for the outcome variables. Covariates included age, gender, currently working for pay, volunteer work status, body mass index (BMI), trouble falling asleep, and having experienced a fall during the past year. The Hosmer and Lemeshow goodness-of-fit test was used to assess model fit (Hosmer & Lemeshow, 1989). Only significant covariates were included in the final model. Odds ratios were computed from the final models for interpretations, comparing TC subjects and BT subjects to the ED subjects who served as an exercise control group.

For the self-esteem and SF-36 health status data, we used analysis of variance for repeated measures to examine the difference between intervention groups and difference over time.

**RESULTS**

Table 1 summarizes, by intervention group, the percentage of subjects 70+ who reported the five exit interview questions. For each of the five binary outcomes measured by the exit interview questions, logistic regression was used for multivariate analyses that included the covariates listed above. The results from logistic regression analyses indicated that age, gender, currently working for pay, trouble falling asleep, and having experienced a fall during the past year were not related to any of the five outcomes. However, volunteer work status and BMI were associated with two outcomes: “normal physical activities changed” and “benefited from participating.” Therefore, volunteer work status and BMI were used for adjustment in the final logistic regression model for these two outcomes. Odds ratios for the final models are shown in Table 2.

For all five exercise outcomes, TC subjects were significantly more likely than control group (ED) subjects to report a beneficial effect. TC subjects, significantly more often than ED subjects, said (1) that participating in the intervention had a noticeable effect on their life (odds ratio = 4.19); (2) that their sense of confidence had changed (odds ratio = 3.21); (3) that their activities of daily life had been affected by the intervention (odds ratio = 4.53); (4) that their normal physical activities had changed (odds ratio = 3.21); and (5) that they had benefited from their participation in the intervention (odds ratio = 5.90).

For one of the exercise outcomes, change in sense of confidence, BT subjects were also significantly more likely than control group (ED) subjects to report a beneficial effect. BT subjects, significantly more often than ED subjects, said that participating in the intervention had changed their sense of confidence (odds ratio = 4.22).
Two covariates were related to exit interview outcomes. First, subjects' volunteer work status had borderline significance for responses to the question that asked if normal physical activity had changed as a result of subjects' participation in the intervention. Older persons reporting involvement in some type of volunteer work were more likely to say that their normal physical activity had changed as a result of their participation in the program. Second, body mass index (BMI) was significant for responses to the question asking if subjects felt that they had benefited from participation in their respective intervention. Each unit increase in BMI, subjects were 15% less likely to indicate that they had benefited from participating.

No statistically significant differences between intervention groups, or difference over time, were found for the self-esteem or the health status measures (Table 3). TC subjects appeared to improve pre- to post-intervention on the self-esteem measure, but the change was not statistically significant. Scores for all subjects on the SF-36 health status domains reflect the generally healthy status of the older persons who participated in our study.

**DISCUSSION**

TC participants, but not BT participants, were significantly more likely than ED participants to report a noticeable effect on their life, effects on activities of daily life, change in normal physical activity, and a sense of having benefited from their exercise training. Among the noticeable effects on their life cited by TC subjects were increased awareness of "the body" and "of different facets of well-being"; reduced stress; "showed me I could do some things I did not think I could"; and "felt as though I had more energy and strength." Activities of daily life for TC subjects were reportedly influenced by the improved "focus," or concentration they had gained (e.g., "more conscious of what I am doing," "more deliberate in my motions"), which in turn helped them to slow down: "[TC] helped me be a little more calm and quiet, not so stressed out"; "... has slowed me down some and helped me to relax." Approximately half of the TC subjects voluntarily enrolled in additional TC classes and continued to practice the forms after the protocol formally ended; this was the predominant "change in normal physical activity" that was cited by TC participants. Specific benefits of the TC exercise training that were mentioned included better coordination and balance, increased alertness, confidence, relaxation, better mental outlook, and a sense of achievement. Finally, several subjects noted that they enjoyed and looked forward to the TC sessions.

Both TC and BT subjects were significantly more likely than control group subjects to report change in sense of confidence. Two major factors contributed to TC and BT subjects' change in confidence, based on the exit interview responses: (1) a perception of having gained a better sense of balance and feeling more secure in their ambulation, and (2) an enhanced generalized sense of well-being.

Improved balance was the confidence-boosting factor that was most emphasized by BT subjects (75%); for example, subjects reported feeling "more sure-footed, especially going up hills," or "more conscious of various aspects of balance, especially the role of feet and ankles." The remainder of the BT group (25%) cited an enhanced sense of well-being, e.g., "assisted me in feeling better about myself and sharpening my positive thinking."

TC subjects, however, were almost equally likely to attribute their improved sense of confidence to improved balance (54%) and to an enhanced sense of well-being (46%). Some TC subjects said they felt "less likely to lose balance if disturbed" and felt "more secure in movement." TC subjects who referred to enhanced well-being as the reason for their changed sense of confidence made comments such as "just generally felt better," "gained a general overall feeling of well-being," and "TC has encouraged me." These perceptions of improved balance and well-being may have contributed to TC participants' significant improvement in fear of falling (Wolff et al., 1996).

These data suggest that a program such as the TC exercise we investigated can impact potential psychological morbidities in addition to the fear that older persons may have about losing their balance and sustaining a fall. Older persons need to feel confident to test the limits of their environment and to continue being mobile, which both the TC and the BT interventions seemed to promote. However, experiencing more generalized feelings of confidence and

| Table 3. Mean Scores for Self-Esteem and SF-36 Perceived Health Status Scales, by Intervention Group and Time |
|--------------------------------------------------|----------------------------------|----------------------------------|-----------------|----------------------------------|----------------------------------|-----------------|----------------------------------|
|                                                  | TC                               |                                  |                   | BT                               |                                  |                   | ED                               |                                  |
|                                                  | _n = 51_                         |                                  |                   | _n = 39_                         |                                  |                   | _n = 40_                         |                                  |
| **Self-esteem scale**                            |                                  |                                  |                   |                                  |                                  |                   |                                  |                                  |
| Total Score*                                     | 7.9 (2.3)                        | 8.2 (2.1)                        | 7.9 (2.1)         | 8.0 (2.1)                        | 8.2 (1.9)                        | 8.2 (2.2)         | 7.8 (2.3)                        | 8.0 (2.4)                        | 8.3 (2.3)                        |
| **SF-36 scales**                                  |                                  |                                  |                   |                                  |                                  |                   |                                  |                                  |                                  |
| General health                                   | 75.2 (17.9)                      | 75.2 (17.8)                      | 73.9 (18.0)       | 80.0 (14.6)                      | 79.0 (16.6)                      | 78.4 (15.9)       | 69.8 (18.4)                      | 69.7 (18.3)                      | 68.7 (18.4)                      |
| Physical health                                  | 71.1 (35.8)                      | 62.5 (38.9)                      | 62.7 (38.2)       | 66.7 (37.3)                      | 74.4 (33.2)                      | 62.8 (35.8)       | 66.9 (36.8)                      | 61.5 (35.7)                      | 58.8 (36.9)                      |
| Mental health                                    | 83.0 (27.0)                      | 85.3 (26.2)                      | 80.4 (32.8)       | 76.9 (32.6)                      | 78.6 (29.1)                      | 77.8 (29.9)       | 75.0 (36.0)                      | 70.9 (35.2)                      | 74.2 (33.3)                      |
| Bodily pain                                       | 81.7 (20.0)                      | 78.0 (20.9)                      | 74.9 (21.8)       | 79.2 (17.5)                      | 78.9 (16.7)                      | 73.8 (24.1)       | 78.6 (18.2)                      | 75.5 (21.3)                      | 77.2 (22.9)                      |
| Social functioning                               | 91.3 (13.9)                      | 85.6 (22.2)                      | 86.3 (20.2)       | 90.3 (17.9)                      | 92.9 (15.6)                      | 86.3 (20.9)       | 84.7 (22.2)                      | 85.5 (20.9)                      | 86.9 (19.8)                      |

*Score range = 0 (low) to 10 (high).  
*Score range = 0 (low perceived health status) to 100 (high perceived health status).

*Standard deviations in parentheses.
of overall psychological well-being, in the context of an enjoyable activity, may effectively motivate older persons to make exercise an ongoing part of their lives.

ACKNOWLEDGMENTS

This study was supported by NIH Cooperative Grant UO1 AG-09124 from the National Institute on Aging.

Address correspondence to Dr. Nancy G. Kutner, Center for Rehabilitation Medicine, Emory University School of Medicine, 1441 Clifton Road, N.E., Atlanta, GA 30322.

REFERENCES


Received October 24, 1996
Accepted April 20, 1997