Health-Related Quality of Life in Frail Institutionalized Elderly: Effects of a Cognition-Action Intervention and Tai Chi

Arnaud Dechamps, Chérifa Onifade, Arnaud Decamps, and Isabelle Bourdel-Marchasson

No previous studies have explored the effects of mind–body approaches on health-related quality of life (HRQoL) in the frail elderly. Cognition and action are an inseparable whole during functioning. Thus, a new intervention-based approach using familiarity-based movements and a nonjudgmental approach of “cognition-action” was proposed and was tested with Tai Chi on HRQoL in frail institutionalized elderly. Fifty-two participants (58% women) age 65–94 took part in a 24-wk Tai Chi (TC) intervention 4 days/wk or a cognition-action (CA) exercise program of 30 min twice a week. Changes in Mini Mental State score, physical (PCS) and mental component (MCS) summaries (SF12); Falls Efficacy Scale (FES); and exercise self-efficacy were explored. PCS improved from 33.6 ± 6.7 to 51 ± 4.8 in the TC group and from 30.6 ± 9.9 to 45.1 ± 10.2 in the CA group (p < .001). MCS of SF-12 (p < .001), FES (p < .001), and exercise self-efficacy (p < .01) were enhanced significantly in both groups. Adapted CA programs and Tai Chi were both efficient in improving HRQoL of frail elderly.

Keywords: HRQoL, self-efficacy, functional score

An extremely sedentary lifestyle is common in elderly participants living in institutions and has significant negative impacts on their health-related quality of life (HRQoL; Richardson, Bedard, & Weaver, 2001). Promotion of light to moderate exercise for institutionalized elderly has been recommended to improve HRQoL and reduce frailty (American Geriatrics Society, British Geriatrics Society, & American Academy of Orthopaedic Surgeons Panel on Falls Prevention, 2001; Bourdel-Marchasson & Berrut, 2005; Lazowski et al., 1999; Spirduso & Cronin, 2001). Recent studies have suggested that Tai Chi (TC) exercises might improve strength, balance, muscle function (Wu, Zhao, Zhou, & Wei, 2002; Xu, Hong, Li, & Chan, 2004), and psychological functioning by reducing fear of falling and improving self-efficacy and overall health in the elderly (Chou et al., 2004; Dechamps, Lafont, & Bourdel-Marchasson, 2007; Li, Harmer, Fisher, & Dechamps is with the Dept. of Physical Activity and Exercise Psychology, VSTII, LACES 4140, and Bourdel-Marchasson, UMR 5536 CNRS, Victor Segalen University, Bordeaux, France. Onifade and Decamps are with the Dept. of Gerontology, CHU of Bordeaux, France.
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McAuley, 2004; Li et al., 2005, 2001; Wolf et al., 2003; Zhang, Ishikawa-Takata, Yamazaki, Morita, & Ohta, 2005). Although those findings support the benefits of TC as an exercise therapy, participants in the studies were robust elderly. No previous studies have explored the effects of TC exercises on HRQoL among institutionalized elderly.

Although there is evidence of the large benefits of exercise in maintaining and improving functional and mental components of quality of life in the elderly, no recommendations have been made to date concerning the structure of exercise programs for frail institutionalized elderly (American Geriatrics Society et al., 2001; Dechamps et al., 2007; Nelson et al., 2007). TC is assumed to be a mind–body therapy, which makes it distinctly different from conventional rehabilitation programs, so it might have internal components that could potentially provide psychological and quality-of-life benefits in institutionalized elderly (Dechamps et al.; Li, Harmer, et al., 2004, 2001). However, it is still unclear whether the observed health benefits of exercise are solely a result of the physical activity internal components of TC (e.g., round and circular movements based on image recollection) or the adapted physical activity expert behavioral approach. Mind–body approaches are characterized by a perception of unity between cognition and action, the two entities being an inseparable whole during functioning (Bedny, Karwoski, & Bedny, 2001; Csikszentmihalyi, 1991). In short, the concept of unity between these two phenomena highlights the relationship between the experience of movement organization and functioning and the reduction of cognitive entropy, which help the individual be in a positive state (“flow”) while doing something (Csikszentmihalyi, 1991, 1997). An intervention based on this principle was named cognition-action (CA).

An unresolved question, therefore, is whether TC or CA benefits elderly who are frail. Fatigability is very common in institutionalized old adults, so long-term practice might be necessary to maintain or obtain notable benefits. In a recent review, a high-frequency TC program (four or five times a week) was found to produce more functional benefits than a low-frequency one, although no data are available concerning frail elderly (Dechamps et al., 2007). So far, little is known about the possible health benefits from differences in frequency of exercise sessions according to exercise programs.

The aim of this study was to explore the clinical effectiveness of two exercise interventions in terms of HRQoL benefits and attendance record. We therefore compared the effects over 24 weeks of a TC program with those of a CA program for frail institutionalized elderly with different pathologies and conditions on HRQoL variables. We hypothesized that the CA intervention would be the most effective in improving HRQoL.

Methods and Procedures

Participants

Ninety participants were screened from two nursing homes and one long-term care home during individual interviewing. To reflect the real-life ecosystem of geriatric institutions, inclusion criteria were broad: age 65 or older, ability to get up alone or with technical or human help if necessary, and ability to understand
basic motor commands. Terminally ill and bedridden patients were excluded. From the original recruitment pool, 48 patients did not meet the inclusion criteria. A total of 52 patients (mean age 80.7 ± 8.9 years) were recruited from the two nursing homes (n = 32) and the long-term care home (n = 20) and gave their informed consent. Fifty-one patients were widowed, 1 was married, and all of them lived in a 24-hr-care setting. The Institutional Review Board of the State Hospital Research University, Bordeaux, France, approved the study protocol. The intervention groups were randomly determined on a 1:1 ratio to receive either 24 weeks of TC (n = 26) or a CA program (n = 26). All exercise sessions were conducted in a group at the patients’ facilities. Participants were diagnosed using the DSM IV-TR criteria for dementia types and psychiatric disorders (American Psychiatric Association & American Psychiatric Association Task Force on DSM-IV, 2000).

Over a 1-week period, all assessments were completed by appropriate members of an interdisciplinary team who were blind to treatment allocation and study outcomes.

**Intervention**

The TC classes were taught by an experienced instructor who followed an adapted variation of the Yang style for the elderly, which emphasizes body sensation, awareness of multidirectional weight shifting, body alignment, and multisegmental movement coordination (Li, Fisher, Harmer, & Shirai, 2003). Deep breathing and traditional TC muscle-reinforcement exercises were integrated in the TC routine. The instructor highlighted the TC theory of mind–body balance, which focuses on cognitive and behavioral strategies to strengthen determination. After taking the population characteristics into consideration, TC was defined as four sessions of 30 min/week over the course of 24 weeks. Intensity of exercise was considered in the context of participants’ physiological capabilities (i.e., frail elderly) and was light to moderate.

The CA group met for 30 min and progressed to 40 min, twice a week for 24 weeks. This program was monitored by an adapted physical activity teacher and consisted predominantly of lower body muscle exercises, arm and abdominal reinforcement, ankle and wrist exercises, and deep abdominal breathing and relaxation. Each session comprised a warm-up for 10 min followed by stepping exercises, upper–lower multisegmental body coordination, and stretching exercises, with most of the exercises performed seated. The main objective for the patients was to be able to complete long series of exercises without discomfort. The sessions had no particular therapeutic objectives. The rationale was to “stick to” the patients’ time perception of their own progress and help them find their own situational awareness and comfort. During sessions, the instructor issued information relevant to health: changes in body functioning, balance, falls prevention, and lifestyle issues such as flow experience (Csikszentmihalyi, 1997), stress, and self-confidence. The instructor used verbal persuasion and incremental objectives and added enactive mastery experience during the exercises to maximize participation and enhance self-efficacy (Bandura, 2005). All the information was given to participants independently of their cognitive impairments. Cognition was introduced
during practice using collaborative change talk in relation to the patients’ verbal and cognitive impairments. The concepts of importance and confidence were addressed during the change process (Dunn & Rollnick, 2003). Using familiarity of movements, brief motivational communication, and encouragement and by keeping attention task oriented, the instructor controlled participants’ frustration during practice and solicited self-regulative resources in terms of completing the specific tasks the participants were engaged in (Csikszentmihalyi, 1997; Egan, 2002; Miller & Rollnick, 2002).

To clarify the CA method, we now describe a possible 5-min interaction with an Alzheimer’s patient (female, severe aphasia, severe spasticity of the upper limbs, no hearing or vision impairment, unable to stand on one leg, MMSE score around 10/30) with aberrant motor behavior such as pacing during a session. The interaction starts with introducing oneself, explaining what will be done during the interaction, and asking questions about how the patient feels, independent of his abilities to understand and answer. To introduce trust, the expert uses brief motivational interviewing (e.g., complimenting and talking about the patient’s progress since the last session, asking about what he thinks about it). Physical and verbal guidance might serve as incentives to the patient during the repetition of a familiarity-based movement (e.g., cycling while seated), and the repetition of the exercise serves as a trigger to reduce muscle spasticity and cognitive entropy. During this interaction, the other patients from the group might perform a specific exercise (alone or in pairs). Overall, the CA exercises are of light to moderate intensity.

The two intervention groups had two distinct characteristics. First, speed of motion was slower in the TC group. Second, in terms of cognitive encoding and retrieval of episodic memory, TC performance relied more on image recollection (Brauer, Woolacott, & Shumway-Cook, 2001; Wolf et al., 2003), whereas the CA approach mainly used familiarity-based movements (Dolcos, LaBar, & Cabeza, 2005).

**Measures**

**HRQoL.** HRQoL outcome measures were quality of life using the SF-12 (Ware, Kosinski, & Keller, 1995), a general health self-report questionnaire reflecting how respondents are able to function, how they feel, and what they think their health status is. The SF-12 is very sensitive to changes in health status and disease severity. Physical (PCS) and mental (MCS) health summary scores are determined using scoring algorithms (Ware et al.). Each subscale is scored from 0 to 100, with higher scores indicating better physical and mental health. Mood was assessed using the self-report 15-item Geriatric Depression Scale (GDS-SF), the score ranging from 0 to 15, with higher scores indicating more depressive symptoms (Lesher & Berryhill, 1994), and the Falls Efficacy Scale (FES), which evaluates the confidence one has to complete 10 basic activities of daily living without fear of falling (Tinetti, Richman, & Powell, 1990), the score ranging from 10 to 100, with higher scores indicating less efficacy. Cognitive function was evaluated at baseline and after 24 weeks using the MMSE (Folstein, Folstein, & McHugh, 1975).
**Self-Efficacy.** Exercise self-efficacy is the confidence one has to perform physical activities, persevere when facing barriers or obstacles, and be resilient when confronted with difficulties on a certain physical activity. The term Tai Chi in the TC exercise self-efficacy scale (Taylor-Piliae & Froelicher, 2004) was modified to adapted physical exercises to facilitate assessment and participants’ understanding of exercise self-efficacy; a global score from 0 to 100 was calculated, with higher scores indicating greater exercise self-efficacy.

**Physical Functioning.** Physical functioning was assessed using the timed up-and-go test (Podsiadlo & Richardson, 1991; time taken to rise from a chair, walk 3 m, return, and sit down) and one-leg stance (time a participant can stay in equilibrium while standing on one leg). Psychological and functional measurements were taken at baseline and at the end of the 24-week program.

**Intervention Adherence.** Adherence was assessed by keeping weekly attendance records in four categories including presence, absence for medical reasons, absence because of other activities (e.g., group activities, family appointment), and other absence (e.g., refused, missed schedule).

**Statistics**

All analyses were conducted on an intention-to-treat basis. All baseline results are therefore presented, and there were no missing data at baseline. Patients who withdrew, were hospitalized, or left the facilities during the course of the 6-month intervention were not included in further analysis. All analyses were performed using SPSS (SPSS Inc., Chicago, IL). Before all analysis, we explored data distribution and found that all the variables were normally distributed. We assessed changes in outcome measures over time and between groups by using global linear models. Post hoc mean comparisons with Bonferroni correction were performed to confirm posttreatment differences. Values of \( p < .05 \) were considered statistically significant.

**Results**

**Baseline Characteristics**

The two intervention groups were comparable on all baseline measures (Table 1), and the participants \( N = 52 \) presented light to moderate cognitive impairment with a mean \( (SD) \) MMSE score of 19.98 (6.67). No difference was found in any of the items between the patients who withdrew, were hospitalized, or left the facilities and the ones from their initial randomized allocation group at baseline. Patients did not differ according to their mental status in key functional or HRQoL measures (Table 2). None of the participants had previously practiced or heard of Tai Chi Chuan.

**Intervention Compliance, Attrition, and Adverse Events**

Class sizes in both groups ranged from 5 to 11 people (mean 8). Eight patients withdrew from the study immediately after they were randomly allocated to inter-
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Of the 44 remaining participants, 4 were hospitalized for health-related causes independent of training (n = 4 in TC) and 4 others left the facilities (3 in TC; 1 in CA) during the 24 weeks. Intervention-class compliance was calculated across the 24-week period (96 sessions for TC and 48 for the CA group) for all class-attending participants (N = 36; TC n = 15, CA N = 21). Attendance in the TC group, M ± SD, was 63.0% ± 27.0% (range 10.5–93.0%) and for the CA group was 64.5% ± 25.0% (range 4.0–98.0%). The average absence for medical reasons in the TC group was 6.5% ± 6.0% (range 1.0–25.0%) and in the CA group was 6.0% ± 4.0% (range 0–12.5%). The average absence because of personal or other group activities in the TC group was 3.5% ± 2.0% (range 0–7.0%) and in the CA group was 4.0% ± 4.0% (range 0–10.0%). Average absence, which included refusal to participate, no reason, bad mood, and other, was 27.0% ± 29.0% (range 2.0–84.0%) in the TC group and 25.5% ± 23.0% (range 2.0–77.0%) in the CA group. No statistical difference was found on any of these categories.

At the end of the 24-week intervention, only 1 participant in the TC group was able to reproduce the complete TC form without a model.

### Measures

Table 2 presents participants’ neuropsychiatric diagnoses and cognitive status, mood, and quality of life at baseline and the end of the intervention in both groups. No difference was found in physical and mental component scores of the SF-12 or in depression across neuropsychiatric diagnoses. Multivariate analysis of variance (MANOVA) showed no effect of MMSE scores on mood or overall quality of life at any time point. At the end of the intervention, all subgroups had improved on mood and SF-12 mental and physical scores independently of their cognitive status. At 24 weeks, the MMSE scores remained stable.

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**Table 1 Baseline Characteristics**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Tai Chi, n = 26</th>
<th>Cognition-action, n = 26</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td>80.8 ± 8.7</td>
<td>80.6 ± 9.2</td>
<td>.95</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>18 (69.2)</td>
<td>12 (46.1)</td>
<td>.09</td>
</tr>
<tr>
<td>MMSE</td>
<td>19.38 ± 7.20</td>
<td>20.67 ± 6.00</td>
<td>.98</td>
</tr>
<tr>
<td>Falls Efficacy Scale</td>
<td>55.3 ± 26.1</td>
<td>47.8 ± 25.5</td>
<td>.30</td>
</tr>
<tr>
<td>Geriatric Depression Scale</td>
<td>6.8 ± 3.1</td>
<td>7.5 ± 4.2</td>
<td>.45</td>
</tr>
<tr>
<td>PCS-SF-12</td>
<td>33.00 ± 6.81</td>
<td>31.3 ± 9.3</td>
<td>.45</td>
</tr>
<tr>
<td>Exercise self-efficacy</td>
<td>40.8 ± 10.6</td>
<td>40.4 ± 11.1</td>
<td>.88</td>
</tr>
<tr>
<td>One-leg stance, eyes open, right</td>
<td>34.4 ± 19.9</td>
<td>32.5 ± 20.8</td>
<td>.74</td>
</tr>
<tr>
<td>One-leg stance, eyes open, left</td>
<td>1.41 ± 2.27</td>
<td>0.89 ± 2.21</td>
<td>.42</td>
</tr>
<tr>
<td>Timed up-and-go test</td>
<td>0.88 ± 1.56</td>
<td>0.45 ± 0.67</td>
<td>.22</td>
</tr>
<tr>
<td></td>
<td>32.09 ± 21.64</td>
<td>26.42 ± 19.77</td>
<td>.34</td>
</tr>
</tbody>
</table>

*Note.* MMSE = Mini Mental State Examination; PCS-SF-12 = Physical Component Summary-Short Form 12; MCS = Mental Component Summary.
Table 2  Participants’ Cognitive Characteristics and Health-Related Quality of Life

<table>
<thead>
<tr>
<th>DSM IV-TR diagnosis</th>
<th>Baseline Testing</th>
<th>End of Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>MMSE</td>
</tr>
<tr>
<td>Alzheimer’s</td>
<td>3</td>
<td>13.7 ± 8.6</td>
</tr>
<tr>
<td>Other dementia</td>
<td>20</td>
<td>17.2 ± 6.4</td>
</tr>
<tr>
<td>Depression</td>
<td>10</td>
<td>24.2 ± 3</td>
</tr>
<tr>
<td>Bipolar disorder</td>
<td>6</td>
<td>19.8 ± 7.4</td>
</tr>
<tr>
<td>Others</td>
<td>13</td>
<td>23.4 ± 5.9</td>
</tr>
</tbody>
</table>

*Note.* MMSE = Mini Mental State Examination; GDS = Geriatric Depression Scale; PCS-SF-12 = Physical Component Summary-Short Form 12; MCS = Mental Component Summary. A post hoc subgroup analysis showed no significant difference on mean scores across the five categories at any time point in the intervention.
Table 3 displays the extent of improvement in the TC and CA groups for MMSE, timed up-and-go, one-leg stance, fear of falling, the Geriatric Depression Scale, and the SF-12. Repeated-measures analysis of variance showed no between-groups difference. The physical and mental component scores of the SF-12 progressed significantly across the 24 weeks. Exercise self-efficacy significantly improved in both groups. Significant reductions in fear of falling and depression were observed in both groups after 24 weeks of intervention. The physical-functioning measures indicated significant improvements in the one-leg-stance scores and the timed up-and-go in both TC and CA groups.

**Discussion**

The main finding of this study was that a CA exercise program offers HRQoL benefits similar to those of TC in a frail institutionalized elderly population. Moreover, these effects were achieved in a short time, thus increasing the likelihood of clinical applications. Several arguments could explain these results. According to both movement cognitive encoding and retrieval of episodic memory and the patients’ overall deconditioning, a 6-month intervention could promote easier movement reproduction and retrieval (e.g., CA movements), so the potential long-term effects of Tai Chi movement encoding and reproduction could not be assessed in our study. Because the repetition of movement could have potential benefits on cognitive entropy (Csikszentmihalyi, 1997), participants recalled that they felt emotionally positive during most of the sessions. Overall, emotional memory might have been enhanced across the 24-week intervention, resulting in mood and mental health improvements. Indeed, the likely residual benefits of such recall have already been demonstrated in young adults (Dolcos et al., 2005).

Even if cognition worsened and regardless of neuropsychiatric diagnoses, quality of life did not decrease in this frail elderly population. Furthermore, HRQoL did not differ according to cognitive status, which is consistent with previous studies (Hoe, Katona, Roch, & Livingston, 2005; Sullivan, Kempen, Van Sonderen, & Ormel, 2000). In line with previous data, the functional improvements obtained in both interventions might have served as an incentive for the participants to become more physically active and to have more self-confidence in their functional abilities (Brassington, Atienza, Perczek, DiLorenzo, & King, 2002; Jones, Harris, Waller, & Coggins, 2005; King et al., 2000; Spirduso & Cronin, 2001).

The current study shows that light- to moderate-intensity exercise decreases mood disturbances, increases self-efficacy, and enhances quality of life in geriatric populations (U.S. Public Health Service, Office of the Surgeon General, National Center for Chronic Disease Prevention and Health Promotion, & President’s Council on Physical Fitness and Sports, 1996). Other potential explanations of our results are that mood and mental health could mediate the observed benefits on HRQoL. Furthermore, CA used familiarity-based movements, which might have maximized the potential effect of routinization on well-being (Bouisson & Swendsen, 2003) over a more decontextualized movement-based approach like TC.
### Table 3  Changes in Health-Related Quality of Life During the 24 Weeks

<table>
<thead>
<tr>
<th>Variable</th>
<th>Tai Chi Group, n = 15</th>
<th>Cognition-Action Group, n = 21</th>
<th>Repeated-Measure p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline (M ± SD)</td>
<td>After 24 weeks (M ± SD)</td>
<td>Within participants</td>
</tr>
<tr>
<td>MMSE</td>
<td>19.4 ± 7.4</td>
<td>21.1 ± 6.4</td>
<td>.600</td>
</tr>
<tr>
<td>Falls Efficacy Scale</td>
<td>55.1 ± 23.44</td>
<td>16.8 ± 7</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Geriatric Depression Scale</td>
<td>6.1 ± 3</td>
<td>4.5 ± 3.4</td>
<td>.005</td>
</tr>
<tr>
<td>PCS-SF-12</td>
<td>33.6 ± 6.7</td>
<td>51 ± 4.8</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>MCS-SF-12</td>
<td>42 ± 12.2</td>
<td>47.6 ± 9.4</td>
<td>&lt;.002</td>
</tr>
<tr>
<td>Exercise self-efficacy</td>
<td>40.3 ± 21.4</td>
<td>56.3 ± 32.4</td>
<td>.003</td>
</tr>
<tr>
<td>One-leg stance, eyes open, right</td>
<td>1.6 ± 2</td>
<td>4 ± 5.4</td>
<td>.019</td>
</tr>
<tr>
<td>One-leg stance, eyes open, left</td>
<td>1.2 ± 2</td>
<td>2.9 ± 3.3</td>
<td>.013</td>
</tr>
<tr>
<td>Timed up-and-go test</td>
<td>25.2 ± 10.7</td>
<td>20.7 ± 10.8</td>
<td>.039</td>
</tr>
</tbody>
</table>

*Note.* MMSE = Mini Mental State Examination; GDS = Geriatric Depression Scale; PCS-SF-12 = Physical Component Summary-Short Form 12; MCS = Mental Component Summary. The *p* columns represent the effect from the repeated-measures analysis of variance. The *p* value in the within-participant effects column is expressed with the post hoc mean Bonferroni correction. No significant effects from treatment condition or Treatment × Condition interaction was observed.
The inclusion criteria enabled enrollment of participants with a broad range of mental and functional pathologies. These broad criteria are one of the strengths of this study in terms of implementation in other settings. The sample was significantly more physically and mentally impaired than those in previous studies (Faber, Bosscher, Chin, & van Wieringen, 2006; Li et al., 2005; Nnodim et al., 2006; Wolf et al., 2003; Zhang et al., 2005). For example, the median score for one-leg stance with eyes open on the right foot at baseline was 1.88 s (range 0.44–16.83) in the study by Wolf et al., compared with 0.3 s (range 0–11) at baseline and 1.21 s (range 0–51.4) at 24 weeks in our study. Attrition because of adverse events such as hospitalization and baseline functional scores found herein revealed the frailty of institutionalized elderly, suggesting that the participants in Wolf et al.’s study were less frail than ours. However, our results should be interpreted with caution. This was a pilot study, the population was extremely frail, and the sample was relatively small. Moreover, we did not add a control arm, so our results should be interpreted in terms of possible clinical utility according to intra-group improvements in HRQoL.

We used physical activity recommendations (U.S. Department of Health and Human Services, 2000) such as frequency and duration in the TC group, resulting in 48 hr of training over the 24-week period, whereas the CA group had a minimum of 24 hr of training. In previous studies, the amount of training was 78 hr over 26 weeks (Li et al., 2005) and a minimum of 96 hr over 48 weeks in a more physically impaired cohort (Wolf et al., 2003). Our data might have several clinically significant implications, considering the acceptable attendance record, the patients’ pathologies and characteristics, and how the elderly adhere to physical activity (McAuley, Jerome, Elavsky, Marquez, & Ramsey, 2003; Schutzer & Graves, 2004). The findings indicate that in frail institutionalized elderly, 24 hr of training over 24 weeks can lead to improved HRQoL.

**Conclusion**

This pilot study shows that a CA program and adapted Tai Chi improved quality of life in frail elderly participants. Our data suggest that a CA approach and Tai Chi in the secondary prevention of pathological aging could have clinical relevance in terms of HRQoL benefits over a 6-month period. Future exercise programs should focus on who should be targeted for which type of exercise, instructor supervision, and the efficiency of the manner in which each exercise is provided (frequency, duration, setting, instructor counseling approach, and cultural aspects) in terms of HRQoL benefits and the adherence mechanisms underlying these effects.

**Acknowledgment**

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Ware, J.E., Kosinski, M., & Keller, S.D. (1995). *SF-12: How to score the SF-12 physical and mental health summary scales* (2nd ed.). Boston: The Health Institute, New England Medical Center.


