



Tai Chi for older nurses: A workplace wellness pilot study

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Purpose: The purpose of this pilot study was to assess the feasibility of a Tai Chi workplace wellness program as a cost effective way of improving physical and mental health, reducing work related stress, and improving work productivity among older nurses in a hospital setting Design A randomized control trial of two groups (control and Tai Chi group).

Design: A randomized control trial of two groups (control and Tai Chi group).

Settings: Northeastern academic medical center.

Subjects: A convenience sample of eleven female nurses (mean age 54.4 years).

Intervention: The Tai Chi group (n = 6) was asked to attend Tai Chi classes once a week offered at their worksite and to practice on their own for 10 minutes each day at least 4 days per week for 15 weeks. Controls (n = 5) received no intervention.

Measures: SF-36 Health Survey, Nursing Stress Scale (NSS), Perceived Stress Scale (PSS), Sit-and-Reach test, Functional Reach test, the Work Limitations Questionnaire, workplace injury and unscheduled time off.

Analysis: The two study groups were compared descriptively and changes across time in the intervention versus control were compared.

Results: The Tai Chi group took no unscheduled time-off hours, whereas, the control group was absent 49 hours during the study period. There was also a 3% increase in work productivity and significant improvement in functional reach (p=0.03) compared to the control group. Other outcomes were not statistically significant.

Conclusion: This pilot study demonstrates the feasibility of Tai Chi with older female workers as a cost effective wellness option in the workplace; thus encouraging replication with a larger sample. Methodological implications were also addressed.

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1. Background

Despite recent gains made in recruiting individuals into the nursing profession, the exiting cohort of “baby boom” nurses will tax the health care system in the decade ahead (Buerhaus, Auerbach, & Staiger, 2009). Sufficient numbers

of younger nurses are not available to replace the enormity of retiring nurses. Moreover, O’Brien-Pallas, Duffield, and Alksnis (2004) calculated that the difference between a nurse retiring at age 58 or age 65 will have a substantial effect on slowing the rate of loss to the nursing workforce. With that incentive, health care employers are now addressing the challenges of managing and retaining a nursing workforce with most nurses older than 45 years (HRSA, 2004).

Strategies to retain older nurses in the workforce demand a heightened workplace consciousness to older nurses’ physical and mental health needs. Older nurses’ workplace

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injuries are the main cause of their early exit from the workforce (Owen, 2000) and thus contribute to the nursing shortage. Common workplace injuries for older nurses include needle-stick injury (43%), back pull or strain (25%), other musculoskeletal injuries (16%), and falls (11%) (Letvak, 2005). Nurses' stressful work environments can also lead to compromised emotional health and subsequent job dissatisfaction, absenteeism, and burnout (Chan & Huak, 2004; Letvak & Buck, 2008; Payne, 2001). Therefore, providing innovative approaches for older nurses to improve health and reduce stress is a "best practice" worth testing (Hatcher et al., 2006).

Mind–Body exercises are increasingly recognized as enhancing physical, emotional, and spiritual health (Astin, Shapiro, Eisenberg, & Forsys, 2003; Innes, Selfe, & Taylor, 2008). Tai Chi, one such approach, has been studied as an intervention to promote physical and mental health, especially in older adults aged 65+ years (Rogers, Larkey, & Keller, 2009; Wu, 2002). Tai Chi is an ancient Chinese martial art with a set of slowly paced and smoothly connected movements of all body parts. Tai Chi emphasizes mind–body connection during these movements. To date, there is no study available on the potential of Tai Chi exercise in the workplace of nurses. However, the widely documented positive effects of Tai Chi in the aging population suggest that Tai Chi may be an effective intervention for older nurses (age 45+ years), promoting mental and physical health, reducing work-related stress, and reducing absence from work. Class may be taken comfortably in loose-fitting nurse's uniforms or scrubs and sneakers, which makes an after-work offering very attractive.

This study was guided by Pender's (1996) Revised Health Promotion Model. This model proffers an orientation in which workplace wellness interventions reflect personal factors (perceptions—biological, psychological, and socio-cultural) filtered through situational influences (work environment). Optimally, this leads to commitment to action and finally health-promoting behaviors. Thus, developing interventions that support and reinforce employee healthy behaviors makes sense for organizations in the business of health care. But is this simply the altruistic thing to do, or does it make business sense as well?

There is mounting evidence that work-based wellness offerings are cost-effective (Goetzel & Ozminkowski, 2008; Pelletier, 2001). In addition to lowering costs related to health insurance and absenteeism, work-based wellness programs may impact productivity (Goetzel et al., 2007). In a period of declining financial resources for many health care organizations, it is only prudent to test workplace wellness interventions with cost implications for the employer included in the design.

2. Purpose

The purpose of this pilot study was to assess the feasibility of a Tai Chi workplace wellness program as a

cost-effective way of improving physical and mental health, reducing work-related stress, and improving work productivity among older nurses.

2.1. Hypotheses

Older nurses (aged 45+ years) who have participated in a 15-week worksite Tai Chi program will show significant improvements in health and well-being, physical functions, work limitations, stress, and work productivity, as compared with those who have not. As a pilot study, the goal was not only to test these hypotheses in a preliminary manner but also to assess the feasibility of the proposed research methods to test these hypotheses.

3. Methods

3.1. Design

A randomized controlled trial was used in which the nurses of one academic medical center at greater risk for work-related musculoskeletal disorders (i.e., work directly with patients) were randomized into an intervention group who participated in a 15-week Tai Chi program and a control group who did not receive any intervention.

3.2. Sample

A total of 14 older nurses (7 in each group), aged 49 years and older, from an academic medical center participated in the study. They were selected from over 70 respondents on a first-come-first-served basis. The inclusion criteria were registered nurses or licensed practical nurses who are 40 years or older currently employed full-time or part-time in staff nurse position that involved lifting patients. Nurses must have worked at least 1 year in the study setting to be eligible to participate in the study. They were excluded if they were unable to attend 15 weeks of class due to work or family scheduling conflicts.

3.3. Study measures

The following study measures were used before and after the intervention for all participants: SF-36 Health Survey (Ware, 2000), Nursing Stress Scale (NSS; Gray-Toft & Anderson, 1981), Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983), sit-and-reach test (Hong et al., 2000), isometric knee extensor strength test dynamometer (Lido model 481, Chattanooga, TN), functional reach test (Thornton, Sykes, & Tang, 2004), Nordic Musculoskeletal Questionnaire (Menzel, 2004), the Work Limitations Questionnaire (WLQ; Lerner et al., 1998), and work absenteeism. Psychometric data for these measures are listed in Appendix A. Work absenteeism was measured using the unscheduled combined time off (CTO) over the comparable time period in the previous year and over the test period, respectively. These data were provided by human resources from payroll records with the permission of the participants.

Table 1
Mean and standard deviation of changes from baseline for main outcome measures for control and Tai Chi groups

Scale	Control (<i>n</i> = 5) <i>M</i> (<i>SD</i>) ^a	Tai Chi (<i>n</i> = 6) <i>M</i> (<i>SD</i>)	<i>p</i> ^b
SF-36			
General health	−4.0 (4.2)	0.6 (7.0)	.33
Mental health	7.0 (9.1)	2.5 (9.3)	.62
NSS			
Conflict with physicians	−1.6 (2.4)	−0.8 (2.8)	.63
Lack of support	0.0 (0.0)	−0.8 (2.8)	.06
Conflict with other nurses	−0.4 (2.3)	−0.8 (0.8)	.83
Workload	0.8 (4.7)	−1.8 (2.5)	.18
Overall NSS (maximum = 102, highly stressful)	2.2 (5.4)	−6.1 (14.2)	.89
PSS (maximum = 40, highly stressful)	−1.4 (3.9)	−2.8 (2.4)	.42
Sit and teach (cm)	0.1 (2.3)	0.3 (1.7)	.17
Functional reach (cm)	−3.1 (1.5)	1.9 (1.5)	<.01
WLQ			
Physical demands	−2.5 (8.1)	−10.4 (11.7)	.32
Mental demands	0.0 (6.6)	−11.1 (10.1)	.14
Overall WLQ (1–100 range)	−0.8 (1.4)	−3.1 (1.2)	.03

^a Change values are computed as the difference between baseline and after the intervention. Negative values indicate decreases from baseline.

^b *p* values are for the differences between groups in their change over time.

The absences included sickness, injury, personal issues, stress, and so forth. Work-related injury over the test period was measured by self-reported limitations (WLQ). In addition, time lost costs were assessed using participants' mean wages and fringe benefits (\$54,849 + 29.17% fringe benefits = \$34.06/hr). This is a conservative estimate of actual cost, which also includes replacement costs and indirect costs attributable to lower morale and productivity. Data collection also included self-reported daily exercise diaries and class attendance.

3.4. Intervention

Participants in the Tai Chi group were asked to attend on-site Tai Chi classes once a week and to practice on their own for 10 minutes each day at least 4 days per week for 15 weeks. Participants in the control group did not receive any intervention but were promised a Tai Chi class at the end of the study. Each Tai Chi class lasted 45 minutes, with 10 minutes of breathing exercises, followed by 30 minutes of Tai Chi practice, and ended with 5 minutes of visualization and cool-down exercises. The Tai Chi instructor had 22 years of experience teaching simplified Yang style Tai Chi.

Table 2
Absent days (unscheduled CTO hours) of intervention and control groups

Measures	Control	Tai Chi experimental group
Four-month average unscheduled CTO hours over previous year	<i>M</i> = 3 hr (<i>SD</i> = 3 hr)	<i>M</i> = 3 hr (<i>SD</i> = 7 hr)
Unscheduled CTO hours during intervention (September 1, 2006–December 15, 2006)	<i>M</i> = 10 hr (<i>SD</i> = 14 hr)	<i>M</i> = 0 hr (<i>SD</i> = 0 hr)
Average hourly RN wage difference between 4-month average and intervention period	\$1,268.66	−\$760.33

3.5. Analysis

Data were first examined descriptively, and then the changes across time in both study groups (intervention versus control) were compared on continuous outcome variables (work limitations, health status, stress, and physical functioning) using a Wilcoxon two-sample test.

4. Results

4.1. Participant information

All participants were women. There were no significant differences between the Tai Chi and control groups in age, weight, hours of work, and participation in regular exercise (Table 1). At baseline, compared with the control group, the intervention group had similar health and physical conditions but significantly higher perceived stress and workload limitation scores (see Table 1). During the study period, three participants dropped out (one in the Tai Chi group and two in the control group). The reasons for dropout included conflict of the Tai Chi class time with work schedule and family responsibilities for the Tai Chi group and an injury in the control group.

4.2. Attendance

Tai Chi class was offered over 15 weeks. Thirteen weekly classes were held, with two classes cancelled for the Thanksgiving holiday and one snow day. None of the six participants had perfect attendance; 2 attended 92% of the classes, 2 attended 85% of the classes, and 2 attended 69% of the classes, for an average attendance of 82%.

4.3. Physical and mental health well-being

The Tai Chi group showed nonsignificant improvement in general health and mental health (+1.2% and +2.1% in SF-36, respectively), whereas the control group showed a decline in both (−4.6% and −3.8%, respectively; see Table 1). The Tai Chi group showed a greater reduction in work stress (−20% in NSS) than the control group did (−8.5%) after exercise (*p* = .89). The reduction in stress related to “lack of support” nearly reached significant group effect (*p* = .06). The Tai Chi group also showed a larger reduction in general stress (−23% in PSS) than the control group did (−17.5%; *p* = .42).

4.4. Risks for musculoskeletal injuries

There was a significant group difference in the change in the functional research test (*p* < .01), with the Tai Chi group

showing an improvement (+0.8%) and the control group showing a decline (−7.9%; see Table 1). The Tai Chi group also showed a larger improvement in trunk flexibility (+6.4% in the sit-and-reach test) than the control group did (+1.2%).

4.5. Work limitations and work productivity

The Tai Chi group also showed a 3% increase in work productivity compared with the control group, as measured by the WLQ ($p = .03$). In addition, the Tai Chi group had no unscheduled combined time-off hours, whereas the control group lost a total of 49 hours during the 15-week intervention (see Table 2). Using the mean hourly salary of the nurses plus a percentage for benefits, replacement costs for the control group's unscheduled time exceeded the Tai Chi group and demonstrated cost savings. The total cost of the Tai Chi program (mainly instructor fee) was recovered by not having to use replacement nurses for the time off taken by the Tai Chi group. There were no workplace injuries reported for participants in either group.

5. Discussion

This pilot study suggests that it is feasible to test Tai Chi, as a workplace wellness intervention, with larger sample sizes and to determine if the impact on absenteeism is reproducible. Concerns about participant recruitment were unfounded as the team was unable to accommodate expressed interest. Participants were also positive about the intervention, as reflected in their evaluations. From the perspective of the institution, the cost and complexity of implementation were minimal, and the costs were covered by the reduced absenteeism and increased productivity. Barriers to further implementation and testing were not identified. The research team was satisfied with the selected instruments and would employ these measures in larger trials.

Although most of the outcome measures did not show statistically significant group differences in their changes over time, the Tai Chi group did show larger improvements than the control group did on all measures. The lack of statistical significance may be attributed by several factors. First, this study involves a relatively small sample size. Second, the participants in this study represented a healthy and relatively unstressed group of women, with the exception of their mean weight. It is possible that a “ceiling effect” was present, and within this time frame, there was little opportunity to see much change on stress scales that were already indicative of a low-stress participant group. This could be particularly true with respect to the WLQ. Although both groups reported very few work limitations, the overall mean level in the Tai Chi group was significantly higher than that of the control group at baseline, thus affording a greater opportunity for change

over time. An interesting finding was that the change seen in the Nurse Stress Scale domain “lack of support” might have been positively influenced by the supportive nature of the weekly exercise group. It might have been helpful to measure exercise compliance and class attendance and correlate these with individual results. Nevertheless, the results of this study suggest that incorporating Tai Chi into workplace wellness offerings is a cost-effective and positively perceived intervention to support workers and enhance workplace productivity.

5.1. Limitations

This study tested both a methodology and a set of hypotheses. The methods were found to be effective and appropriate for broader scale study. The pilot purposefully employed a small sample size to test the methodology, which in turn is the most serious limitation of the study. The small sample size impedes a full-cost analysis, and the self-selected nature of the convenience sample does not address applicability beyond those potentially interested in such techniques. Moreover, the baseline differences between the control and treatment group could not be statistically controlled due to the small sample size. Presumably, a larger sample, again randomly assigned, would enable a more even starting point or the potential for statistical control.

An intervention tested beyond “ready recruits” would be a valuable contribution to the literature as this self-selected sample may differ markedly from those nurses potentially in greatest need of work stress place reduction and fitness regimes. Moreover, the study was done in a single geographic area and lacked underrepresented populations and men. It is also impossible to dissect instructor effects due to individual style, which impacts external validity.

5.2. Implications for practice

Employers need to test best practices for retaining older nurses who will be needed in the predicted years of nursing shortage that lay ahead. This includes cost-effective employee wellness offerings. Evidence-based interventions for improving older nurses' physical and mental health are essential, and this pilot study provides results that encourage replication and further study of Tai Chi in the workplace.

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Appendix A. Psychometric data on the questionnaire instruments and trunk flexibility, leg strength, and postural stability measurements

Instrument	Reliability	Validity
The SF-36 Version 2 (Ware, 2000)	Internal consistency and test–retest measures have exceeded a standard of .70 in more than 25 studies. Cronbach's alpha of $\geq .80$ in seven of eight scales	Studies to date have yielded content, concurrent, criterion, construct, and predictive evidence of validity (Ware, 2004)
WLQ (Lerner et al., 1998)	Interrater reliability and less recall error established, Cronbach's alpha between .70 and .90 for all items	Content validity established by literature review, focus groups, physician panel, and interviews of 40 employed individuals with chronic illness. Construct validity was established with comparison to the SF-36 role limitation scale. Relative validity ratios ranged from 0 to 1. Criterion validity established comparing objectively measured work productivity and disability claims to WLQ
NSS (Gray-Toft & Anderson, 1981)	Test–Retest coefficient of .81 and four measures of internal consistency indicated satisfactory levels.	IPAT Anxiety Scale, Affect Rating Scale, turnover rates, and the NSS were significantly correlated; the Job Description Index was not. Nursing assistants scored less job stress and turnover than did the licensed practical nurses or RNs
PSS (Cohen et al., 1983)	Test–Retest correlation values were .85 and .55; coefficient alpha reliability values were .84, .85, and .86.	Concurrent and predicative validity have been established for age and gender. Significant correlations between the PSS and the number of life events, the impact of life events, and utilization of health services
Nordic Musculoskeletal Questionnaire (Menzel, 2004)	Test–Retest 0% to 23% disagreeing answers	Disagreement between questionnaire and physiotherapist assessment is 0%–20%.
Functional reach test (Thornton et al., 2004)	Test–Retest reliability is .8; interrater reliability is .98	Functional reach test is correlated with center of pressure excursion ($r = .71$).
Isokinetic force dynamometer (Lido model 481, Chattanooga, TN)	Test–Retest reliability for peak torque of knee extensors is .90 or higher	Isokinetic force dynamometer measurement can detect differences in leg extensor strength in people with osteoarthritis as compared with healthy adults and is significantly correlated with gait speed in people with stroke.
Sit-and-reach test (Hong et al., 2000)	Test–Retest correlation over 8 months is .83	Sit-and-reach test scores are correlated with general trunk flexibility ($r = .61$)

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