



Published in final edited form as:

*Appl Nurs Res.* 2012 February ; 25(1): 54–59. doi:10.1016/j.apnr.2010.01.002.

## Tai Chi for Older Nurses: A Workplace Wellness Pilot Study

**Mary Val Palumbo, DNP, APRN,**

University of Vermont, Office of Nursing Workforce, 106 Carrigan Drive, Burlington, VT 05405-0068, 802 656-0023, FAX – 802 656-8306

**Ge Wu, PhD,**

University of Vermont, Department of Rehabilitation and Movement Science, 305 Rowell Building, Burlington, VT 05405, phone: 802-656-2556, FAX: 802-656-6586

**Hollie Shaner-McRae, DNP, RN, FAAN,**

Fletcher Allen Health Care, 111 Colchester Avenue - Mod b 217, Burlington, VT 05401, 802 847 9909, FAX: 802 847 4305

**Betty Rambur, PhD, RN, and**

University of Vermont, Department of Nursing, 106 Carrigan Drive, Burlington, VT 05405-0068, 802 656-3401, FAX – 802 656-8306

**Barbara McIntosh, PhD, SPHR**

University of Vermont, School of Business Administration, 318 Kalkin Hall, 802-656-0507, FAX: 802-656-8279

Mary Val Palumbo: mpalumbo@uvm.edu; Ge Wu: ge.wu@uvm.edu; Hollie Shaner-McRae: Hollie.Shaner-McRae@vtmednet.org; Betty Rambur: brambur@uvm.edu; Barbara McIntosh: mcintosh@bsad.uvm.edu

### 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, P., Auerbach, D and Staiger, D., 2009). Sufficient numbers of younger nurses are not available to replace the enormity of retiring nurses. Moreover, O’Brien-Pallas et al., (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 the majority of nurses over 45 years of age (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 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/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).

---

**Publisher's Disclaimer:** This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Mind-body exercises are increasingly recognized as enhancing physical, emotional, and/or 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+ (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 absence from work. Class may be taken comfortably in loose fitting nurse's uniforms/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 healthcare. 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.

## 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.

## Hypotheses

Older nurses (age 45 +) who have participated in a 15-week worksite Tai Chi program will show significant improvements in health and wellbeing, physical functions, work limitations, stress, and work productivity, as compared to 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.

## Methods

### 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.

### Sample

A total of 14 older nurses (7 in each group), aged 49 years and above 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 which involved lifting patients. Nurses must have worked at least one 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.

### 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 and Anderson, 1981), Perceived Stress Scale (PSS) (Cohen, Kamarck, and 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 et al., 2004), Nordic Musculoskeletal Questionnaire Menzel, (2004), the Workload Limitation Questionnaire (WLQ) (Lerner & Amick, 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 was provided by Human Resources from payroll records with the permission of the subjects. The absences included sickness, injury, personal issues, stress, etc. 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.

### 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 five minutes of visualization/cool down exercises. The Tai Chi instructor, had 22 years of experience teaching simplified Yang style Tai Chi.

### 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.

## Results

### Subject information

All participants were female. 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 to 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 subjects dropped out (two in the Tai Chi group and one 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.

## 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. Non of the six participants had perfect attendance; two attend 92% of classes, two attended 85%, and two attended 69% for an average attendance of 82%.

## Physical and mental health wellbeing

The Tai Chi group showed non significant improvement in general health and mental health (+1.2% and +2.1% in SF36, respectively) while 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%) post exercise ( $p = 0.89$ ). The reduction in “lack of support” related stress nearly reached significant group effect ( $p=0.06$ ). The Tai Chi group also showed a larger reduction in general stress (-23% in PSS) than the control group did (-17.5%) ( $p = 0.42$ ).

## Risks for musculoskeletal injuries

There was a significant group difference in the change in the Functional Research test ( $p<0.01$ ), 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 Sit-and-Reach test) than the control group (+1.2%).

## Work limitations and work productivity

The Tai Chi group showed a greater reduction in the Work Limitation Scale post intervention (-65%) than the control group (-60%;  $p=0.03$ , see Table 1). 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. The Tai Chi group also showed a 3% increase in work productivity as compared to the control group, as measured by Workload Limitation Questionnaire. There was no workplace injuries reported for subjects in either group.

## 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 reproduceable. Concerns about subject 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 was 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 the majority 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 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's possible that a "ceiling effect" was present, and within this timeframe there was little opportunity to see much change on stress scales that were already indicative of a low-stressed subject group. This could be particularly true with respect to the Work Limitations Questionnaire. While 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. Interestingly, 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..

### 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.

### 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.

### Acknowledgments

Support was received from: State of Vermont - Agency of Human Services, University of Vermont, General Clinical Research Center and Janice Bunn PhD, NIH Grant # M01 RR00109, Fletcher Allen Health Care

### References

- Astin JA, Shapiro SL, Eisenberg DM, Forsys KL. Mind-body medicine: state of the science, implications for practice. *J Am Board Fam Pract.* 2003; 16(2):131–147. [PubMed: 12665179]
- Buerhaus P, Auerbach D, Staiger D. The recent surge in nurse employment: causes and implications. *Health Affairs.* 2009; 28(4):657–668.
- Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *Journal of Health and Social Behavior.* 1983; 24:385–396. [PubMed: 6668417]
- Chan A, Huak C. Influence of work environment on emotional health in a health care setting. *Occupational Medicine (Oxford).* 2004; 54(3):207–212.

- Goetzel RZ, Ozminkowski RJ. The health and cost benefits of work site health-promotion programs. *Annu Rev Public Health*. 2008; 29:303–323. [PubMed: 18173386]
- Goetzel RZ, Shechter D, Ozminkowski RJ, Marmet PF, Tabrizi MJ, Roemer EC. Promising practices in employer health and productivity management efforts: findings from a benchmarking study. *J Occup Environ Med*. 2007; 49(2):111–130. [PubMed: 17293753]
- Gray-Toft P, Anderson JG. Stress among hospital nursing staff: Its causes and effects. *Social Science and Medicine*. 1981; 15:639–647.
- Hatcher, BJ.; Bleich, MR.; Connolly, C.; Davis, K.; O'Neil Hewlett, P.; Stokley Hill, K. *Wisdom at Work: The Importance of the Older and Experienced Nurse in the Workplace*. 2006. Retrieved July 31, 2006, from <http://www.rwjf.org/files/publications/other/wisdomatwork.pdf>
- Hong Y, Li JX, Robinson PD. Balance control, flexibility, and cardiorespiratory fitness among older Tai Chi practitioners. *British Journal of Sports Medicine*. 2000; 34(1):29–34. [PubMed: 10690447]
- HRSA. *The Registered Nurse Population: Findings from the 2004 National Sample Survey of Registered Nurses*. 2004. Retrieved December 19, 2009 from <http://bhpr.hrsa.gov/healthworkforce/rnsurvey04/>
- Innes KE, Selfe TK, Taylor AG. Menopause, the metabolic syndrome, and mind-body therapies. *Menopause*. 2008; 15(5):1005–1013. [PubMed: 18779682]
- Lerner DJ, Amick BC 3rd, Malspeis S, Rogers WH, Gomes DR, Salem DN. The Angina-related Limitations at Work Questionnaire. *Qual Life Res*. 1998; 1:23–32. [PubMed: 9481148]
- Letvak S. Health and safety of older nurses. *Nurs Outlook*. 2005; 53(2):66–72. [PubMed: 15858524]
- Letvak S, Buck R. Factors influencing work productivity and intent to stay in nursing. *Nurs Econ*. 2008; 26(3):159–165. [PubMed: 18616053]
- Menzel NN. Back pain prevalence in nursing personnel: measurement issues. *AAOHN J*. 2004; 52(2): 54–65. [PubMed: 14979616]
- O'Brien-Pallas L, Duffield C, Alksnis C. Who will be there to nurse? Retention of nurses nearing retirement. *J Nurs Adm*. 2004; 34(6):298–302. [PubMed: 15190225]
- Owen BD. Preventing injuries using an ergonomic approach. *AORN J*. 2000; 72(6):1031–1036. [PubMed: 11141704]
- Payne N. Occupational stressors and coping as determinants of burnout in female hospice nurses. *Journal of Advanced Nursing*. 2001; 33(3):396–405. [PubMed: 11251727]
- Pelletier KR. A review and analysis of the clinical- and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: 1998–2000 update. *Am J Health Promot*. 2001; 16(2):107–116. [PubMed: 11727590]
- Pender, N. *Health promotion in nursing practice*. 3. Stamford, CT: Appleton & Lange; 1996.
- Rogers CE, Larkey LK, Keller C. A review of clinical trials of tai chi and qigong in older adults. *West J Nurs Res*. 2009; 31(2):245–279. [PubMed: 19179544]
- Thornton EW, Sykes KS, Tang WK. Health benefits of Tai Chi exercise: improved balance and blood pressure in middle-aged women. *Health Promotion International*. 2004; 19(1):33–8. [PubMed: 14976170]
- Ware JE Jr. SF-36 health survey update. *SPINE*. 2000; 15;25(24):3130–9.
- Wu G. Evaluation of the effectiveness of Tai Chi for improving balance and preventing falls in the older population--a review. *J Am Geriatr Soc*. 2002; 50(4):746–754. [PubMed: 11982679]

**Table 1**

Mean and SD of changes from baseline for main outcome measures for control and Tai Chi groups.

Scale	Control (n=5) Mean (SD) <sup>a</sup>	Tai Chi (n=6) Mean (SD)	p value <sup>b</sup>
<b>SF36</b>			
<i>General Health</i>	-4.0 (4.2)	0.6 (7.0)	0.33
<i>Mental Health</i>	7.0 (9.1)	2.5 (9.3)	0.62
<b>Nursing Stress Scale</b>			
<i>Conflict with Physicians</i>	-1.6 (2.4)	-0.8 (2.8)	0.63
<i>Lack of Support</i>	0.0 (0.0)	-0.8 (2.8)	0.06
<i>Conflict with Other Nurses</i>	-0.4 (2.3)	-0.8 (0.8)	0.83
<i>Workload</i>	0.8 (4.7)	-1.8 (2.5)	0.18
<i>Overall NSS (max=102, highly stressful)</i>	2.2 (5.4)	-6.1 (14.2)	0.89
<b>Perceived Stress Scale (max=40, highly stressful)</b>	-1.4 (3.9)	-2.8 (2.4)	0.42
<b>Sit and Reach (cm)</b>	0.1 (2.3)	0.3 (1.7)	0.17
<b>Functional reach (cm)</b>	-3.1 (1.5)	1.9 (1.5)	<0.01
<b>Work Limitations Questionnaire</b>			
<i>Physical Demands</i>	-2.5 (8.1)	-10.4 (11.7)	0.32
<i>Mental Demands</i>	0.0 (6.6)	-11.1 (10.1)	0.14
<i>Overall WLQ (1-100 range)</i>	-0.8 (1.4)	-3.1 (1.2)	0.03

<sup>a</sup>Notes: Change values are computed as post-pre. Negative values indicate decreases from baseline.

<sup>b</sup>p values are for the differences between groups in their change over time.

**Table 2**

Absent days (unscheduled CTO hrs) of intervention and control groups

Measures	Control	Tai Chi Experimental Group
<b>Four Month Average Un-scheduled CTO hrs over previous year</b>	3 hrs mean (3sd)	3 hrs mean (7 sd)
<b>Un-scheduled CTO hrs during intervention (9/01/06 - 12/15/06)</b>	10 hrs mean (14sd)	0 hr mean (0 sd)
<b>Average Hourly RN Wage Difference between 4 month average and Intervention Period</b>	\$1268.66	-\$760.33



### Appendix A

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

Instrument	Reliability	Validity
The SF 36v2 (Ware, 2000)	Internal consistency and test – retest measures have exceeded standard of .70 in more than 25 studies. Cronbach' alpha =>.80 in 7/8 scales.	Studies to date have yielded content, concurrent, criterion, construct and predictive evidence of validity (Ware, 2004)
The Work Limitations Questionnaire (Lerner & Amick, 1998)	Inter-rater reliability and less recall error established, Cronbach' alpha between .70 and .90 for all items.	Content validity established by literature review, focus groups, physician panel, and interviews 40 employed chronically ill individuals. Construct validity was established with comparison to the SF-36 role limitation scale.. Relative validity ratios ranged from 0–1. Criterion validity established comparing objectively measured work productivity, and disability claims to WLQ.
The Nursing Stress Scale (NSS) (Gray-Toft and Anderson, 1981)	Test-retest coefficient of 0.81 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 LPNs or RNs
The Perceived Stress Scale. Cohen, Kamarck, and Mermelstein (1983)	Test-retest correlation was .85 and .55, Coefficient alpha reliability was .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 0–20%
Functional Reach Test. Thornton et al., (2004).	Test-retest reliability is 0.8 Inter-rater reliability is 0.98	Functional Reach Test is correlated with center of pressure excursion (r=0.71)
Isokinetic force dynamometer (Lido <sup>®</sup> model 481, Chattanooga, TN).	Test-retest reliability for peak torque of knee extensors is 0.90 or higher	Isokinetic force dynamometer measurement can detect differences in leg extensor strength in people with osteoarthritis as compared to 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 eight months is 0.83	SR scores are correlated with general trunk flexibility (r = .61)