

Service Learning Capstone Experience Final Paper

Unintentional Fall Injuries among Older Adults in Four Nebraska Counties

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List of Abbreviations

CEESP	Cancer Epidemiology Education in Special Populations
COPH	College of Public Health
DHHS	Nebraska Department of Health and Human Services
ED	Emergency Department
IRB	Institutional Review Board
MLH	Mary Lanning Healthcare
ORCI	Ocean Road Cancer Institute
SHDHD	South Heartland District Health Department
TCMBB	Tai Chi: Moving for Better Balance
UNMC	University of Nebraska Medical Center

Placement Site

South Heartland District Health Department, Hastings, Nebraska

Mission: The South Heartland District Health Department is dedicated to preserving and improving the health of residents of Adams, Clay, Nuckolls and Webster counties. We work with local partners to develop and implement a Community Health Improvement Plan and to provide other public health services mandated by Nebraska state statutes.

Guiding Principles:

- We are committed to the principles of public health and strive to be a credible, collaborative and stable resource in our communities.
- We seek to perform our duties in a courteous, efficient and effective manner within the limits of sound fiscal responsibility.
- We work together to create a positive environment, listening carefully and treating everyone with honesty, sensitivity, and respect.

Vision: Healthy people in healthy communities.

Abstract

In 2014, Nebraskans aged 65 and older had a combined 15,681 emergency department visits and hospitalizations (Nebraska Department of Health and Human Services Injury Prevention Program, 2016). To prevent unintentional falls by older adults in the South Heartland District Health Department (SHDHD) region, SHDHD participated in the Nebraska DHHS Injury Prevention Program's Tai Chi: Moving for Better Balance Program. They were one of several health departments who applied for sub-award to implement this program in the SHDHD region. Using pre- and post-test survey data from the tai chi program, analysis was conducted to assess the effectiveness of the program for reducing falls and improving health status among participants of the program from 2016 to 2017. Additionally, emergency department data from Mary Lanning Healthcare (MLH) in Hastings, Nebraska was analyzed to estimate the incidence of falls by age group from 2012 to 2016. While the Timed Up and Go (TUG) test times improved for participants from the pre-test to the post-test in the tai chi program ($p < .0001$), self-reported general health did not significantly improve from pre-test to post-test. The MLH data found as age increased, more unintentional falls were seen in the MLH ED. The incidence rate of unintentional falls in Adams County, Nebraska was found to be 158.9 ED visits for unintentional falls per 1,000 Adams County residents aged 65 or older. While this data gives new information on the effectiveness of the tai chi program in the SHDHD region and the incidence rate of unintentional falls for older adults in Adams County, there is still more work to be done. Future research could be done to examine trends in the SHDHD and MLH ED data, as well as to look at the best ways to promote the tai chi program.

Introduction

Tai Chi: Moving for Better Balance (TCMBB) has been sponsored by the Nebraska injury prevention program (Nebraska Department of Health and Human Services Injury Prevention Program, 2016). The main objective for the TCMBB program, according to the 2008 study by Li, et al. is “to improve functional ability (balance, physical function) and, consequently, reduce fall-related risks and falls frequency.” The Nebraska injury prevention program works with local health departments to implement tai chi programs around the state. One of the local health departments they have worked with is SHDHD, and they have been holding tai chi classes for the South Heartland District Health Department (SHDHD) community since 2012.

Problem Statement

Unintentional falls among Nebraskans aged 65 and older resulted in 184 deaths, 3,585 hospitalizations, and 12,096 emergency department visits in 2014 alone (Nebraska Department of Health and Human Services Injury Prevention Program, 2016). Fall deaths have increased for both males and females of age 65 or older in Nebraska from 2007 to 2014 (Nebraska Department of Health and Human Services Injury Prevention Program, 2016). Nebraskans aged 65 or older only make up 13.5% of the population in 2010, but were involved in 85% of all fall deaths in the state in 2014 (United States Census Bureau, 2016 and Nebraska Department of Health and Human Services Injury Prevention Program, 2016). Currently, the Injury Prevention Program only reports the state-wide injury and death rates but the region-specific information is lacking. Also, there has been no study, at the local level, conducted to evaluate the intervention Tai Chi: Moving for Better Balance Program. Therefore, in the proposed project, we will use hospital data

to assess the burden of fall injuries and fall deaths in the SHDHD region and SHDHD data to assess the effectiveness of the tai chi program that has been in place since 2012.

Importance of Proposed Project

Medical costs associated with unintentional fall injuries are high (Nebraska Department of Health and Human Services Injury Prevention Program, 2016). Lifetime costs for fall injuries of Nebraskans aged 65 or older in 2014 totaled over \$335 million (Nebraska Department of Health and Human Services Injury Prevention Program, 2016). From 2007 to 2014, the rate of fall deaths has increased for Nebraska residents aged 85 years or older (Nebraska Department of Health and Human Services Injury Prevention Program, 2016). The proposed study will add regional information about unintentional fall injuries in the South Heartland District Health Department region and will also examine the possible trends of fall injuries. This study also aims to examine the effectiveness of the SHDHD tai chi program based on pre- and post-test surveys completed by participants of the program.

Literature Review

Burden of Unintentional Falls

Unintentional falls are common among older adults, with about one out of three older adults falling every year, nationally (Huang et al., 2010). Some falls may be minor, but others may cause serious injury or death. Unintentional falls in the United States result in \$31 billion in medical costs every year, of which, two-thirds is costs from hospital bills (CDC, 2016). Every year in the United States, 2.8 million older adults are treated in emergency rooms for falls (CDC, 2016). The Nebraska DHHS definition of an unintentional fall (Newmyer et al., 2015) includes:

- fall on or from stairs or steps
- fall on or from ladders or scaffolding

- fall from or out of building or other structure, such as a balcony or roof
- fall into hole or other opening in surface
- fall from one level to another including: fall from playground equipment, chairs, beds, and other furniture
- fall on same level from slipping, tripping, or stumbling
- fall on same level from collision, pushing, or shoving, by or with other person, including in sports
- other and unspecified falls

Between 2009 and 2013, unintentional injuries were the 5th leading cause of death for Nebraskans (Newmyer et al., 2015). Of the 3,556 unintentional injuries reported to DHHS, 46.7% were falls (Newmyer et al., 2015). During the period 2009-2013, the age-adjusted hospitalization rate due to unintentional falls was 230.4 per 100,000 Nebraskans (Newmyer et al., 2015). Adults 65 years or older accounted for 74% of fall-related hospitalizations (Newmyer et al., 2015). The age-adjusted rate of fall deaths in 2007 of 7.2 per 100,000 Nebraskans increased to 9.4 per 100,000 by 2014 (Nebraska Department of Health and Human Services Injury Prevention Program, 2016).

The age-adjusted rate for hospitalizations for those aged 85 or older for a fall was 3,963 per 100,000 Nebraskans, and the age-adjusted rate for deaths for those aged 85 or older due to a fall was 236 per 100,000 Nebraskans (Newmyer et al., 2015). Emergency department visits due to falls for those aged 85 or older is 9,430 per 100,000 Nebraskans (Newmyer et al., 2015). In Nebraska, on average, 233 emergency department visits are made by residents aged 65 or older every week due to unintentional falls (Nebraska Department of Health and Human Services Injury Prevention Program, 2016). There are also an average 70 hospitalizations and 4 deaths per

week for this age group (Nebraska Department of Health and Human Services Injury Prevention Program, 2016). In 2014, 78% of fall deaths among those aged 65 or above were associated with a traumatic brain injury (Newmyer et al., 2015). For falls leading to hospitalizations that same year, 80% of hospitalizations for falls occurred to treat fractures (Newmyer et al., 2015). The majority of fall deaths by residents aged 65 years or older occur in the home (59%), while only 23% of the fall deaths occur in residential facilities (Nebraska Department of Health and Human Services Injury Prevention Program, 2016).

Unintentional fall injuries come at a cost too. With medical bills and work loss, Nebraska's unintended fall deaths, hospitalizations, and emergency department visits have a lifetime cost of over \$335 million per year (Nebraska Department of Health and Human Services Injury Prevention Program, 2016). Medicare paid for 73% of the costs associated with unintentional fall hospitalizations between 2009 and 2013 in Nebraska, while 19% were covered by private insurance (Newmyer et al., 2015).

Tai Chi

Tai chi is an exercise that can help prevent falls in older adults (National Institute on Aging, 2017). It focuses on the balance aspect of the National Institute of Health's "Go4Life" program (National Institute on Aging, 2017). One study conducted in Taiwan concluded that tai chi can help older adults prevent the deterioration of walking and balancing abilities (Lin et al, 2006). Whether abroad or in the United States, if tai chi exercise helps residents to safely walk groceries to their car or get around their homes, we may see the impact of a tai chi program benefiting many aspects of our service area. These could include fewer calls to 911 and fewer visits for fall-related injuries to local hospitals.

According to another study conducted by Choi, Moon, and Song, tai chi is a low-intensity exercise, which makes it a desirable exercise for older adults. Choi, Moon, and Song's study (2005) found that older adults who participated in tai chi had better flexibility and mobility than the control group. Another study found that 45 minutes of tai chi twice a week can support better balance, which can lead to fewer falls (Maciaszek and Osinski, 2012).

Another study compared two groups, with one group participating in tai chi exercises, and they found that the tai chi group had better flexibility and scored better on heart rate (Hong et al, 2000). The researchers recommended regular practice of tai chi for older adults (Hong et al, 2000).

A study out of New York also used the Tai Chi: Moving for Better Balance program (Gallant, et al., 2017). The evaluation of the program showed a statistically significant improvement in the Up and Go timed test and other fall-related measures (Gallant, et al., 2017). While not statistically significant, fewer participants of the program reported falling in the past 6 months after the program than did before the program (Gallant, et al., 2017). Also of note, most participants stated they took the tai chi classes for fun, and few stated taking the class due to doctor recommendation (Gallant, et al., 2017).

Gaps in Tai Chi Knowledge

While the Nebraska DHHS and the Nebraska injury prevention program has provided help in creating the Tai Chi: Moving for Better Balance Program in the SHDHD region, data has not been analyzed at the local health department level. Thus far, DHHS reported the state-wide results based on combined data from participating programs and limited information specific to SHDHD is available (See Appendices 5-10). Also, it is not clear how the tai chi program had an

impact of fall injuries at the population-level. Such analysis requires the use of hospital data for a population of interest.

Goals and Objectives

1. Goal: Create a report on the effectiveness of the SHDHD tai chi program from 2016-2017.
 - a. Objective #1: Gather pre- and post-test surveys from participants of the SHDHD tai chi program from 2016-2017.
 - i. Activity #1: Create a code book for the variables that will be entered from the pre- and post-test data from SHDHD.
 - ii. Activity #2: Using Excel software, enter the data from the pre- and post-tests.
 - b. Objective #2: Gather Mary Lanning Healthcare (MLH) emergency department unintentional falls data for 2012-2016.
 - i. Activity #3: Create a code book for the variables to determine the burden of unintentional falls in the SHDHD region.
 - c. Objective #3: Analyze pre- and post-test data from the SHDHD tai chi program.
 - i. Activity #4: Using SAS, run appropriate statistical tests on the SHDHD tai chi data.
 - d. Objective #4: Analyze MLH emergency department unintentional falls data for 2012-2016.
 - i. Activity #5: Using SAS, run appropriate statistical tests on the MLH data.
 - e. Objective #5: Create a report for SHDHD on the effectiveness of the tai chi program.

- i. Activity #6: Create and present the report using easy-to-understand terms and graphics, as this information could be used by SHDHD for future promotion of the tai chi program.
- f. Objective #6: Complete final Capstone paper.
 - i. Activity #7: Use literature review from proposal plus any new research that could be helpful.
 - ii. Activity #8: Complete results section using analyzed data, making sure to make the information and graphics easy-to-understand.

Research Methods

Tai Chi Program Evaluation

Research Question

Is the tai chi program at SHDHD effective in reducing the number of falls and fear of unintentional falls among participants?

Study Design

This study is an evaluation of the effectiveness of reducing falls among older adults through the Tai chi: Moving for Better Balance program (also to be referred to as ‘tai chi program’). Data from the SHDHD tai chi program was collected from 2012-2017 in the form of pre- and post-test questionnaires. Data from 2012-2015 was given to Nebraska DHHS for aggregated reports, and was not returned to the health department. Therefore, only pre- and post-tests from 2016 and 2017 were utilized. Basic and advanced tai chi classes are held in the SHDHD region, but for this project, only the basic tai chi class pre- and post-tests were analyzed. The population of interest in this study is residents of the SHDHD area, which includes Adams, Clay, Nuckolls, and Webster counties. From January 2016 to May 2017 a total of 139 pre-test

surveys were completed by participants of the SHDHD tai chi program, and 74 post-test surveys were completed.

Data Collection Methods

Pre-tests were distributed to participants of the tai chi program at the first session of the 12-week tai chi program for each site (see Appendix 1). The pre-test included both self-reported questions and a Timed Up and Go test. The Timed Up and Go test, or TUG, evaluates an older adult's mobility skills by measuring the time it takes for the individual to get up from a chair, walk 3 meters, then turn around to walk back to the chair and sit back down in the chair (TUG, 2015). According to SHDHD tai chi pre- and post-tests, TUG time of 14 seconds or more puts the older adult at a high risk of falling. The following variables were included in the baseline questionnaire:

- County (categorical)
- Sex (categorical)
- Age (continuous)
- Primary reason for taking the tai chi course (categorical)
- How they heard about the course
- General Health (categorical)
- Health limiting activity questions (categorical)
- Have they fallen in the past 12 weeks (categorical)
- How many times they've fallen (categorical)
- Have they had fall injuries (categorical)
- Ability to do activities (categorical)
- What they hope to gain from the course

- TUG test time (continuous)

At the end of the final session of the tai chi program, participants were given post-tests with self-reported questions and another Timed Up and Go test (see Appendix 2). Similar variables appear in the post-test, but also include:

- Practice tai chi outside of class (categorical)
- Understanding of teachers' instructions (categorical)
- Feeling of success from class (categorical)
- Overall satisfaction of class (categorical)

Statistical Methods

A code book was created for the SHDHD data, and the data was entered into an Excel spreadsheet using the predetermined codes (see Appendix 3). First, descriptive statistics were conducted on the sample for demographic information such as sex and age. The pre- and post-tests were analyzed using SAS 9.3, where frequencies of falls, average Timed Up and Go test time, and confidence in performing activities were used as outcome variables. A paired t-test was used to compare the TUG test times for the pre- and post-tests. A p-value of less than .05 will be considered significant for this research.

Mary Lanning Healthcare Emergency Department Data Analysis

Research Question

What is the incidence of unintentional falls, requiring emergency department attention, among those age 65 and older in the Hastings, Nebraska area?

Study Design

A secondary data analysis of hospital unintentional fall data from MLH was performed for individuals age 65 and older who sought treatment from the MLH ED between 2012 and

2016 for an unintentional fall. While we expected most of the study population to be residents of the Hastings, Nebraska area, we could not exclude older adults from the SHDHD area, which includes Adams, Clay, Nuckolls, and Webster counties or other places in the state, country, or world, as place of residence was not provided to the researcher. The data from the MLH emergency department was collected by the hospital as part of their normal data collection. Deidentified data was provided to SHDHD by MLH. The following variables were collected by MLH for ED visits due to unintentional falls:

- Age (continuous)
- Gender (categorical)
- Month and Year of Admission (categorical)
- Final Impression of Injury (categorical)
- Disposition (Status at end of visit) (categorical)

A total of 861 cases of older adult (65+) falls were accessed through MLH ED records for 2012-2016 and entered into an Excel spreadsheet using the predetermined codes from the researcher-created MLH code book (see Appendix 4). The data was analyzed using SAS 9.3 to calculate the incidence rate of unintentional falls. Since it is not known to the researcher which county each patient came from, assumptions had to be made about who the patients of MLH are. Since MLH is located in Adams County, the 2016 census population for only Adams County will be included in the denominator for the fall rate calculations, as suggested by MLH's Vice President of Quality, Charlene Sanders.

Ethics

There was minimal risk to the subjects in this research project. The biggest concern was loss of confidentiality, which has been addressed with the UNMC IRB personnel. All data was

stored on encrypted flash-drives, computers, and the UNMC one-drive. UNMC IRB determined that this study did not constitute human subject research as defined at 45CFR46.102. Thus, no further IRB action was required. Nebraska DHHS gave permission for the use of the tai chi data.

Administrative Resources

To accomplish this project, I utilized an encrypted computer, encrypted flash-drive, and the UNMC one drive. I obtained the surveys collected by SHDHD during their tai chi program and entered them into Excel before returning them to the health department. MLH data was sent, already deidentified, via email. SAS statistical software was used to analyze the collected data. All data will be returned to SHDHD at the conclusion of the research project.

Results

Tai Chi Program

From January 2016 to May 2017, 139 tai chi pre-tests and 75 tai chi post-tests were collected by SHDHD. 66 participants completed both a pre-test and a post-test. The mean age of the participants completing the pre-test was 72.76 years of age (46-95) while the mean age of participants completing the post-test was 72.27 years (46-95) (See Table 1). The majority of tai chi participants came from the age groups of 65-75 and 75-85. Most participants were females (86.33% in pre-test and 82.67% in post-test), and the majority of participants did not report having suffered an unintentional fall in the 12 weeks before taking each survey.

General Health was measured by a self-reported question on health, where participants could answer from “excellent” (5) to “poor” (1). No participants in the study reported “poor” general health. The average general health of the participants did improve from the pre-test to the post-test (3.27 to 3.46), however, this improvement was not statistically significant ($p=.08$).

The Timed Up and Go test (TUG), which was collected at the first and last tai chi class of each 12-week session, did see improvement. The average TUG test time for the pre-test, while still below the 14 second threshold, was 9.79 seconds. A decreased average TUG time for the post-tests came in at 8.28 seconds. This difference was statistically significant ($p < .0001$).

Table 1

Characteristic	Pre-Test (N=139)				Post-Test (N=75)				Significance
	M	(SD)	N	(%)	M	(SD)	N	(%)	
Age	72.76	8.03	139	100	72.27	9.05	75	100	
<65			24	17.27			16	21.33	
65-74			60	43.17			30	40.00	
75-84			43	30.94			22	29.33	
85+			12	8.63			7	9.33	
Sex									
Male			19	13.67			13	17.33	
Female			120	86.33			62	82.67	
Fall in the past 12 weeks									
Yes			22	15.94			6	8.11	
With injuries that required medical attention			4	2.94			1	1.35	
With injuries that did not require medical attention			16	11.76			5	6.67	
General Health	3.27	0.77			3.46	0.74			
Excellent			9	6.47			6	8.11	
Very Good			38	27.34			27	36.49	
Good			74	53.24			36	48.65	
Fair			18	12.95			5	6.76	
Poor			0	0			0	0	
County									
Adams			51	39.84			35	46.67	
Clay			33	25.78			19	25.33	
Nuckolls			14	10.94			10	13.33	
Webster			30	23.44			11	14.67	
Timed Up and Go (TUG)	9.79	2.50	139		8.28	2.67	75		<.0001

It was also found that there was a moderate correlation between the age of participants and their post-test general health score (.58). However, there was no correlation between the age of participants and their pre-test general health score. As well, there was no correlation between age and the TUG tests for either pre- or post-tests.

Using the data from the 66 participants who completed both the pre-test and the post-test, a McNemar's test was also completed to see if subjects had similar reports of falls (See Table 2).

The test was not statistically significant ($p=.71$).

Table 2

Pre-Test Falls by Post-Test Falls With McNemar's Test			
Report of Fall at Pre-Test	Report of Fall at Post-Test		
	No	Yes	Total
No	55	3	58
	84.62	4.62	89.23
	94.83	5.17	
	93.22	50	
Yes	4	3	7
	6.15	4.62	10.77
	57.14	42.86	
	6.78	50	
Total	59	6	65
	90.77	9.23	100
Frequency Missing = 83			p=.71

Table 3

Limiting Activities	Pre-Test (N=66)		Post-Test (N=66)	
	N (%)	N (%)	N (%)	N (%)
	Yes, Limited	No, Not limited	Yes, Limited	No, Not limited
Vigorous activities (such as running, lifting heavy objects, strenuous sport)	55 83.33	9 13.64	53 80.30	13 19.70
Moderate activities (such as moving a table, vacuuming, bowling or golf)	27 40.91	38 57.58	27 40.91	39 59.09
Lifting or carrying groceries	21 31.82	44 66.67	18 27.27	48 72.72
Climbing several flights of stairs	40 60.61	25 37.88	44 66.67	22 33.33
Climbing one flight of stairs	18 27.27	47 71.21	25 37.88	41 62.12

Bending or kneeling	44 66.67	20 30.30	48 72.72	17 25.76
Walking more than a mile	29 43.94	35 53.03	31 46.97	35 53.03
Walking half a mile	17 25.76	47 71.21	24 36.36	42 63.64
Walking 100 yards (150-200 paces)	13 19.70	51 77.27	14 21.21	52 78.79
Bathing and dressing yourself	7 10.61	58 87.88	8 12.12	58 87.88

As well, using the paired data, frequencies and percentages were reported for whether participants felt their health limited their ability to do certain activities (see Table 3). None of the pre-test to post-test differences were statistically significant, however, walking 100 yards (150-200 paces), vigorous activities (such as running, lifting heavy objects, strenuous sport), moderate activities (such as moving a table, vacuuming, bowling or golf), and lifting or carrying groceries all saw an increased number of responses in the post-test for the “no, not limiting.”

Ability to do certain activities was measured by a self-reported question on health, where participants could answer from “excellent” (5) to “poor” (1) (see Table 4). Like the health limiting questions, none of the ability questions were statistically different between the pre-test and the post-test for the paired data. Getting dressed and undressed and taking a bath or shower were the only activities that showed a positive change between the pre-test and the post-test.

Table 4

	Pre-Test Average	Post-Test Average	Change
Getting dressed or undressed	4.59	4.64	+
Taking a bath or shower	4.50	4.56	+
Getting in or out of a chair	4.26	4.24	-
Going up or down stairs	3.92	3.82	-
Reaching for something above your head or on the ground	4.02	3.82	-
Walking up or down a slope	3.82	3.68	-
Going out to a social event (e.g. religious services, family gathering or club meeting)	4.50	4.44	-

Mary Lanning Healthcare Emergency Department

Between 2012 and 2016, 861 unintentional falls for individuals over 65 years of age came into the MLH ED. The greatest frequency of individuals coming to the ED were 85 years of age or older (See Table 2). The median age of unintentional fall cases was 84.0. Most of the cases were female (68.14%), and the majority of cases were discharged from the ED after their visit (61.44%).

Table 5

Mary Lanning Healthcare Emergency Department 2012-2016 N=861			
Characteristic	Median	N	(%)
Age	84.0		
65-74		192	(22.3)
75-84		279	(32.4)
85+		390	(45.3)
Sex			
Male		274	(31.86)
Female		586	(68.14)
Status after ED visit			
Discharged		529	(61.44)
Admitted		313	(36.35)
Other		19	(2.21)

A chi-square test was performed to see if there was a difference in status after ED visit for each gender. Because 25% of the cells in the chi-square test has expected cell counts less than 5, the Fisher’s exact test was used and it was found that there is no difference in status after ED visit for males and females (p=.598).

A chi-square test was also performed to see if there was a difference in status after ED visit for the age groups of 65-74, 75-84, and 85 or greater. It was discovered that there was a statistically significant difference in status after ED visit for the age groups of 65-74, 75-84, and 85 or greater (p<.01). Those aged 85 and older were more likely to be admitted to the hospital after their ED visit than the other age groups.

As you can see in table 3, the SHDHD region has a population of 45, 4715 residents as of July 1, 2016. About 18.8%, or 8,603, of these residents are 65 or older. This is greater than the United States, which has an estimated 15.2% of residents being 65 or older (US Census Bureau: US, 2016).

Table 6

County	%	Population (As of 7/1/16)
Adams		31,684
65+	17.1	5,418
Clay		6,163
65+	20.1	1,239
Nuckolls		4,265
65+	26.2	1,117
Webster		3,603
65+	23.0	829
SHDHD Region		45,715
65+	18.8	8,603

*Source: United States Census Bureau. (2016). Quick facts: United States. Retrieved July 10, 2017, from <https://www.census.gov/quickfacts/>

An incidence rate of 158.9 ED visits for unintentional falls per 1,000 Adams County residents aged 65 or older was calculated using the number of fall cases from MLH ED, and the

Adams County population from Table 3. If the incidence rate were to be calculated using all the counties in the SHDHD region, an incidence rate of 100.08 ED visits for unintentional falls per 1,000 SHDHD residents aged 65 or older would be reported.

An incidence rate of 57.77 hospitalizations for unintentional falls per 1,000 Adams County residents aged 65 or older was calculated using the number of fall cases from MLH ED, and the Adams County population from Table 3. If the incidence rate were to be calculated using all the counties in the SHDHD region, an incidence rate of 36.38 hospitalizations for unintentional falls per 1,000 SHDHD residents aged 65 or older would be reported.

Discussion

Tai Chi Program

Data collected from the tai chi program at SHDHD found that there was a statistically significant improvement in the TUG tests from pre-test to post-test ($p < .0001$). This finding is in line with other research on the effectiveness of the TCMBB program (Gallant, et al., 2017). However, data collected by the state of Nebraska from 2012-2013 did not show a statistically significant improvement in TUG test times (see Appendix 8). One possible reason for the difference between the DHHS data and the SHDHD data could be the mean age of the participants. The mean age of SHDHD participants in the tai chi program was lower than the mean age of DHHS's tai chi program participants (see Table 1 and Appendix 5). Because self-reported health results were similar between the SHDHD data and the DHHS data, it is not suggested that the health of participants led to the difference in TUG test improvement (see Table 1 and Appendix 7).

While females make up 50.2% of the population of Nebraska, we found that the majority of tai chi participants were women (86.33%). This was similar to the frequency of women

participating in the tai chi program the state collected data on (see Appendix 6). Qualitative data on why participants chose to take the tai chi course was collected in the pre-test of the tai chi data, and further study could be done into why females chose to do tai chi versus why males chose to do tai chi. This information could be valuable information to SHDHD and DHHS as they continue to promote the tai chi program in their regions.

The majority of participants in the tai chi program had not suffered an unintentional fall in the 12-weeks prior to taking either the pre-test or the post-test. This would indicate that those who felt stable and felt they were unlikely to fall were more likely to participate in a tai chi class. Physical activity for someone who regularly suffers from unintentional falls would be difficult and could lead to more unintended falls.

While some health limiting activities and abilities showed self-reported improvement, none of the improvements were statistically significant, and some items even showed declining self-reported ability to do activities (see Tables 3 and 4 and Appendix 9). Future research could be conducted to look at the self-reported limiting and ability questions in the tai chi questionnaire. Some physical tests could even be performed to see if the perceived ability is different than the actual ability of participants.

Mary Lanning Healthcare Emergency Department

For the MLH ED data median age was utilized instead of mean age. This is because MLH reported the age of cases who came in up to age 89, and any person 90 years or older would be categorized as “90+”. To avoid skewing the data with the mean age, median age was used in its place.

An increase in the number of cases seen by the MLH ED was seen as the age of the cases increased. This is consistent with unintentional fall hospitalizations reported on by Nebraska

DHHS (Newmyer, et. al., 2015). The larger percentage of female cases is also consistent with the findings in the Nebraska DHHS report.

DHHS data reported by Will Schmeekle found that from 2007-2009, a rate of 41.8 hospitalizations due to falls per 1,000 population ages 65 and older was reported in the SHDHD region, and from 2010-2012, a rate of 43.1 hospitalizations due to falls per 1,000 population ages 65 and older was reported in the SHDHD region (see Appendix 10). These rates were different than those found using the MLH data from 2012 to 2016. An incidence rate of 57.77 hospitalizations for unintentional falls per 1,000 Adams County residents aged 65 or older was calculated using the number of fall cases from MLH ED. And the incidence rate using all the counties in the SHDHD region was 36.38 hospitalizations for unintentional falls per 1,000 SHDHD residents aged 65 or older.

An incidence rate of 158.9 ED visits for unintentional falls per 1,000 Adams County residents aged 65 or older was calculated using the number of fall cases from MLH ED, and the Adams County population from Table 3. If the incidence rate were to be calculated using all the counties in the SHDHD region, an incidence rate of 100.08 ED visits for unintentional falls per 1,000 SHDHD residents aged 65 or older would be reported. This was somewhat different than the incidence rate of 94.30 ED visits for unintentional falls per 1,000 Nebraskans aged 85 and older.

This study could not calculate incidence rates for the age categories of 65-74, 75-84, and 85+ because census bureau information about the number of individuals in each county for each age category was not available to the researcher. Therefore, only incidence for individuals age 65 and older were calculated (see Table 6).

Recommendations

Tai Chi Program

In observing the SHDHD tai chi program, the following recommendations are being made to the health department for consideration:

1. Adopt a unique numbering system for tai chi surveys.
 - a. While the surveys are printed using large print so they are easy-to-read, it was difficult to distinguish which surveys went with which years, and which pre- and post-tests went together. In the future, and numbering system for surveys would make data entry easier for the health department. For example, an ID could look like this:

2017-2-16-b

This numbering would start with the year of the class “2017”, followed by the class number for the year, so the second class of the year would have a “2”, a number for which participant this represents, the “16” would represent the 16th person on the registration list for the class, and finally an “a” for the advanced class, or a “b” for the basic class. By utilizing a unique numbering system, the surveys would be free of any personal identifying information, while giving the program coordinator an easy way to gain information about the survey they are looking at. This will also make linking the pre- and post-tests easier.

2. Continue to collecting pre- and post-test survey data to analyze possible trends over time.

3. Change the advanced tai chi survey to more closely mirror the basic tai chi survey.
 - a. The advanced survey data could not be analyzed with the basic survey data because some of the survey questions asked different things. For example, the basic survey asks “What is your ability for doing any of the following activities?” while the advanced survey asks “Since doing tai chi have you noticed a change in your ability for doing any of the following activities?” Future surveys could be created to ask the same questions, so advanced students and basic students could be compared.
4. Edit the current basic tai chi surveys.
 - a. While the large font on the tai chi surveys helps older participants to fill out the survey with more ease, some of the questions used in the survey could be confusing to participants, and the following changes could be considered (see Appendices 1 & 2):
 - i. For question 8 in pre-test (10 in post-test), “How many times did you fall in the past 12 weeks?”: An option for “more than 4” should be utilized, as the current options are not exhaustive for the questions.
 - ii. For question 9 in pre-test (11 in post-test), a question about where they were seen could help link MLH data to the tai chi data.
 - iii. For question 10 in pre-test (12 in post-test), “What is your ability for doing any of the following activities?”: I would suggest changing “ability” to difficulty. For example, “How difficult are

the following activities?” Then, instead of a poor thru excellent rating, they could pick from:

1. Not difficult at all
2. Somewhat difficult
3. Very difficult
4. I cannot perform that activity
5. Not applicable

These options may give the health department better data about the abilities of the individuals.

iv. Shorten the survey.

1. Long surveys can be time consuming; therefore, I would suggest SHDHD think about what they really want to know from the participants. If a question on the survey does not answer a question they want to know the answer to, then it can be deleted.

v. Have an online survey option available.

1. Currently, data from the paper surveys is entered into Survey Monkey for analysis. A possible time saver for the health department would be to offer the link to the survey monkey to be sent to the participant’s email. They could fill out the pre- and post- tests at their convenience, and SHDHD staff would not have to take the time to enter that survey data. The participant’s ID would have to be given to

them to enter, however, so you know who each survey belongs to for linking with their other survey.

Mary Lanning Healthcare Emergency Department Data

1. Create relationship with SHDHD to promote tai chi program for those who come to ED after suffering an unintentional fall.
 - a. This may also be used to capture data on how many ED fall cases have attended a tai chi course, SHDHD sponsored or other.

Limitations

Due to the loss of SHDHD tai chi program data from 2012-2015, this study is limited in its ability to show trends in the program over multiple years. Also, while trends can be shown from data from the emergency department at MLH and fall reduction effectiveness can be shown from the SHDHD data, no causation can be established. In other words, we cannot prove that the tai chi program at SHDHD is the reason unintentional fall injuries leading to ED visits are decreasing at MLH. The data from participants of the tai chi program cannot be linked to patients in the ED at MLH, and therefore, no connection can be made between falls in the two data sets.

As the tai chi program pre- and post-test surveys did not have unique identifiers, there was some trouble in linking the pre- and post-tests for each basic tai chi class. As well, some individuals dropped the class and did not complete the post-test, and some may have completed a post-test but not the pre-test.

Due to the limited information that could be gathered by the US Census Bureau, incidence rates for ED visits to MLH were not able to be calculated for the age categories of 65-74, 75-84, and 85+, therefore, only incidence rates for age 65 and older could be calculated.

Conclusion

While the Tai Chi: Moving for Better Balance program is an evidence-based program, specific results in Adams, Clay, Nuckolls, and Webster counties have yet to be seen. Through this research, the hope is that improvements can be made in the promotion and effectiveness of the tai chi program in the SHDHD area. Continued partnerships, like those between SHDHD and MLH, may help both organizations to catch trends in unintentional falls and injuries among the older adults in their service areas. Future work could be done with more years of data from the tai chi program to better the program, and increase its reach to older adults in the SHDHD region.

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Service Learning/Capstone Experience Reflection

Ocean Road Cancer Institute

My service learning and capstone experience began in October 2015 when I started meeting with Dr. Amr Soliman about the Cancer Epidemiology Education in Special Populations (CEESP) program. With the help of Dr. Soliman and Dr. Crispin Kahesa, I designed a retrospective study to look at the co-morbidities of HIV/AIDS patients with and without non-AIDS defining cancers. The data collection began in May 2016 at Ocean Road Cancer Institute (ORCI) in Dar es Salaam, Tanzania.

The first month of my time in Dar es Salaam was filled with learning experiences. The preparation I did for this project could not have come close to preparing me for the real-world experiences that I would soon face. Ocean Road Cancer Institute (ORCI) is a large organization. As such, there is always an abundance of projects going on, and it can be easy to get lost in the shuffle. The doctor and PhD candidate that we shared an office with, Dr. Johnson Katanga, had been working on an HPV study that summer for ORCI. To help Dr. Katanga on this project, myself and another student helped organize the printed pieces of his survey and attach ID numbers to each form. This was a very helpful learning experience because I was using the same skills that I was learning in my first year public health classes. Good methods are good methods, and it was encouraging to see that sound research is being done all around the world.

That month, we also visited Muhimbili University and Hospital in Dar. Many doctors from Tanzania get their education at Muhimbili, and it was beneficial to see how their education set up differs from ours in the U.S. It is very nice that the students have a national hospital right across the street that they can practice their skills at. I also visited the Amana care and treatment clinic (CTC clinic) for the first time. The language barrier became a real issue for the first time

on this trip. While the doctors know English, they preferred speaking in Kiswahili, and I had to have a colleague translate most of what was being said. I could tell that the nurse we were working with did not fully trust me yet. This was a valuable lesson in understanding cultures before you start a public health intervention. It is always important to work on gaining the confidence of those that you will be working with.

Ocean Road Cancer Institute (ORCI) is the only specialized facility for cancer treatment in Tanzania. You have research going on, but it is a hospital first. They cater to the sick, those who are suffering from a disease that, in some cases, we know little about. While cancer research and prevention is important to ORCI, they are faced with the task of also treating current cancer patients with the budget that the government allots them. Paper records are used at ORCI, and sometimes are damaged, dirty, or lost. A lot of education also goes on in and outside of ORCI. Whether it is a nurse going to other hospitals to ensure cervical cancer screenings are being done correctly, or medical students presenting what they've learned about cancer, there is always some type of education being done to better the community.

ORCI is a very busy place. The compound houses buildings used for cancer screening, cancer treatment, the Tanzania Albinism Society, mortuary, research, telehealth, and more. It takes a large team to accomplish the mission of ORCI. Everyone is always overbooked with meetings, outreach, and their normal work load. Flexibility is one of the most important management skills that I have observed in my time at ORCI. Things work very differently in Tanzania than they do in the United States. For example: traffic in Dar es Salaam. A city of over 5 million, Dar es Salaam traffic jams are almost 24/7. I learned from Dr. Kahesa that he tries not to set up more than one meeting that involves traveling in a day because there is no way to make

it to two different places during business hours. Our first trip to the Amana CTC clinic took almost 2 hours of driving just to get there. This changes the way that you can do business. It never occurred to me before that you would have to plan trips so carefully. It makes correspondence by email or phone a better alternative in a lot of cases.

During this first month in Dar es Salaam I learned that I have much more patience than I thought I did. Things do not move as quickly in Tanzania. People are much more laid back, and a 10am meeting might not start until 11 or 12 (traffic is a factor in that). I like making plans and setting goals, and here, plans change, things don't always get completed when you were expecting them to get completed. I learned to take a breath and move forward. The person I needed to meet today can be met tomorrow, the files I wanted to have sorted by noon can be sorted by 5. Sometimes, my days would end early because I hit a standstill. The time difference changes things too. I get to work at about 1am CT time. Even if someone from the US responded to my email at 8am, it is 4pm here, and the day is over. I had to be flexible, and willing to let things happen when they would happen. I've learned that not everything is in my control. The second month in Dar es Salaam included lots of traveling. Dr. Samwel Sumba and I traveled to the Amana CTC clinic a number of times to meet with staff, get an idea of how they run their clinic and how they keep records, and to collect medical record data. My original timeline allowed for 1 week at the Amana CTC clinic to gather records. The amount of time needed ended up nearly doubling because we would arrive to talk to the staff and learn that no records had been pulled for me to use that day. It was frustrating because normally I would like to take things into my own hands, and go pull the records, however, they were not comfortable with me doing the record pulling, and insisted on pulling them for me. This created a time issue, and there was nothing that I could do about it. I also began collecting medical records from ORCI.

Gathering the files was sometimes a challenge because records would be missing, have torn pages, be written in illegibly, or have other issues. It was also interesting to see how medical record reporting could vary so much. Most patients did not have height and weight recorded. Sometimes smoking status would be written in by the nurse, but most times it was not. I noticed the lack of standardized reporting very quickly, and it does appear that forms could be created in the future to insure that all patients are being asked the same questions and pertinent information is being collected.

During my second month in Dar, I continued to learn about the politics that surround organizations. You have to ask for things in a certain order, ask certain people, and be patient. Offending someone is a guaranteed way to make your project stall. Knowing how to work with this kind of system was helpful, however, and the same kinds of skills can be applied to jobs back in the U.S. Certain things might need approval from a direct supervisor, while others need to be taken straight to a higher supervisor. Knowing the organization you are working for helps you to complete your job better.

I learned that communication is key. Whether it is sending and answering emails, taking and making phone calls, writing and receiving text messages, or visiting people's offices, communication makes things run more smoothly. Although this project is "mine," it takes a village to complete. Making sure everyone is on the same page is vital to any project's success. When communication suffers, the project loses organization. It is important to learn about people's communication styles too. While one person best responds to emails, another might require a phone call. Pushing your preferred communication method on others can backfire if they don't adapt to your style. While sending one email to 20 people on a project may be efficient, if 6 don't respond or see it, then they can't be effective members of the team. I have

found it's easier to send that email and automatically call a few people so that I can ensure everyone is on the same page.

Patience is a virtue, or so Ben Franklin said, and I continue to surprise myself with my new found virtue. Things for this project did not been moving as quickly as I had hoped, and I had to think about what I could change and what I couldn't. It doesn't help me to dwell on the things that are not going well if I cannot change them or if it is in the past. I can, however, work to create solutions for the things I can change. I can give thought to the issues that have plagued my project, and think of ways that future students could avoid them. During the last week of project reporting, while meeting with my committee chair, we changed my research question because the original co-morbidity data that we thought we would find in the medical records was not actually recorded. Flexibility is key in a project like this where you are trying to learn about a very different health system.

After nearly three months of work, I left Tanzania without any data. With so many unforeseen obstacles, it became impossible to collect the necessary data to answer the research question. While this was disappointing, I do not regret my time in Tanzania, as it taught me so much about public health. From learning about study design to implementing one myself, I had many opportunities to learn the real-life skills that I had only learned about in the classroom prior to this trip.

After Tanzania, I spent three to four months meeting with new organizations to try and come up with a new capstone project. During this time, my committee chair, Dr. Amr Soliman removed himself from my committee, and Dr. Shinobu Wanatanbe-Galloway became my new committee chair. Dr. Lynette Smith and Dr. Brandon Grimm stayed on as committee faculty members. While looking for a new project, I met with the Nebraska DHHS Injury Prevention

Project group in Lincoln, the Central States Center for Agricultural Safety and Health out of Omaha, and South Heartland District Health Department in Hastings before settling on a project with SHDHD, an organization that I had interned for in the summer of 2013. The spring of 2017 was spent planning a project with their health department on unintentional falls among older adults.

South Heartland District Health Department

My experience at SHDHD began in May 2017 by attending one of their basic tai chi classes, like the one where the data for my project was collected. I also attended meetings with SHDHD staff, including my preceptor Michele and the tai chi program director Liz. After months of being told that SHDHD owned the tai chi data, and I had permission to use it, on May 22, my first day at the health department, I was told that we needed to get DHHS approval to use the data, since, at one time, the data was theirs. It took two weeks for this to happen. While this did put me behind, once we got approval, we moved quickly to the next steps. Code books were created for the Mary Lanning Healthcare (MLH) data and the tai chi data, and the data was entered.

I also attended “Stepping On,” a class for older individuals who fear they have a risk of falling, and I learned a lot about problems facing older adults in the Hastings area. I worked on building professional relationships, as well as personal ones with members of the community. During my time with SHDHD, I noticed the way they operate as a team. They are a small but mighty organization, and therefore, they must rely on each other to accomplish their goals. For example, if the receptionist is out of the office, other employees will answer the phones, take messages, and transfer calls. Everyone seems to pitch in when it comes to the work SHDHD is doing. From taking shifts at county fair booths for the health department, to preparing for accreditation, they all have a stake in the success of their programs. During my time at SHDHD,

people have been kind and helpful. I believe that their teamwork mentality has helped create that kind atmosphere. When employees are happy and feel like they are part of a team, they will work harder to accomplish their goals.

Seeing leadership that encourages teamwork has made me think about the way I want to lead. SHDHD holds weekly staff meeting where everyone gets up-to-speed on all the projects in the health department, they talk about their upcoming events, and there is an open dialogue about everything in the health department. Having that openness has changed the way I think about leading. A leader does not tell you what to do, they work with you to accomplish the goals of the organization.

During this project, I learned that I am resilient. No matter how many bumps I have had in this road, I have not quit. I've learned how to get out of my comfort zone too. Being the "new kid" in an organization can be hard, but you have to put yourself out there and give it your best shot, or you will never reach your fullest potential. There is a light at the end of every tunnel, and in public health, you work towards that light every day.

Appendix 1

Tai Chi: Moving for Better Balance Participant Baseline Questionnaire

For Office Use Only ID# __ __ County _____

**Tai chi: Moving for Better Balance
Participant Baseline Questionnaire**

Thank you for signing up for this Tai chi class. Before we get started, we would like to ask you a few questions. The information you provide will help us learn more about who joins this type of Tai chi class, and how helpful Tai chi classes are in building physical strength and balance that may help to prevent falls in older adults.

All of the information you provide will be kept confidential and an ID number will be used instead of your name to record your responses.

Today's Date: _____ / _____ / _____

1. What is your gender?

- Male Female

2. How old are you?

_____ years of age

3. What is the primary reason you chose to take this Tai chi course? (Please check only one box.)

- I thought it would be fun.
- I wanted to get more exercise.
- I have done Tai chi in the past and enjoyed it.
- A friend of mine is enrolled in this course and I thought I would join them.
- My health care provider recommended the class.
- Other (please explain) _____

4. How did you hear about this class? _____

5. In general, would you say your health is ...

(Please circle only one number)

- | | | | | |
|------|------|------|-----------|-----------|
| 1 | 2 | 3 | 4 | 5 |
| Poor | Fair | Good | Very Good | Excellent |

6. Does your health limit you in any of the following activities? If so, how much?

	Yes, limited a lot	Yes, Limited a little	No, Not limited
a. Vigorous activities (such as running, lifting heavy objects, strenuous sport)			
b. Moderate activities (such as moving a table, vacuuming, bowling or golf)			
c. Lifting or carrying groceries			
d. Climbing several flights of stairs			
e. Climbing one flight of stairs			
f. Bending or kneeling			
g. Walking more than a mile			
h. Walking half a mile			
i. Walking 100 yards (150-200 paces)			
j. Bathing and dressing yourself			

7. Have you fallen in the past 12 weeks?

(Please note: A fall is when you land on the floor or ground, or fall and hit any object like the stairs or a piece of furniture, by accident.)

- Yes No (Skip to question 10)

8. How many times did you fall in the past 12 weeks?

- 1 time 2 times 3 times 4 times

9. Did you have any injuries from a fall in the past 12 weeks where you had to be seen by a physician or visit the emergency room?

- Yes No

10. What is your ability for doing any of the following activities?

Please reply thinking about how you usually do the activity. If you currently do not do the activity, please answer to show whether you think you would be concerned about falling if you did the activity. Please check the box which is closest to your own opinion to show how concerned you are that you might fall if you did this activity.

	1 Poor	2 Fair	3 Good	4 Very Good	5 Excellent
a. Getting dressed or undressed					
b. Taking a bath or shower					
c. Getting in or out of a chair					
d. Going up or down stairs					
e. Reaching for something above your head or on the ground					
f. Walking up or down a slope					
g. Going out to a social event (e.g. religious services, family gathering or club meeting)					

11. What are you hoping to gain from taking this Tai chi class?

End of Survey Questions-Thank You!!!

**Tai chi: Moving for Better Balance
Selected Clinical Outcome Measures
Pre-Test**

Date: _____

Recorder's Name: _____

Instructions Timed Up and Go (TUG):

- Have the participant sit back in a standard arm chair.
- Tell the participant that at—GO, timing begins. At this time the participants:
 - **Stands up from the chair.**
 - **Walks to the line on the floor (Three meters or 10 feet),**
 - **Turn around,**
 - **Walk back to their chair, and**
 - **Sits down.**
- Stop timing when the person sits down.

Time taken _____ (seconds)

Note: An older adult who takes more than 14 seconds to complete the TUG is at high risk for falling.

End of clinical outcome measures – Thank You!!!

Appendix 2

Tai Chi: Moving for Better Balance Participant Follow-up Questionnaire

For Office Use Only ID# __ __ County _____

**Tai chi: Moving for Better Balance
Participant Follow-up Questionnaire**

Thank you for participating in this Tai chi class. Now that the class has ended, we would like to ask you a few questions. The information you provide will help us learn more about who joins this type of Tai chi class, and how helpful Tai chi classes are in building physical strength and balance that may help to prevent falls in older adults.

All of the information you provide will be kept confidential and an ID number will be used instead of your name to record your responses.

Today's Date: _____ / _____ / _____

1. **What is your gender?**
 Male Female

2. **How old are you?**
_____ years of age

3. **Do you practice Tai chi outside of class?** (45 minutes per week in the past 12 weeks)
 Yes No Sometimes

4. **Did you understand the teachers' instructions?**
 Yes No Somewhat

5. **Do you feel that you have successfully learned the majority of the movements (or forms) taught during class?**
 Yes No Somewhat

6. **Overall, how satisfied are you with this Tai chi class experience?**
 Very satisfied
 Somewhat satisfied
 Slightly satisfied
 Not at all satisfied

7. **In general, would you say your health is ...**
(Please circle only one number)

1 2 3 4 5

Poor Fair Good Very Good Excellent

8. Does your health limit you in any of the following activities? If so, how much?

	Yes, limited a lot	Yes, Limited a little	No, Not limited
k. Vigorous activities (such as running, lifting heavy objects, strenuous sport)			
l. Moderate activities (such as moving a table, vacuuming, bowling or golf)			
m. Lifting or carrying groceries			
n. Climbing several flights of stairs			
o. Climbing one flight of stairs			
p. Bending or kneeling			
q. Walking more than a mile			
r. Walking half a mile			
s. Walking 100 yards (150-200 paces)			
t. Bathing and dressing yourself			

9. Have you fallen in the past 12 weeks?

(Please note: A fall is when you land on the floor or ground, or fall and hit any object like the stairs or a piece of furniture, by accident.)

- Yes No (Skip to question 12)

10. How many times did you fall in the past 12 weeks?

- 1 time 2 times 3 times 4 times

11. Did you have any injuries from a fall in the past 12 weeks where you had to be seen by a physician or visit the emergency room?

- Yes No

12. What is your ability for doing any of the following activities?

Please reply thinking about how you usually do the activity. If you currently do not do the activity, please answer to show whether you think you would be concerned about falling if you did the activity. Please check the box which is closest to your own opinion to show how concerned you are that you might fall if you did this activity.

	1 Poor	2 Fair	3 Good	4 Very Good	5 Excellent
h. Getting dressed or undressed					
i. Taking a bath or shower					
j. Getting in or out of a chair					
k. Going up or down stairs					
l. Reaching for something above your head or on the ground					
m. Walking up or down a slope					
n. Going out to a social event (e.g. religious services, family gathering or club meeting)					

13. Please include any additional comments you may have about your experience in this Tai chi class in the box provided:

End of Survey Questions-Thank You!!!

**Tai chi: Moving for Better Balance
Selected Clinical Outcome Measures
Pre-Test**

Date: _____

Recorder's Name: _____

Instructions Timed Up and Go (TUG):

- Have the participant sit back in a standard arm chair.
- Tell the participant that at—GO, timing begins. At this time the participants:
 - **Stands up from the chair.**
 - **Walks to the line on the floor (Three meters or 10 feet),**
 - **Turn around,**
 - **Walk back to their chair, and**
 - **Sits down.**
- Stop timing when the person sits down.

Time taken _____ (seconds)

Note: An older adult who takes more than 14 seconds to complete the TUG is at high risk for falling.

End of clinical outcome measures – Thank You!!!

Appendix 3
SHDHD Tai Chi Program Code Book

Variable Name	Question	Variable Type	Code
ID	Unique ID	Continuous	
County	Which county the class was completed in	Categorical	0=Adams 1=Clay 2=Nuckolls 3=Webster
Year	Year of Tai chi class	Categorical	0=2016 1=2017
Sex	What is your gender?	Categorical	0=Male 1=Female
Age	How old are you?	Continuous	
Gen_health_pre	In general, would you say your health is	Categorical	1=Poor 2=Fair 3=Good 4=Very Good 5=Excellent
Limit_1_pre	Does your health limit you in vigorous activities (such as running, lifting heavy objects, strenuous sport)?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Limit_2_pre	Does your health limit you in moderate activities (such as moving a table, vacuuming, bowling or golf)?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Limit_3_pre	Does your health limit you in lifting or carrying groceries?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Limit_4_pre	Does your health limit you in climbing several flights of stairs?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Limit_5_pre	Does your health limit you in climbing one flight of stairs?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Limit_6_pre	Does your health limit you in bending or kneeling?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited

Limit_7_pre	Does your health limit you in walking more than a mile?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Limit_8_pre	Does your health limit you in walking half a mile?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Limit_9_pre	Does your health limit you in walking 100 yards (150-200 pases)?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Limit_10_pre	Does your health limit you in bathing and dressing yourself?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Fall_pre	Have you fallen in the past 12 weeks?	Categorical	0=Yes 1=No
Timefall_pre	How many times did you fall in the past 12 weeks?	Categorical	0=Didn't fall in past 12 weeks 1=1 time 2=2 times 3=3times 4=4 times
Injury_pre	Did you have any injuries from a fall in the past 12 weeks where you had to be seen by a physician or visit the emergency room?	Categorical	0=Didn't fall in past 12 weeks 1=Yes 2=No
Able_1_pre	What is your ability for getting dressed or undressed?	Categorical	1=Poor 2=Fair 3=Good 4=Very Good 5=Excellent
Able_2_pre	What is your ability for taking a bath or shower?	Categorical	1=Poor 2=Fair 3=Good 4=Very Good 5=Excellent
Able_3_pre	What is your ability for getting in or out of a chair?	Categorical	1=Poor 2=Fair 3=Good 4=Very Good 5=Excellent

Able_4_pre	What is your ability for going up or down stairs?	Categorical	1=Poor 2=Fair 3=Good 4=Very Good 5=Excellent
Able_5_pre	What is your ability for reaching for something above your head or on the ground?	Categorical	1=Poor 2=Fair 3=Good 4=Very Good 5=Excellent
Able_6_pre	What is your ability for walking up or down a slope?	Categorical	1=Poor 2=Fair 3=Good 4=Very Good 5=Excellent
Able_7_pre	Going out to a social event (e.g. religious services, family gathering, or club meeting)	Categorical	1=Poor 2=Fair 3=Good 4=Very Good 5=Excellent
TUG_pre	Time in seconds for TUG pre-test	Continuous	
Dropped_class	Did the individual drop the class	Categorical	0=No 1=Yes
Class_attend	Number of classes attended	Continuous	(out of 24 classes)
Gen_health_post	In general, would you say your health is	Categorical	1=Poor 2=Fair 3=Good 4=Very Good 5=Excellent
Limit_1_post	Does your health limit you in vigorous activities (such as running, lifting heavy objects, strenuous sport)?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Limit_2_post	Does your health limit you in moderate activities (such as moving a table, vacuuming, bowling or golf)?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Limit_3_post	Does your health limit you in lifting or carrying groceries?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited

Limit_4_post	Does your health limit you in climbing several flights of stairs?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Limit_5_post	Does your health limit you in climbing one flight of stairs?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Limit_6_post	Does your health limit you in bending or kneeling?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Limit_7_post	Does your health limit you in walking more than a mile?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Limit_8_post	Does your health limit you in walking half a mile?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Limit_9_post	Does your health limit you in walking 100 yards (150-200 pases)?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Limit_10_post	Does your health limit you in bathing and dressing yourself?	Categorical	0=Yes, limited a lot 1=Yes, limited a little 2=No, not limited
Fall_post	Have you fallen in the past 12 weeks?	Categorical	0=Yes 1=No
Timefall_post	How many times did you fall in the past 12 weeks?	Categorical	0=Didn't fall in past 12 weeks 1=1 time 2=2 times 3=3times 4=4 times
Injury_post	Did you have any injuries from a fall in the past 12 weeks where you had to be seen by a physician or visit the emergency room?	Categorical	0=Didn't fall in the past 12 weeks 1=Yes 2=No
Able_1_post	What is your ability for getting dressed or undressed?	Categorical	1=Poor 2=Fair 3=Good 4=Very Good 5=Excellent

Able_2_post	What is your ability for taking a bath or shower?	Categorical	1=Poor 2=Fair 3=Good 4=Very Good 5=Excellent
Able_3_post	What is your ability for getting in or out of a chair?	Categorical	1=Poor 2=Fair 3=Good 4=Very Good 5=Excellent
Able_4_post	What is your ability for going up or down stairs?	Categorical	1=Poor 2=Fair 3=Good 4=Very Good 5=Excellent
Able_5_post	What is your ability for reaching for something above your head or on the ground?	Categorical	1=Poor 2=Fair 3=Good 4=Very Good 5=Excellent
Able_6_post	What is your ability for walking up or down a slope?	Categorical	1=Poor 2=Fair 3=Good 4=Very Good 5=Excellent
Able_7_post	Going out to a social event (e.g. religious services, family gathering, or club meeting)	Categorical	1=Poor 2=Fair 3=Good 4=Very Good 5=Excellent
TUG_post	Time in seconds for TUG post-test	Continuous	

Appendix 4
MLH ED Falls Code Book

Variable Name	Question	Variable type	Code
Age	Age	Continuous	90=90 or older
Sex	Sex	Categorical	0=Male 1=Female
Visit	Date of visit	Continuous	MM/DD/YYYY
Disposition	Status after ED visit	Categorical	0=Discharged 1=Admit 3=Transferred 4=Other

Appendix 5
Age of Tai Chi Participants- State Data

Age						
	35-50	51-60	61-70	71-80	81 & over	Mean
2011-2012 (n=163)	2.5%	6.7%	20.9%	39.9%	30.1%	75.3
2012-2013 (n=146)	2.7%	6.8%	17.1%	45.9%	27.5%	74.2

(Source: Schmeeckle, Will. **Implementing Tai Chi: Moving for Better Balance in Local Nebraska Communities**)

Appendix 6
Gender of Tai Chi Participants- State Data

Gender		
	Male	Female
2011-2012 (n=163)	12.9%	87.1%
2012-2013 (n=146)	11.6%	88.4%

(Source: Schmeeckle, Will. **Implementing Tai Chi: Moving for Better Balance in Local Nebraska Communities**)

Appendix 7
Self-Reported Health of Tai Chi Participants- State Data

Self-reported health									
		Poor [1]	Fair [2]	Good [3]	Very Good [4]	Excell ent [5]	Mean	Chang e	p
2011-2012 (n=152)	Baseline	0.7%	9.9%	55.3%	30.9%	3.3%	3.26	0	1.00
	Follow-up	0.7%	13.8%	48.0%	33.6%	3.9%	3.26		
2012-2013 (n=144)	Baseline	0.7%	13.9%	52.8%	29.2%	3.5%	3.21	+.12	.170
	Follow-up	0.0%	10.4%	50.0%	36.1%	3.5%	3.33		

(Source: Schmeeckle, Will. **Implementing Tai Chi: Moving for Better Balance in Local Nebraska Communities**)

Appendix 8
Timed Up and Go Test Results of Tai Chi Participants- State Data

Average up and go time (seconds)* (n=134)			
Baseline	Follow-up	Change	p
11.18	10.37	-.81	.235

(Source: Schmeckle, Will. Implementing Tai Chi: Moving for Better Balance in Local Nebraska Communities)

Appendix 9
Health Limiting Activities of Tai Chi Participants- State Data

Health limits the following activities								
			Yes, limited a lot [1]	Yes, limited a little [2]	No, not limited [3]	Mean	Change	p
Vigorous activities (running, lifting heavy objects, strenuous sport)	2011-2012 (n=152)	Baseline	39.5%	41.4%	19.1%	1.80	-.04	.473
		Follow-up	40.8%	44.7%	14.5%	1.74		
	2012-2013 (n=144)	Baseline	42.4%	44.4%	13.2%	1.71	+.01	.928
		Follow-up	36.8%	54.9%	8.3%	1.72		
Moderate activities (moving a table, vacuuming, bowling, golf)	2011-2012 (n=153)	Baseline	17.0%	36.6%	46.4%	2.29	+.06	.534
		Follow-up	15.0%	35.3%	49.7%	2.35		
	2012-2013 (n=144)	Baseline	16.7%	29.9%	53.5%	2.37	+.04	.633
		Follow-up	13.9%	31.3%	54.9%	2.41		
Lifting or carrying groceries	2011-2012 (n=150)	Baseline	12.0%	24.0%	64.0%	2.52	-.02	.801
		Follow-up	10.0%	30.0%	60.0%	2.50		
	2012-2013 (n=145)	Baseline	10.3%	28.3%	61.4%	2.51	+.03	.727
		Follow-up	9.7%	26.9%	63.4%	2.54		
Climbing several flights of stairs	2011-2012 (n=152)	Baseline	28.3%	25.0%	46.7%	2.18	-.09	.235
		Follow-up	27.6%	37.5%	34.9%	2.07		
	2012-2013 (n=143)	Baseline	21.7%	44.8%	33.6%	2.12	-.04	.625
		Follow-up	21.7%	49.0%	29.4%	2.08		
Climbing one flight of stairs	2011-2012 (n=146)	Baseline	9.6%	28.8%	61.6%	2.52	+.01	.930
		Follow-up	8.9%	29.5%	61.6%	2.53		
	2012-2013 (n=137)	Baseline	5.8%	26.3%	67.9%	2.62	-.01	.841
		Follow-up	6.6%	26.3%	67.2%	2.61		
Bending or kneeling	2011-2012 (n=153)	Baseline	19.0%	44.4%	36.6%	2.18	+.06	.443
		Follow-up	19.6%	36.6%	43.8%	2.24		
	2012-2013 (n=142)	Baseline	19.0%	45.8%	35.2%	2.16	+.04	.612
		Follow-up	14.8%	50.0%	35.2%	2.20		
Walking more than a mile	2011-2012 (n=146)	Baseline	28.1%	32.9%	39.0%	2.11	-.03	.777
		Follow-up	30.8%	30.1%	39.0%	2.08		
	2012-2013 (n=133)	Baseline	30.1%	32.3%	37.6%	2.08	+.06	.554
		Follow-up	28.6%	29.3%	42.1%	2.14		

Walking half a mile	2011-2012 (n=149)	Baseline	19.5%	22.8%	57.7%	2.38	+.06	.715
		Follow-up	18.8%	20.8%	60.4%	2.42		
	2012-2013 (n=146)	Baseline	19.9%	24.0%	56.2%	2.36	+.11	.264
		Follow-up	17.1%	19.2%	63.7%	2.47		
Walking 100 yards (150-200 paces)	2011-2012 (n=148)	Baseline	6.1%	23.6%	70.3%	2.64	0	1.00
		Follow-up	7.4%	20.9%	71.6%	2.64		
	2012-2013 (n=143)	Baseline	8.4%	21.7%	69.9%	2.62	+.04	.502
		Follow-up	6.3%	21.0%	72.7%	2.66		
Bathing and dressing	2011-2012 (n=154)	Baseline	1.3%	9.7%	89.0%	2.88	-.02	.766
		Follow-up	1.9%	9.7%	88.3%	2.86		
	2012-2013 (n=146)	Baseline	0.7%	13.0%	86.3%	2.86	+.03	.395
		Follow-up	0.0%	11.0%	89.0%	2.89		
Health limitation index (aggregate of the above items)	2011-2012 (n=156)	Baseline				2.33	+.01	.953
		Follow-up				2.34		
	2012-2013 (n=147)	Baseline				2.32	+.03	.653
		Follow-up				2.35		

(Source: Schmeckle, Will. Implementing Tai Chi: Moving for Better Balance in Local Nebraska Communities)

Appendix 10

Rate of Emergency Department Visits for Falls- State Data

Rate of Emergency Department Visits Due to Falls per 1,000 Population Ages 65 and Older					
		65-74	75-84	85 and over	Total
2007-2009	Elkhorn-Logan Valley	19.3	40.3	84.1	38.9
	Four Corners	14.3	33.4	64.8	29.9
	South Heartland	23.6	41.7	84.1	41.8
	Two Rivers	22.5	45.6	89.2	42.7
	Total	20.3	41.0	82.3	39.0
	All other LHDs	23.7	46.3	92.4	42.6
2010-2012	Elkhorn-Logan Valley	24.4	49.6	95.9	47.1
	Four Corners	15.9	37.1	74.2	33.6
	South Heartland	20.6	46.4	95.9	43.1
	Two Rivers	23.0	50.5	115.7	48.0
	Total	21.4	46.8	98.3	43.9
	All other LHDs	23.7	58.6	111.5	49.0

(Source: Schmeckle, Will, Nebraska DHHS, Emergency Department Visit Data, 2007-2012)