# Traditional Chinese Medicine Use for Health-Related Quality of Life, a Secondary Analysis of the INCLD Health Data

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Abstract

# Traditional Chinese Medicine Use for Health-Related Quality of Life, a Secondary Analysis of the INCLD Health Data

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**Background:** Traditional Chinese Medicine (TCM) commonly employs acupuncture and herbal medicine, both of which are growing in popularity in the United States. These treatments are commonly used in overall health maintenance to promote health and for disease prevention. However, there is a lack of information on how TCM affects Health-Related Quality of Life (HRQoL).

**Objectives:** The objectives of this study are to evaluate the association of TCM and self-reported HRQoL measures, and to explore the association of TCM and both medication use and medical comorbidities.

**Methods:** Data collected and analyzed were from the International Cohort on Lifestyle Determinants of Health (INCLD Health) study and identified a prospective cohort of students reporting the concurrent use of acupuncture and Chinese herbal medicine. Generalized Estimating Equations with a working independence correlation structure were used for cross-sectional analyses for baseline and six-month follow-up observations. The HRQoL outcomes

included the PROMIS®-29 profile, the Perceived Stress Scale, and the Personal Wellbeing Index, modified. The covariate-adjusted estimates were reported for HRQoL measures, and odds ratios were reported for the associations of TCM use and medication and comorbidities.

**Results:** Of the 173 observations at baseline, 48 were classified as using TCM. Of the 90 observations at the six-month follow-up, 31 were classified as using TCM. PROMIS®-29 instrument scores indicated values congruent with the average United States adult population at both baseline and follow-up for both groups, with only slightly higher scores for fatigue and anxiety. At baseline, TCM use was associated with lower Perceived Stress, and higher perceptions of mental, spiritual, personal, social, and overall wellness. At follow-up, TCM use was associated with lower Perceived Stress, and higher perceptions of physical and overall wellness. These differences at baseline and follow-up were considered statistically significant, but were not considered clinically meaningful. Medication use and the presence of comorbidities were not associated with TCM.

**Conclusions:** TCM use over six months was not associated with further improvements in HRQoL. Comorbidities and medication use did not appear to affect an individual's decision to use TCM. The small sample size and a healthy cohort limit the ability to detect meaningful changes in HRQoL from the use of TCM. With more individuals using TCM for health maintenance, future research should focus on HRQoL outcomes.

## BACKGROUND

Acupuncture and herbal medicine are growing in popularity in the United States, although their use is relatively uncommon.[1-4] Among American adults in 2012, only 1.5% reported the use of acupuncture, and 0.4% reported the use of medicinal herbs specifically from non-conventional complementary and integrative health (CIH) disciplines such as Chinese medicine and homeopathy.[3] However, the use of acupuncture and medicinal herbs has been increasing steadily since 2002.[1,3] And as of 2015, approximately 35% of American adults reported the use of at least one medicinal herb, with an average of 2.6 herbal supplements consumed.[4]

Acupuncture and herbal medicine are but two of five disciplines under the umbrella of Traditional Chinese Medicine (TCM) – medicinal herbs, acupuncture, dietetics, therapeutic exercise (qì gōng), and medical-massage (tuī ná).[5] All five disciplines are connected through the same traditional medical model of TCM and are often prescribed in various combinations concurrently, with acupuncture and Chinese herbal medicine being the most common combination.

In the United States, consumers of acupuncture are more likely to be older in age, female, White, have higher education, and have a higher annual income.[6] Consumers of medicinal herbs are more likely to have a college degree or higher, and tend to report a history of stroke, breathing problems, or use either over-the-counter products or use a mail-order pharmacy.[4] Most Americans seek these therapies and other CIH modalities for a variety of medical conditions and health goals. Individuals with significant medical conditions such as cancer and diabetes are more likely to report the use of medicinal herbs.[4,7-10] Acupuncture is commonly employed for individuals with arthritis and neurological disorders.[6] Individuals

report the use of either modality for general health, wellness, and disease prevention,[6,7,11] or to relieve the side effects of conventional medicine including concerns over the side effects of pharmaceuticals,[8,9,11] or that conventional medicine was not effective.[6,11] Adults also report the use of CIH modalities to reduce stress and as a prevention for future concerns from medical conditions.[8,9,11]

Health-related quality of life (HRQoL) includes the perceptions of social functioning, physical health, and mental health by individuals, both in the presence of disease or in the absence of disease.[12] Reduced HRQoL is associated with increased mortality and increased healthcare utilization.[13-22] Specifically, reduced quality of life related to physical functioning deficits has consistently demonstrated an association with early mortality.[14-20] Reduced quality of life related to mental and emotional health also are associated with early mortality, specifically among individual in the United States.[18] Other health measures such as the duration of time cancer-free are associated with HRQoL.[22]

Even with the existing evidence-base for the importance of HRQoL and the use of acupuncture and medicinal herbs for wellness and disease prevention, there is a paucity of research for HRQoL outcomes from the use of Chinese herbal medicine and acupuncture in the United States.[2,4] National databases for health consumer behavior in the United States have sparse information on acupuncture use and even less information on the concurrent use of these two modalities. Some of the reasons for limited information is that there are significant barriers to acupuncture use,[1,2,6,23-25] plus Chinese herbal medicines are regulated as dietary supplements, and therefore are not required to demonstrate pre-market safety or efficacy, and the surveillance of safety is inadequate.[26,27]

To begin to address this knowledge gap in the use of acupuncture and Chinese herbal medicine in the United States for HRQoL outcomes, this study set out to examine the association between TCM and HRQoL among adults enrolled in a CIH education program. Data from five acupuncture and Chinese medicine schools across the United States indicate that the majority of students are female, White, non-Hispanic, and are approximately 43 years of age,[28] and this is similar demographically to consumers of acupuncture and medicinal herbs in the United States. Moreover, access to CIH modalities including acupuncture and medicinal herbs is greater for students enrolled in CIH education programs. As such, increased access allows for the opportunity for more treatments over time.

**Aims**

The primary aim of this study is to evaluate the association of TCM use and self-reported HRQoL measures, including the perception of well-being and stress. The second aim is to explore the association of TCM use and medication use. The third aim is to explore the association of TCM use and the presence of self-reported medical comorbidities.

**Hypothesis**

The hypothesis for this study is that individuals using TCM will have improvements in self-reported HRQoL measures. Additionally, the hypotheses for aims two and three are that TCM utility increases with higher medication use and also with more comorbidities.

# METHODS

## Study design

Cross-sectional and longitudinal analyses were conducted in a prospective cohort of individuals enrolled in the International Cohort on Lifestyle Determinants of Health (INCLD Health) study (Bradley, Principal Investigator).[29]

## Study dataset

The INCLD Health (National University of Natural Medicine, Portland, OR, USA) data is a longitudinal study of students studying at a predominantly CIH-training university. The INCLD Health characterizes changes over time in health, wellness, and lifestyle for CIH students, examining the association between lifestyle factors and gut microbiota populations and diversity, examining stress and stress management practices and sleep, quality of life, and overall health.[29] The INCLD Health is an ongoing longitudinal cohort from September 2018 and ongoing as of this writing of a convenience sample of adult students ages 18 and older enrolled in complementary medicine education programs such as Ayurvedic medicine, Chinese medicine, naturopathic medicine, nutrition, and integrative medicine. As of March 2022, 190 students were enrolled in the study.

## Study sample

The study sample for this project included all participants enrolled in the INCLD Health study. The study sample was restricted to the baseline and six-month follow-up timepoints, as relatively few participants were eligible for the later time points. Six-months is an appropriate timeframe for TCM use and changes in HRQoL. Acupuncture, which is one component of the TCM exposure, has consistently demonstrated beneficial results in systematic reviews for clinical populations for domains related to pain, depression, anxiety, and

insomnia.[30-33] Additionally, multiple studies about the responsiveness of many PROMIS® (Patient-Reported Outcomes Measurement Information System) measures use a timeframe of six months or less in specific clinical populations,[34,35] or clinical populations without acute clinical symptomatology.[36] Participants were excluded if information on acupuncture and Chinese herbal medicine use was missing.

**Identification of Traditional Chinese Medicine**

The exposure was the use of TCM, as defined as the concurrent use of acupuncture and Chinese herbal medicine as self-reported by CIH students at baseline or at the six-month follow-up. The comparison group consisted of individuals who used only acupuncture, only Chinese herbal medicine, or other forms of complementary health in the absence of concurrent acupuncture and Chinese herbal medicine at either baseline or the six-month follow-up. An indicator variable was created to document TCM use (1 = yes, 0 = no).

**Variables**

**(1) Health-Related Quality-of-Life**

Health-Related Quality-of-Life was documented with the 29-question PROMIS® Adult Profile Instruments, v2.0 (PROMIS®-29).[37] The PROMIS profiles are not disease specific, and the PROMIS®-29 index allows for calculation of eight PROMIS quality-of-life subscales including physical function, anxiety, depression, fatigue, sleep disturbance, ability to participate in social roles and activities, pain interference, and global pain intensity.

The PROMIS®-29 does not produce a composite score, and final scores reflect the sum of each included measure. Each PROMIS short form in the PROMIS®-29 uses Likert-type scales.[38] Each question produces a numeric score, and the final score for a measure reflects the sum from all questions. This raw score from each instrument then converts to its own PROMIS-

T-score, which centers on a population norm (mean = 50, standard deviation = 10). Higher scores reflect higher amounts of each construct measured.

Responses for the PROMIS® Adult v1.0 Physical Function 4a subscales are Likert scales from 5 = "without any difficulty" to 1 = "unable to do." Responses for the PROMIS® Adult v1.0 Depression 4a, PROMIS® Adult v1.0 Anxiety 4a, and the PROMIS® Adult v1.0 Ability to Participate in Social Roles and Activities 4a subscales are Likert scales from 5 = "never" to 1 = "always." Scoring for the PROMIS® Adult v1.0 Fatigue 4a and the PROMIS® Adult v1.0 Pain Interference 4a subscales are Likert scales from 5 = "not at all" to 1 = "very much." Scoring for three of the four the PROMIS® Adult v1.0 Sleep Disturbance 4a subscales (refreshing sleep, problems with sleep, difficulty falling asleep) are Likert scales for 5 = "a little bit" to 1 = "very much," with the remaining subscale (sleep quality) also as a Likert scale from 5 = "very poor" to 1 = "very good." Last, the PROMIS® Pain Intensity item is a single question and uses an 11-point numeric rating scale, from 0 (no pain) to 10 (worst pain imaginable).

Each PROMIS instrument's meaningful change within groups and the minimal important differences between groups vary significantly with the clinical population tested.[39-42] This study sample did not include a specific clinical population. Therefore, a threshold for a meaningful change for the analyses was not specified.

**(2) Perceived Stress Scale**

The Perceived Stress Scale (PSS-10) is a 10-item scale that measures an individual's perception of stress over the preceding month.[43] Responses are categorized as 0 = "never," 1 = "almost never," 2 = "sometimes," 3 = "fairly often," and 4 = "very often." Scoring is a composite score from the total sum across all items. Higher scores mean higher perceived stress.

**(3) Multi-dimensional Index of Wellness (MI Wellness)**

The INCLD Health project adapted this wellness inventory from the Personal Wellbeing Index-Adult version 5.0 by the International Wellbeing Group.[29,44] Respondents rated their perception of wellbeing on a numeric scale from 1 to 10 for the constructs of physical, emotional, mental, spiritual, sexual, personal, family, social, financial, and overall wellbeing. Scoring is for each individual item from the ten constructs. Higher scores reflect higher perceptions of wellbeing for each measure.

**(4) Medication use**

Medication use was documented based on respondent self-reports. The reported medications were then grouped by the drug class within broad categories of antimigraine, cardiovascular, contraceptives (oral and intrauterine device), endocrine, gastrointestinal, hormones, immune system, infection, muscle relaxers, neurological, non-steroidal anti-inflammatory (NSAID), pain, psychological or psychiatric, respiratory, topical steroids, and antihistamines. Both an indicator for medication use by drug group (0 = no/1 = yes) and an overall count for the number of medications used was calculated.

**(5) Comorbidities**

Medical comorbidity for acute and chronic medical conditions was documented from the responses to the Health History Questionnaire, which was designed specifically for the INCLD Health study.[29] Symptoms were grouped by systems (cardiovascular, respiratory, dermatologic, gastrointestinal, neuromuscular, endocrine, genitourinary, cancer, psychiatric, other). Indicators for the presence of a medical comorbidity (0 = none or past, 1 = current), and a count for the number of medical comorbidities per respondent was calculated.

**(6) Medical symptomatology**

Medical symptomatology was documented with the responses from the Symptom Monitoring Questionnaire, which was designed specifically for the INCLD Health study.[29] Symptoms were grouped by systems (eyes, ears, nose, and throat, gastrointestinal including mouth, neurologic, muscular, psychological/mental health, cardiopulmonary, skin, genitourinary, constitutional). Both an indicator for reported symptomatology (0 = none or mild, 1 = moderate or severe) and a count for the number of symptomatology reported was calculated.

**(7) Age**

The respondent's age was documented at baseline and at the follow-up in years.

**(8) Sex assigned at birth**

Sex assigned at birth was documented as 0 = male, 1 = female, 3 = intersex.

**(9) Gender**

Gender identity was documented at both baseline and at the follow-up as 0 = cis-male, 1 = trans-male, 3 = cis-female, 4 = trans-female, 5 = non-binary, 6 = prefer not to say.

**(10) Race**

Race was documented as 0 = White/Caucasian, 1 = Black or African American, 2 = Asian, 3 = Middle Eastern, 4 = Native Hawaiian or other Pacific Islander, 5 = American Indian/Alaska Native, 6 = more than one race, and 7 = other or unknown.

**(11) Ethnicity**

Ethnicity was documented as 0 = Hispanic or Latino/Latina/Latinx, 1 = not Hispanic or Latino/Latina/Latinx, and 2 = unknown/not reported.

**(12) Physician use**

The presence of having a physician was documented with a binary indicator (1 = yes, 0 = no/undisclosed).

**(13) Supplement use**

Dietary supplement use was documented by the self-report of respondents, and the number of supplements used per respondent was calculated. Supplements were defined as non-pharmaceutical, natural products such as vitamins, minerals, herbal medicines, isolated bioactive compounds from food, and other commercially available substances.

**(14) Physical activity**

Physical activity behaviors were collected based on responses to the International Physical Activity Questionnaire,[45] a 12-item instrument designed to assess weekly activity intensity. Sedentary activity was calculated by the number of reported hours sitting in a week, light activity was calculated by the number of days per week one engaged in walking, moderate activity was calculated also in the number of days per week, and vigorous activity was calculated in the number of days per week.

**Conceptual Model**

Variables from the INCLD data were determined *a priori* for possible inclusion in the analyses. The selections were based in part on the behavioral model and access to medical care framework.[46,47] This model indicates that three broad categories determine health care utilization: predisposing factors such as demographics, social structures (such as occupation and education), and health beliefs; enabling factors such as personal, family and community resources for income, insurance coverage, travel time, physical availability of clinics; and need-related factors such perceptions of health and functional states. Based on this framework, the

following variables were considered from the INCLD data for using TCM: age, race, ethnicity, and gender as predisposing factors, having a physician as an enabling factor, and the presence of medical symptoms and medical conditions as need-related factors. These variables are associated with CIH use, including acupuncture and medicinal herbs.[1,6,7] HRQoL also has associations with age,[48,49] gender,[48,50-52] race,[53-55] ethnicity,[53,55] medical conditions,[48] medical symptomatology,[49] and physical activity.[56] Supplement use is associated with CIH and conventional healthcare utilization, and many HRQoL domains.[1] Pharmaceutical medications were assumed to be a function of healthcare utilization, which includes the association with the use of TCM and HRQoL.

The selected variables were considered a function of all other data elements, with the exception of demographic variables. Therefore, the demographic variables were considered unidirectional in relation to the other variables. All other relationships were considered to be bidirectional.

Pathways for these variables and relationships were examined with Daggity 3.0[57] to determine possible covariates for the analyses (Figure 1). Based on this pathway examination, covariates included in the regression models were age, gender, race, ethnicity, medical comorbidities, and medical symptomatology.

**Analysis**

Descriptive statistics were reported for sample age, sex assigned at birth, gender, race, ethnicity, health care provider status, physical activity, HRQoL, medical symptomatology, medical comorbidities, supplement use, and medication use. Frequency counts and percentages for categorical variables and the mean and standard deviation for continuous variables were reported.

**Missingness and multiple imputation**

Missing observations were considered missing at random. A Multiple Imputation Chained Equations (MICE) approach was used to impute missing observations.[58]

Use of TCM, respondent's age, sex at birth, gender identity, ethnicity, race, health care provider status, activity level (vigorous, moderate, light, sedentary), counts of medical symptoms, counts of medical comorbidities, counts of supplements, counts of medications, and the scores for each of the items for quality-of-life measures (PROMIS®-29, Perceived Stress Scale, and Wellness Inventory) were designated for use in the imputation process.

Clusters for longitudinal analysis were identified by respondent identification and timepoint. For the predictor matrix used in the MICE approach, imputation methods designated for missing observations were predictive mean matching for continuous variables, logistic regression imputation for binary variables, and polytomous regression imputation for categorical variables with more than two categories. Five complete datasets were imputed, using forty iterations to calculate each missing observation within each imputed dataset. Imputation was assessed visually with box plots displaying each imputed value from each of the five imputed datasets. The results from each imputed dataset were pooled for use in the regression modeling analyses.

For inferential analysis, a working independence correlation structure with a marginal model with Generalized Estimating Equation (GEE) was used to examine the association of TCM use and the outcomes of interest. Use of the GEE marginal model is suited for longitudinal data with correlated data. Designation of a working independence structure is robust with GEE methods when the covariance structure is not known.

**HRQoL**

To evaluate changes in HRQoL, perceived stress, and wellness as the outcomes measured at baseline and follow-up, nineteen regression models were fit, one for each of the eight PROMIS®-29 measures (physical function, anxiety, depression, fatigue, sleep disturbance, ability to participate in social roles and activities, pain interference, and pain intensity), the composite score for the Perceived Stress Scale, and each of the ten Wellness Inventory measures (physical, emotional, mental, spiritual, sexual, personal, family, social, financial, and overall wellbeing). A working independence correlation structure with a marginal model with Generalized Estimating Equation (GEE) was used. The fixed effects were TCM use, and the covariates were age at each time point as a linear function in years, gender, race, ethnicity, counts of comorbidities, and counts of medical symptomatology. The covariate-adjusted estimates for HRQoL, perceived stress, and wellness outcomes for baseline scores, and six-month follow-up scores were reported.

**Medication use**

To evaluate if medication use was associated with the use of TCM at baseline and follow-up, a working independence correlation structure with a marginal model with a Generalized Estimating Equation (GEE) using a local odds ratio parameterization was used. The main effect was the count of medications, and the covariates were age at each time point as a linear function in years, gender, race, ethnicity, counts of comorbidities, and counts of medical symptomatology. The covariate-adjusted odds ratio for the odds of using TCM were reported for individuals as a function of medication use at baseline and at the six-month follow-up.

**Medical comorbidities**

To evaluate if medical comorbidities was associated with the use of TCM at baseline and follow-up, a working independence correlation structure with a marginal model with a Generalized Estimating Equation (GEE) using a local odds ratio parameterization was used. The main effect was the count of medications, and the covariates were age at each time point as a linear function in years, gender, race, ethnicity, and counts of medical symptomatology. The covariate-adjusted odds ratio for the odds of using TCM were reported for individuals as a function of number of reported comorbidities at baseline and at the six-month follow-up.

**Sensitivity analysis**

Each of the three aims included a sensitivity analysis to determine if an association between the predictor and outcome variables of interest were associated with TCM use over time, from baseline to six months by use of the same regression models described above and included an interaction term between TCM and timepoint. The estimate for the interaction term for each covariate adjusted model was reported.

## RESULTS

The sample included 173 individuals who provided a response to use of acupuncture and or medicinal herbs (Table 1). Ninety individuals completed questionnaires for the six-month follow-up. Forty-eight individuals reported TCM use at baseline and 31 at the follow-up. Most individuals reported identifying as female, White, and non-Hispanic. Most reported seeing a conventional medical provider in the past 12 months. Medical symptomatology remained consistent among TCM users between baseline and follow-up, but non-TCM users reported fewer symptoms on average at follow-up from baseline. Supplement use increased on average

in both groups from baseline to follow-up, but medication use on average remained consistent. The most prevalent symptomatology reported among all respondents at baseline was dermatologic and psychiatric. However, at follow-up, respondents reported a higher prevalence of neuromuscular symptoms and psychiatric symptoms. Most HRQoL measures from the PROMIS®-29, the Perceived Stress Scale, and the Wellness Inventory remained relatively stable from baseline to follow-up for both groups. However, TCM users reported changes of one or more points on average for more sleep disturbance, and non-TCM users reported less depression and less fatigue.

**Missingness and multiple imputation**

Out of 17,358 total observations in the dataset used for inferential analysis, 206 observations (1.17%) were missing. Histograms for missing observations revealed a non-monotone pattern (Figure 2). Missingness occurred with the variables age (n = 8), sex assigned at birth (n = 8) gender (n = 8), ethnicity (n = 7), and race (n = 3). A single observation was missing from each of the PROMIS®-29 fatigue (average fatigue) and sleep (difficulty falling asleep) measures, and from the Perceived Stress Scale for controlling important things in one's life and an inability to cope with all things one had to do. Two individuals did not complete the Wellness Inventory, and this accounted for a total of 40 missing observations. Data for physical activity had significant missingness (sedentary = 37, light = 16, moderate = 34, and vigorous = 39).

With the overall low number of missing observations, five imputations using chained equations was conducted and considered appropriate.[59,60] Visual inspection showed sufficient imputation with similar patterns across imputed datasets (Figure 3).

## Inferential analysis

Table 2 displays the results of the regression models using Generalized Estimating Equation with a working independence correlation to evaluate the association of TCM use and each of the 19 HRQoL measures at baseline, and at follow-up.

TCM use was associated with beneficial changes in HRQoL, including lower perceived stress, and for all perceived wellness domains and most of the PROMIS®-29 measures except for physical function, fatigue, sleep disturbance, pain interference, and global pain intensity. However, all results except for Perceived Stress indicated a change of less than one point. For the PROMIS measures, less than a single-point change would not yield a change in the PROMIS-T-score. While perceived stress was considered statistically significant, the difference from the use of TCM represented only a change of 6.7%, and this magnitude is in-line with the magnitude of change in the other HRQoL scores. Few results for perceived wellness were considered statistically significant.

### *HRQoL at baseline*

After adjusting for age, race, ethnicity, gender, presence of moderate or severe medical symptomatology and having a medical comorbidity, TCM users at baseline had on average: 2.73 points lower for perceived stress compared to non-TCM users (95% CI -4.58, -0.90, p = 0.004); 0.55 points higher for perceived mental wellness (95% CI 0.03, 1.07, p = 0.041); 0.75 points higher for perceived spiritual wellness (95% CI 0.17, 1.32, p = 0.014); 0.62 points higher for perceived personal wellness (95% CI 0.09, 1.14, p = 0.018); 0.95 points higher for perceived social wellness (95% CI 0.40, 1.50, p < .001); and 0.49 points higher for perceived overall wellness (95% CI 0.08, 0.90, p = 0.019). PROMIS®-29 scores for TCM users at baseline did have on average less depression, less anxiety, more ability to participate in social roles and

activities, but on average also had more fatigue, more sleep disturbance, more pain interference, more pain intensity, lower physical functioning, and higher scores for the remaining five wellness measures from the MI Wellness scores. However, these changes were not considered statistically significant. Moreover, none of the PROMIS measures exceeded a point or more in the raw scores, which would not yield a change in the PROMIS-T-score.

***HRQoL at six-month follow-up***

After adjusting for age, race, ethnicity, gender, presence of moderate or severe medical symptomatology and having a medical comorbidity, TCM users at follow-up had on average 2.75 points lower for perceived stress compared to non-TCM users (95% CI -4.71, -0.79, p = 0.006); 0.67 points higher for perceived physical wellness (95% CI 0.03, 1.32, p = 0.043); and 0.53 points higher for perceived overall wellness (95% CI 0.06, 0.99, p = 0.026). TCM users at follow-up had on average less depression, less anxiety, less fatigue, less pain interference, more ability to participate in social roles and activities, but on average also had more sleep disturbance, more pain intensity, lower physical functioning, and higher scores for the remaining eight wellness measures. However, these results were not considered statistically significant. Similar to baseline, none of the PROMIS measures exceeded a point or more in the raw scores, which would not yield a change in the PROMIS-T-score.

***Medication Use***

Medication use was not associated with the use of TCM. At baseline, adjusting for age, race, ethnicity, the presence of moderate or severe medical symptomatology, and medical comorbidities, the odds of TCM use per medication used was 0.76 (95% CI: 0.56, 1.03), p = 0.082.

At the six-month follow-up, adjusting for age, race, ethnicity, the presence of moderate or severe medical symptomatology, and medical comorbidities, the odds of TCM use per medication used was 1.19 (95% CI: 0.71, 1.97), p = 0.508.

***Medical comorbidities***

Presence of a current medical condition was not associated with the use of TCM. At baseline, adjusting for age, race, ethnicity, and the presence of moderate or severe medical symptomatology, the odds of TCM use per medical comorbidity reported was 0.98 (95% CI: 0.90, 1.08), p = 0.744.

At the six-month follow-up, adjusting for age, race, ethnicity, and the presence of moderate or severe medical symptomatology, the odds of TCM use per medical comorbidity reported was 1.51 (95% CI: 0.99, 2.30), p = 0.060.

***Sensitivity analysis***

The sensitivity analysis explored if TCM use over time from baseline to the six-month follow-up was associated with HRQoL (Table 4). Of the nineteen HRQoL measures, pain interference and sleep disturbance showed an association with TCM use from baseline through six months. Adjusting for age, race, ethnicity, gender, presence of moderate or severe medical symptomatology and medical comorbidities, TCM users over time from baseline through follow-up had on average 1.46 lower for pain interference scores (95% CI -2.50, -0.42, p = 0.006) and 1.52 points higher for sleep disturbance (95% CI -0.07, 2.96, p = 0.040). None of the remaining differences for the seventeen HRQoL measures were considered statistically significant.

## DISCUSSION

TCM commonly employs multiple modalities in treatment by certified and licensed practitioners, and current research commonly examines either acupuncture or medicinal herbs alone. This study evaluated if the use of TCM, as defined as the use of both acupuncture and medicinal herbs, improved HRQoL which included the perceptions of stress and wellness, for individuals enrolled in a CIH education program. While the results indicated only a small change in all HRQoL domains for TCM users compared to non-TCM users, TCM use shows promise for many areas of wellness. An explanation for the small change in HRQoL outcomes is that the respondents were essentially a healthy sample. Although respondents indicated having a sedentary lifestyle slightly more than the average United States adult,[61] likely attributed to their student status, they engaged in light to moderate activity for at least one half of a week every week. Also, even though at least six comorbidities were reported on average at either timepoint, and most respondents reported having a conventional medical provider, most respondents reported no medication use, with the average number of medications per individual of less than one. This use of medications is below the average of one or more medications among almost half of the adults in the United States.[62] This suggests that medical conditions might be clinically stable, or not problematic. Last, HRQoL measures did not indicate a negative quality of life for the study sample. The measures are congruent with the average American adult with PROMIS-T-scores centering around 50.[37] Fatigue and anxiety, however, were both only slightly higher (PROMIS-T-scores were approximately 54 and 56 for fatigue and anxiety, respectively). Also, perceived stress overall was low and perceived wellness was high. These results are in-line with the findings by Austin and colleagues that a common reason for acupuncture utilization commonly stems from an interest in overall health and disease

prevention, and not just because of inadequate clinical outcomes from conventional medicine.[6] Similarly, common reasons to use medicinal herbs are for health maintenance and prevention.[7] As the number of medications and number of comorbidities were not associated with TCM use, it is possible that the study sample utilized acupuncture and medicinal herbs for maintenance and prevention purposes.

**Strengths and limitations**

The strength of this study is that the sample included individuals with greater access to CIH modalities, which allows for more treatments and over a longer duration. Second, this study used the PROMIS®-29 instrument, which is comprised of validated instruments that are not disease specific. TCM clinical assessments are based on pattern discrimination, which involves grouping symptoms by correspondences with the internal organs as outlined by Chinese medicine. As such, TCM patterns will include syndromes that are clinically assessed with a multitude of biomedical diagnoses. Use of the non-disease specific instruments such as the PROMIS measures allow for more accurate surveillance on changes organic to these patterns in TCM.

However, there are several limitations to this study. The primary limitation is the small sample size both overall and for subgroup analyses. Because of this, the study was limited in its ability to examine the association of TCM and medical comorbidities by system and drug use by drug class. The study was also limited in the ability to evaluate the association of TCM use over time and HRQoL outcomes. A second limitation is that the current analysis was only able to examine two time points six months apart. This timeframe might be too short to see meaningful changes in a healthy population. Also, the inclusion of data at the 12 month follow-up and even 24 month follow-up might identify more evident trends, but that is beyond the scope of this

thesis. A third limitation is from the multiple comparisons created by 19 HRQoL measures. The results were not adjusted for multiple comparisons, and therefore any of the associations should be interpreted with caution. A fourth limitation is that the study sample was a healthy population, with HRQoL scores comparable with the average United States adult. A fifth limitation to this study is that the MI Wellness instrument used for this project is an adaptation, and is not validated. This limits the ability to draw firm conclusions about the direction of benefit from the use of TCM in the ten wellness domains. Most respondents in the study sample were approximately 30 years of age, identified as female, racially identified as white, and were non-Hispanic. While this is largely congruent with the characterization of acupuncture consumers in the United States,[6] the study sample was not representative of the United States population, limiting generalizability. Last, this was an observational study, and only associations can be inferred. This limits the ability to draw conclusions about the causal nature for the direction and magnitude of the effect of TCM and HRQoL. It is possible that the effects of TCM were that of maintaining health only.

**Future directions**

Future research should focus on Chinese medicine as it is commonly employed in the United States. With more individuals using TCM for health maintenance and as a medical treatment, future research should focus in-depth on health consumers' motivations for selecting TCM and if clinical outcomes depend on medical conditions and medication use. Additionally, TCM surveillance in the United States is inadequate, and future research should focus on HRQoL outcomes and TCM use in specific clinical populations and how these HRQoL outcomes change over time.

## Conclusions

Despite evidence of a healthy sample, TCM use over six months was not associated with further improvements in HRQoL suggesting its role in overall wellness and health maintenance by students. The presence of self-reported comorbidities and medication use did not appear to affect an individual's decision to use TCM.

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Appendix A tables and figures

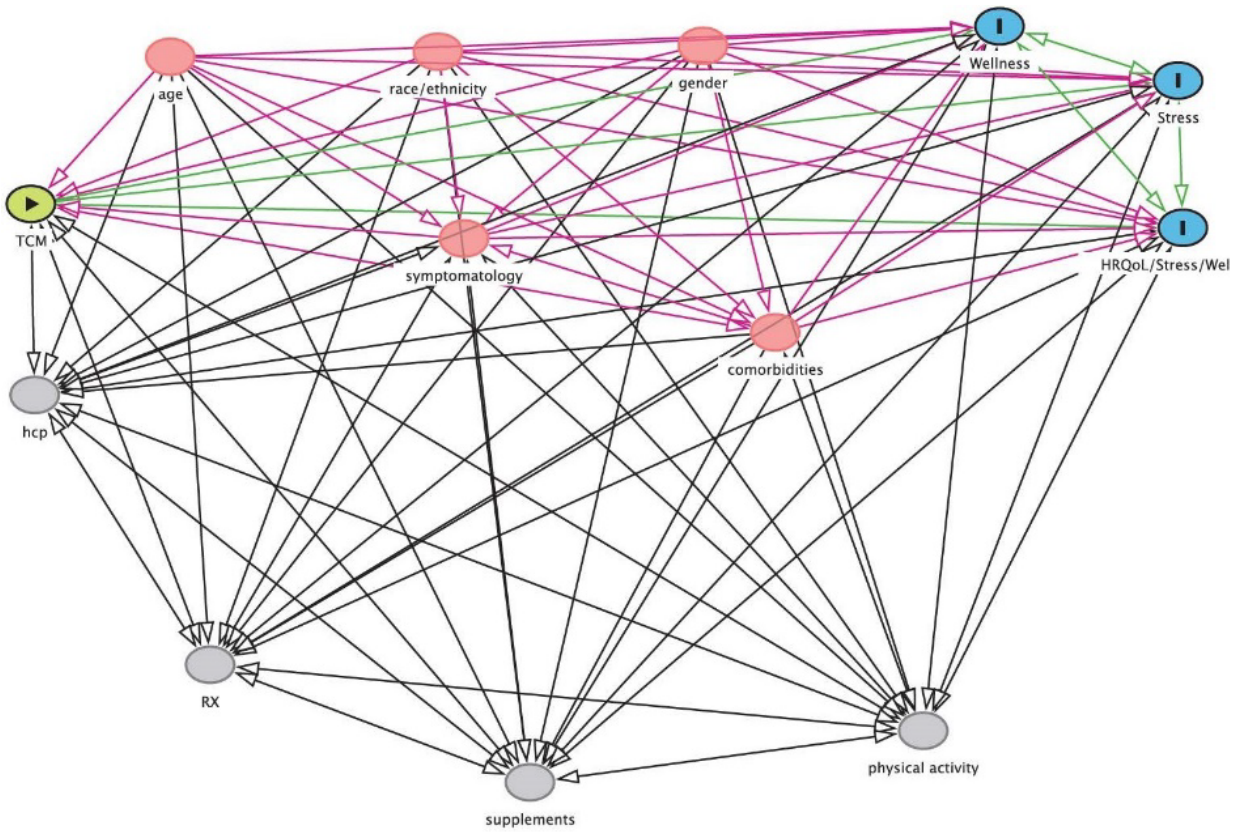


Figure 1. Relationship model

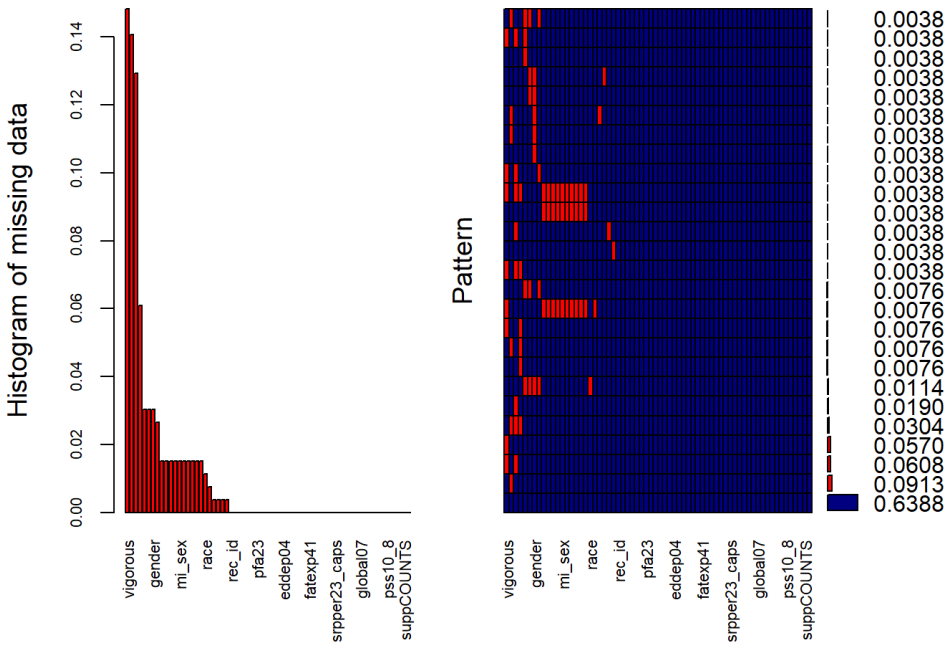


Figure 2. Pattern of missingness

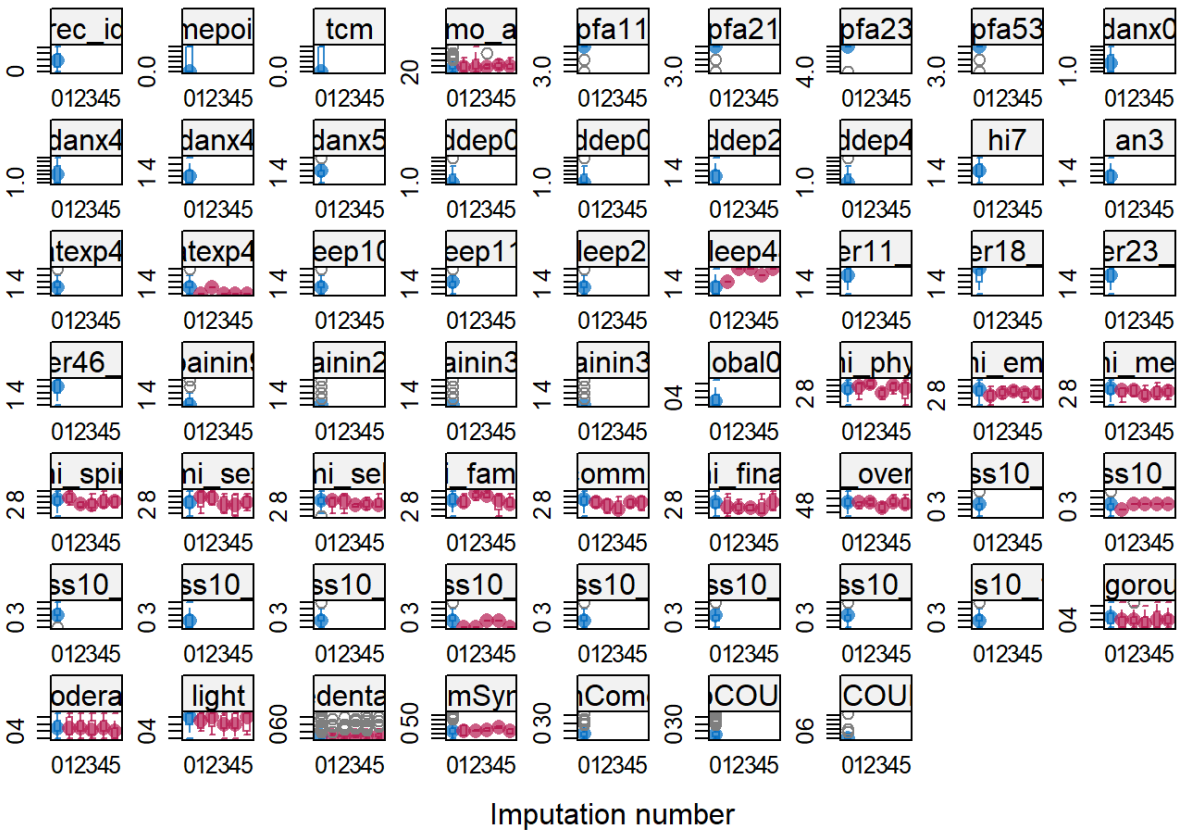


Figure 3. Imputed observations for five datasets with 40 iterations

Table 1. Characteristics of INCLD Health participant subgroups based on TCM use.

| | Baseline | | 6 months | |
|---|---|---|---|---|
| | TCM group (n = 48) | non-TCM group (n = 125) | TCM group (n = 31) | non-TCM group (n = 59) |
| Age (mean, ±sd) | 29.7 (6.8) | 30.7 (6.8) | 29.0 (5.1) | 30.5 (3.4) |
| *missing* (n,%) | 2 (4.2%) | 4 (3.2%) | 0 (0.0%) | 2 (3.4%) |
| Sex Assigned at Birth (n, %) | | | | |
| Female | 41 (85.4%) | 103 (82.4%) | 30 (96.8%) | 47 (79.7%) |
| Male | 5 (10.4%) | 18 (14.4%) | 1 (3.2%) | 10 (16.9%) |
| *missing* (n,%) | 2 (4.2%) | 4 (3.2%) | 0 (0.0%) | 2 (3.4%) |
| Gender (n, %) | | | | |
| Female | 38 (79.2%) | 99 (79.2%) | 28 (90.3%) | 45 (76.3%) |
| Male | 5 (10.4%) | 18 (14.4%) | 1 (3.2%) | 10 (16.9%) |
| Non-binary | 2 (4.2%) | 3 (2.4%) | 2 (6.5%) | 2 (3.4%) |
| Not disclosed | 1 (2.1%) | 1 (0.8%) | 0 (0.0%) | 0 (0.0%) |
| *missing* (n,%) | 2 (4.2%) | 4 (3.2%) | 0 (0.0%) | 2 (3.4%) |
| Race (n, %) | | | | |
| White/Caucasian | 37 (77.1%) | 96 (76.8%) | 26 (83.9%) | 42 (71.2%) |
| Non-White | 10 (20.8%)* | 29 (23.2%)* | 5(16.1%)* | 15 (25.4%)* |
| *missing* (n,%) | 1 (2.1%) | 0 (0.0%) | 0 (0.0%) | 2 (3.4) |
| Ethnicity (n, %) | | | | |
| Hispanic or Latino/Latina/Latinx | 40 (83.3%) | 106 (84.8%) | 27 (87.1%) | 49 (83.1%) |
| Not Hispanic or Latino/Latina/Latinx | 5 (10.4%) | 12 (9.6%) | 2 (6.5%) | 6 (10.2%) |
| Unknown or not disclosed | 1 (2.1%) | 4 (3.2%) | 2 (6.5%) | 2 (3.4%) |
| *missing* (n,%) | 2 (4.2%) | 3 (2.4%) | 0 (0.0%) | 2 (3.4%) |
| Physician use (n, %) | | | | |
| Yes | 28 (58.3%) | 85 (68.0%) | 21 (67.7%) | 38 (64.4%) |
| Never | 20 (41.7%) | 40 (32.0%) | 10 (32.3%) | 21 (35.6%) |
| Physical activity** (mean, ±sd) | | | | |
| hours sedentary daily | 10.9 (12.9) | 12.0 (13.1) | 11.3 (13.3) | 8.3 (6.0) |
| days of light activity | 4.8 (2.2) | 5.3 (2.1) | 5.0 (2.1) | 5.4 (1.8) |
| days of moderate activity | 3.1 (2.0) | 3.0 (2.0) | 3.2 (1.8) | 3.3 (2.2) |
| days of vigorous activity | 2.4 (1.9) | 2.6 (1.9) | 2.6 (1.8) | 3.3 (1.9) |
| *missing* (n,%) | 25 (52.1%) | 82 (65.6%) | 8 (25.8%) | 11 (18.6%) |
| Medical symptomatology (mean, ±sd) | 20.3 (11.2) | 17.1 (9.3) | 20.8 (11.3) | 14.2 (8.5) |
| *missing* (n,%) | 0 (0.0%) | 1 (0.8%) | 0 (0.0%) | 1 (1.7%) |
| Symptom Monitoring Questionnaire (n,%) ** | | | | |
| eyes, ears, nose, and throat | 40 (83.3%) | 104 (83.2%) | 27 (87.1%) | 46 (78.0%) |
| gastrointestinal including mouth | 41 (85.4%) | 103 (82.4%) | 28 (90.3%) | 43 (72.9%) |
| neuromuscular | 45 (93.8%) | 99 (79.2%) | 27 (87.1%) | 40 (67.8%) |
| psychological/mental health | 42 (87.5%) | 113 (90.4%) | 28 (90.3%) | 52 (88.1%) |
| cardiopulmonary | 28 (58.3%) | 40 (32.0%) | 18 (58.1%) | 15 (25.4%) |
| skin | 34 (70.8%) | 92 (73.6%) | 24 (77.4%) | 45 (76.3%) |
| genitourinary | 37 (77.1%) | 99 (79.2%) | 27 (87.1%) | 43 (72.9%) |
| constitutional | 26 (54.2%) | 51 (40.8%) | 12 (38.7%) | 22 (37.3%) |
| other | 10 (20.8%) | 14 (11.2%) | 7 (22.6%) | 4 (6.8%) |
| *missing* (n,%) † | 1 (2.1%) | 9 (7.2%) | 8 (25.8%) | 0 (0.0%) |
| Supplement use (mean, ±sd) | 7.5 (5.9) | 5.1 (4.9) | 9.9 (6.5) | 8.1 (6.7) |
| Medication use** (mean, ±sd) | 0.6 (1.0) | 0.7 (1.3) | 0.6 (0.9) | 1.0 (1.7) |
| Medications (n,%) | | | | |
| antimigraine | 0 (0.0%) | 1 (0.8%) | 0 (0.0%) | 1 (1.7%) |
| cardiovascular | 1 (2.1%) | 5 (4.0%) | 1 (3.2%) | 3 (5.1%) |
| contraceptives | 2 (4.2%) | 11 (8.8%) | 1 (3.2%) | 4 (6.8%) |
| endocrine | 4 (8.3%) | 9 (7.2%) | 3 (9.7%) | 6 (10.2%) |
| gastrointestinal | 1 (2.1%) | 1 (0.8%) | 0 (0.0%) | 1 (1.7%) |
| hormones | 2 (4.2%) | 2 (1.6%) | 0 (0.0%) | 3 (5.1%) |
| immune system | 0 (0.0%) | 2 (1.6%) | 0 (0.0%) | 2 (3.4%) |
| infection | 2 (4.2%) | 7 (5.6%) | 2 (6.5%) | 5 (8.5%) |
| muscle relaxers | 0 (0.0%) | 1 (0.8%) | 0 (0.0%) | 1 (1.7%) |
| neurological | 4 (8.3%) | 9 (7.2%) | 3 (9.7%) | 5 (8.5%) |
| NSAID | 4 (8.3%) | 6 (4.8%) | 3 (9.7%) | 5 (8.5%) |

| | | | | |
|---|---|---|---|---|
| pain | 1 (2.1%) | 2 (1.6%) | 0 (0.0%) | 3 (5.1%) |
| psychological or psychiatric | 4 (8.3%) | 10 (8.0%) | 2 (6.5%) | 5 (8.5%) |
| respiratory | 1 (2.1%) | 2 (1.6) | 0 (0.0%) | 0 (0.0%) |
| topical steroids | 0 (0.0%) | 1 (0.8%) | 0 (0.0%) | 1 (1.7%) |
| antihistamines | 1 (2.1%) | 2 (1.6%) | 1 (3.2%) | 3 (5.1%) |
| Comorbidities (mean, ±sd) | 7.3 (5.0) | 5.7 (4.5) | 7.5 (5.2) | 6.6 (5.4) |
| Health History Questionnaire (n,%) ** | | | | |
| cardiovascular | 8 (16.7%) | 13 (10.4%) | 10 (32.3%) | 8 (13.6%) |
| respiratory | 4 (8.3%) | 13 (10.4%) | 3 (9.7%) | 4 (6.8%) |
| dermatologic | 20 (41.7%) | 41 (32.8%) | 5 (16.1%) | 17 (28.8%) |
| gastrointestinal | 14 (29.2%) | 18 (14.4%) | 7 (22.6%) | 11 (18.6%) |
| neuromuscular | 18 (37.5%) | 37 (29.6%) | 14 (45.2%) | 21 (35.6%) |
| endocrine | 6 (12.5%) | 7 (5.6%) | 4 (12.9%) | 4 (6.8%) |
| genitourinary | 11 (22.9%) | 16 (12.8%) | 8 (25.8%) | 15 (25.4%) |
| cancer | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| psychiatric | 14 (29.2%) | 41 (32.8%) | 11 (35.5%) | 20 (33.9%) |
| other | 10 (20.8%) | 14 (11.2%) | 7 (22.6%) | 4 (6.8%) |
| *missing* (n %) † | 3 (6.3%) | 7 (5.6%) | 2 (6.5%) | 9 (15.3%) |
| PROMIS-29 v.2.0 (mean, ±sd) | | | | |
| physical function total | 19.4 (1.2) | 19.9 (0.6) | 19.6 (0.9) | 19.8 (0.6) |
| chores | 4.9 (0.4) | 4.9 (0.2) | 4.8 (0.5) | 4.9 (0.3) |
| navigate stairs | 4.7 (0.5) | 5.0 (0.2) | 4.8 (0.5) | 4.9 (0.3) |
| walk for 15 minutes or more | 4.9 (0.3) | 5.0 (0.1) | 5.0 (0.2) | 5.0 (0.1) |
| errands and ship | 4.9 (0.2) | 5.0 (0.2) | 5.0 (0.0) | 5.0 (0.1) |
| anxiety total | 9.0 (3.5) | 9.0 (3.1) | 8.8 (2.7) | 8.7 (3.4) |
| felt fearful | 2.0 (0.9) | 2.1 (1.0) | 1.9 (0.9) | 2.0 (1.0) |
| focus on anything other than anxiety | 2.2 (1.0) | 2.0 (1.0) | 2.1 (0.8) | 2.0 (1.0) |
| overwhelming worry | 2.3 (1.0) | 2.2 (1.0) | 2.1 (0.8) | 2.2 (1.1) |
| uneasy | 2.5 (1.0) | 2.6 (0.9) | 2.7 (1.0) | 2.5 (1.0) |
| depression total | 6.7 (3.2) | 6.7 (2.8) | 6.2 (2.5) | 6.5 (2.9) |
| felt worthless | 1.5 (0.9) | 1.5 (0.8) | 1.5 (0.7) | 1.4 (0.8) |
| felt helpless | 1.5 (0.8) | 1.6 (0.8) | 1.4 (0.7) | 1.6 (0.8) |
| felt depressed | 2.0 (1.1) | 2.0 (1.0) | 1.9 (0.9) | 1.8 (0.9) |
| felt hopeless | 1.7 (1.0) | 1.6 (0.8) | 1.5 (0.7) | 1.6 (0.9) |
| fatigue total | 11.0 (4.2) | 10.0 (3.6) | 10.2 (4.1) | 8.8 (3.3) |
| feel fatigued | 3.1 (1.1) | 2.8 (1.0) | 2.8 (1.1) | 2.5 (1.1) |
| trouble starting things | 2.6 (1.2) | 2.2 (1.1) | 2.4 (1.3) | 1.9 (0.9) |
| feel fun-down on average | 2.7 (1.2) | 2.5 (1.0) | 2.5 (1.0) | 2.2 (0.9) |
| feel fatigued on average | 2.6 (1.1) | 2.5 (0.9) | 2.5 (1.1) | 2.3 (1.0) |
| *missing* (n %) | 0 (0.0%) | 1 (0.8%) | 0 (0.0%) | 0 (0.0%) |
| sleep disturbance total | 9.5 (3.2) | 9.6 (3.3) | 10.5 (3.2) | 8.9 (2.7) |
| sleep quality | 2.5 (0.8) | 2.6 (1.0) | 2.7 (0.8) | 2.4 (0.9) |
| sleep refreshing | 2.7 (1.0) | 2.7 (1.0) | 3.0 (1.0) | 2.6 (0.8) |
| sleep problems | 2.4 (1.0) | 2.2 (1.1) | 2.7 (1.1) | 2.2 (1.0) |
| difficulty falling asleep | 2.0 (1.1) | 2.1 (1.1) | 2.1 (1.0) | 1.8 (1.0) |
| *missing* (n %) | 1 (2.1%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| social roles and activities total | 15.2 (3.6) | 15.8 (3.5) | 15.8 (4.2) | 16.3 (3.7) |
| regular leisure activities with others | 3.9 (1.0) | 4.0 (1.0) | 4.1 (1.2) | 4.2 (1.1) |
| difficulty with family activities | 4.0 (1.1) | 4.2 (1.0) | 4.2 (1.3) | 4.1 (1.1) |
| difficulty with usual work | 3.7 (1.0) | 3.9 (1.0) | 3.7 (1.1) | 3.9 (1.0) |
| difficulty with activities with friends | 3.6 (1.1) | 3.8 (1.1) | 3.9 (1.2) | 4.1 (1.0) |
| pain interference total | 6.5 (3.4) | 5.2 (2.5) | 5.2 (1.5) | 5.1 (2.2) |
| with day to day | 2.0 (1.1) | 1.5 (0.8) | 1.5 (0.6) | 1.4 (0.8) |
| work around home | 1.5 (0.9) | 1.2 (0.7) | 1.3 (0.5) | 1.3 (0.6) |
| social activities | 1.5 (0.9) | 1.2 (0.6) | 1.2 (0.4) | 1.2 (0.6) |
| household chores | 1.5 (0.9) | 1.2 (0.6) | 1.3 (0.5) | 1.2 (0.5) |
| global pain intensity | 2.4 (1.9) | 1.6 (1.6) | 2.0 (1.8) | 1.5 (1.9) |
| Perceived Stress Scale (mean, ±sd) | | | | |
| Overall | 14.0 (6.3) | 16.3 (6.0) | 14.8 (6.0) | 15.6 (7.2) |
| unexpected events | 1.4 (0.7) | 1.8 (0.9) | 1.8 (0.7) | 1.8 (0.9) |
| unable to exert control over things | 1.4 (1.0) | 1.6 (1.0) | 1.6 (1.0) | 1.8 (1.1) |
| nervous and stressed | 2.4 (0.9) | 2.7 (0.9) | 2.5 (1.1) | 2.4 (0.8) |

| | | | | |
|---|---|---|---|---|
| confidence | 0.9 (0.8) | 1.1 (0.8) | 1.0 (0.9) | 0.9 (0.9) |
| going as planned | 1.1 (0.9) | 1.4 (0.8) | 1.3 (0.7) | 1.5 (1.0) |
| cannot cope | 1.4 (1.2) | 1.7 (1.0) | 1.4 (1.3) | 1.4 (1.2) |
| control irritations | 1.1 (0.8) | 1.2 (0.9) | 1.1 (0.9) | 1.1 (1.0) |
| on top of things | 1.5 (1.0) | 1.7 (0.8) | 1.4 (0.9) | 1.5 (1.0) |
| angered | 1.6 (1.0) | 1.6 (1.0) | 1.5 (1.0) | 1.7 (1.2) |
| overwhelming difficulties | 1.1 (1.0) | 1.4 (1.1) | 1.2 (1.1) | 1.4 (1.0) |
| *missing* (n %) | 1 (2.1%) | 1 (0.8%) | 0 (0.0%) | 0 (0.0%) |
| Wellness Inventory (n, mean, ±sd) | | | | |
| physical | 6.9 (1.9) | 6.6 (2.1) | 6.7 (1.9) | 7.3 (1.9) |
| emotional | 6.8 (1.5) | 6.4 (1.8) | 6.7 (1.9) | 6.6 (1.8) |
| mental | 7.1 (1.8) | 6.6 (1.9) | 6.6 (1.9) | 6.7 (2.0) |
| spiritual | 7.1 (2.0) | 6.4 (2.1) | 6.7 (1.9) | 6.4 (2.1) |
| sexual | 6.2 (2.2) | 5.8 (2.5) | 5.5 (2.3) | 5.6 (2.8) |
| personal | 7.3 (1.7) | 6.9 (2.0) | 7.2 (1.7) | 6.8 (2.2) |
| family | 7.1 (2.0) | 7.1 (2.2) | 7.2 (2.0) | 7.2 (2.0) |
| social | 7.2 (1.8) | 6.3 (2.3) | 6.4 (1.8) | 6.0 (2.5) |
| financial | 5.7 (2.1) | 5.6 (2.2) | 6.2 (2.3) | 5.6 (2.3) |
| overall | 7.1 (1.5) | 6.9 (1.5) | 7.2 (1.6) | 7.1 (1.5) |
| *missing* (n %) | 0 (0.0%) | 20 (16%) | 0 (0.0%) | 20 (33.9%) |

Abbreviations. TCM = use of acupuncture and herbs together. Non-TCM users no use of acupuncture and herbs together, but can include use of either modality on its own.
* Non-White race category groups all non-White categories, which are also displayed as n, %
** n = n of the total individuals reporting the presence of a medical comorbidity, medication use, or supplement use within each study group at baseline and in the six-month follow-up timepoint and one individual may endorse more than one category.
† Missingness reported in these categories are observations missing in total across all categories, and reflects that one individual may endorse more than one category.

Table 2. Regression estimates for Health-Related Quality of Life outcomes for TCM users and non-TCM users.

| | Baseline | | | | 6 months | | | |
|---|---|---|---|---|---|---|---|---|
| | β TCM | SE | 95% CI | *p* | β TCM | SE | 95% CI | *p* |
| PROMIS-29 * | | | | | | | | |
| physical function | -0.19 | 0.11 | -0.41, 0.03 | 0.099 | -0.13 | 0.12 | -0.37, 0.11 | 0.289 |
| anxiety | -0.51 | 0.44 | -1.37, 0.35 | 0.250 | -0.61 | 0.48 | -1.6, 0.33 | 0.203 |
| depression | -0.42 | 0.45 | -1.29, 0.46 | 0.351 | -0.66 | 0.46 | -1.57, 0.24 | 0.160 |
| fatigue | 0.31 | 0.56 | -0.80, 1.41 | 0.587 | -0.59 | 0.59 | -1.76, 0.57 | 0.318 |
| sleep disturbance | 0.06 | 0.48 | -0.88, 1.01 | 0.896 | 0.07 | 0.55 | -1.02, 1.15 | 0.906 |
| social roles and activities | 0.13 | 0.51 | -0.88, 1.13 | 0.804 | 0.38 | 0.62 | -0.85, 1.60 | 0.546 |
| pain interference | 0.41 | 0.36 | -0.29, 1.12 | 0.253 | 0.00 | 0.35 | -0.68, 0.68 | 0.962 |
| global pain intensity | 0.35 | 0.24 | -0.12, 0.83 | 0.148 | 0.21 | 0.28 | -0.34, 0.76 | 0.454 |
| Perceived Stress Scale * | -2.73 | 0.93 | -4.58, -0.90 | **0.004** | -2.75 | 1.00 | -4.71, -0.79 | **0.006** |
| Wellness Inventory * | | | | | | | | |
| physical | 0.30 | 0.27 | -0.17, 0.88 | 0.276 | 0.67 | 0.33 | 0.03, 1.32 | **0.043** |
| emotional | 0.40 | 0.23 | -0.24, 0.83 | 0.079 | 0.44 | 0.28 | -0.0, 0.98 | 0.113 |
| mental | 0.55 | 0.27 | 0.03, 1.07 | **0.041** | 0.41 | 0.33 | -0.24, 1.05 | 0.219 |
| spiritual | 0.75 | 0.30 | 0.17, 1.32 | **0.014** | 0.61 | 0.36 | -0.10, 1.32 | 0.092 |
| sexual | 0.40 | 0.37 | -0.30, 1.16 | 0.276 | 0.01 | 0.42 | -0.82, 0.84 | 0.946 |
| personal | 0.62 | 0.26 | 0.09, 1.14 | **0.018** | 0.41 | 0.31 | -0.19, 1.01 | 0.178 |
| family | 0.31 | 0.32 | -0.29, 1.01 | 0.337 | 0.33 | 0.34 | -0.33, 1.00 | 0.328 |
| social | 0.95 | 0.28 | 0.40, 1.50 | **<.001** | 0.35 | 0.34 | -0.31, 1.01 | 0.297 |
| financial | 0.45 | 0.33 | -0.20, 1.10 | 0.172 | 0.68 | 0.37 | -0.05, 1.42 | 0.070 |
| overall | 0.49 | 0.21 | 0.08, 0.90 | **0.019** | 0.53 | 0.24 | 0.06, 0.99 | **0.026** |

* covariates included age, race, ethnicity, medical symptomatology, medical comorbidities

Table 3. Odds ratio of using TCM by medication or comorbidities.

| | Baseline | | | | 6 months | | | |
|---|---|---|---|---|---|---|---|---|
| | OR | SE | 95% CI | *p* | OR | SE | 95% CI | *p* |
| medication use * | 0.76 | 0.16 | 0.56, 1.03 | 0.082 | 1.19 | 0.26 | 0.71, 1.97 | 0.508 |
| comorbidities ** | 0.98 | 0.05 | 0.90, 1.08 | 0.744 | 1.51 | 0.22 | 0.99, 2.3 | 0.060 |

* covariates included age, race, ethnicity, medical symptomatology, medical comorbidities
** covariates included age, race, ethnicity, medical symptomatology

Table 4. Sensitivity analyses for changes in HRQoL, medication use, and reported comorbidities with TCM use from baseline through six months.

| | TCM (β/OR) | SE | 95% CI | *p* |
|---|---|---|---|---|
| PROMIS-29 * (β) | | | | |
| physical function | 0.23 | 0.16 | -0.09, 0.56 | 0.154 |
| anxiety | -0.28 | 0.72 | -1.69, 1.13 | 0.698 |
| depression | -0.54 | 0.61 | -1.73, 0.65 | 0.377 |
| fatigue | -0.25 | 0.78 | -1.80, 1.29 | 0.747 |
| sleep disturbance | 1.52 | 0.74 | -0.07, 2.96 | **0.040** |
| social roles and activities | 0.73 | 0.87 | -0.97, 2.44 | 0.399 |
| pain interference | -1.46 | 0.53 | -2.50, -0.42 | **0.006** |
| global pain intensity | -0.43 | 0.42 | -1.26, 0.40 | 0.308 |
| Perceived Stress Scale *(β) | 0.53 | 1.34 | -2.09, 3.16 | 0.691 |
| Wellness Inventory *(β) | | | | |
| physical | -0.67 | 0.42 | -1.50, 0.16 | 0.114 |
| emotional | -0.36 | 0.44 | -1.22, 0.49 | 0.407 |
| mental | -0.34 | 0.46 | -1.26, 0.57 | 0.459 |
| spiritual | -0.11 | 0.49 | -1.07, 0.86 | 0.830 |
| sexual | -0.18 | 0.52 | -1.21, 0.85 | 0.736 |
| personal | 0.29 | 0.48 | -0.66, 1.23 | 0.552 |
| family | 0.31 | 0.50 | -0.66, 1.28 | 0.528 |
| social | -0.37 | 0.49 | -1.32, 0.59 | 0.528 |
| financial | 0.44 | 0.55 | -0.63, 1.51 | 0.421 |
| overall | 0.13 | 0.35 | -0.56, 0.83 | 0.703 |
| Medications * (OR) | 1.03 | 0.28 | 0.45, 1.36 | 0.382 |
| Comorbidities ** (OR) | 0.97 | 0.07 | 0.88, 1.07 | 0.547 |

* covariates included age, race, ethnicity, medical symptomatology, medical comorbidities
** covariates included age, race, ethnicity, medical symptomatology