DEPARTMENT OF HUMAN SERVICES

Is Acupuncture associated with Reduced Opiate Use?

A review of Minnesota Medicaid claims

February 15, 2018

Minnesota Department of Human Services

Health Care Research and Quality, Health Care Administration

Office of the Medical Director, Health Care Administration

PO Box 64983

St. Paul, MN 55164-0983

(Phone) (651) 431-2836

sara.lent@state.mn.us

mn.gov/dhs

 For accessible formats of this publication or assistance with additional equal access to human services, write to dhs.info@state.mn.us, call 651-431-2400, or use your preferred relay service. (ADA1 [7-16])

TTY users can call through Minnesota Relay at (800) 627-3529.

For Speech-to-Speech, call (877) 627-3848.

For other information on disability rights and protections, contact the agency's ADA coordinator.

As requested by Minnesota Statute 3.197: This report cost approximately $ to prepare, including staff time, printing and mailing expenses.

Upon request, this material will be made available in an alternative format such as large print, Braille or audio recording. Printed on recycled paper.

Contents

Executive Summary

This study utilized a statistical technique called "Propensity Score Matching" to compare acupuncture users with a matched control group of non-acupuncture users to evaluate whether there were differences in their later use of opioids. Propensity Score Matching allows the statistician to obtain a control group of subjects that are similar to those who have been treated with an intervention (i.e., acupuncture) across a set of variables which may be correlated with both the treatment assignment and any outcomes of interest (i.e., opioid use). In the first stage of the analysis, a statistical model is used to predict assignment into the treatment category based on variables of the researchers' choosing. Then, the "treated" individuals are matched to "untreated" individuals who have the same predicted probability of having received the treatment. This method reduces the bias introduced by potentially confounding variables.

Researchers analyzed Medicaid medical claims and enrollment data for State Fiscal Year 2017. The sample frame was limited to individuals who received a diagnosis that would have made them eligible to receive acupuncture, were age 18-64, and were continuously enrolled in Minnesota Health Care Programs during SFY 2017. For the strongest possible test of whether acupuncture use can reduce reliance on opiates, researchers further restricted the sample to only individuals who did not receive any opioids during the first half of SFY 2017, and measured acupuncture use (at least six treatments) in the first half of SFY 2017, with the primary outcome of interest measured as opioid use during the second half of SFY 2017.

Therefore, this research design examines whether previously opioid-naïve acupuncture users are more or less likely to subsequently use opioids than are similar individuals who did not receive acupuncture services.

Analysis indicated that although the matching routine was moderately successful at finding a set of non-users that statistically resembled the acupuncture users, the variables chosen to predict acupuncture use do not explain much of the variation in acupuncture use. Thus there may be unmeasured variables influencing both acupuncture use and opioid use that were not included in the statistical model or are not able to be measured using DHS' claims data. This means that acupuncture users may be different from the comparison group in important ways that we were unable to adjust for and which may have influenced the results.

Our analysis suggests that there is no difference in the use of opioids by populations of Medicaid enrollees who used acupuncture, and populations who did not. Across three measures of opioid use (any use of opioids, amount of opioids in Morphine Milligram Equivalents, and amount of opioids in total days' supply), acupuncture users had slightly higher opioid use than did non-users. However,

Is Acupuncture associated with Reduced Opiate Use?

these differences failed to reach conventional levels of statistical significance. This study used a sophisticated methodology but may have lacked some important indicators which could have prevented us from identifying a truly comparable comparison group. Given our results, we cannot conclude whether acupuncture users subsequently use opioids at higher or lower rates than non-users.

Background

During the 2017 legislative session, the Minnesota legislature directed the Minnesota Department of Human Services (DHS) to conduct a study on opioid and acupuncture use (Laws of Minn. 2017, 1st Spec. Sess., Chap. 6, Art. 1, Sec. 4, Subd. 53):).

> Sec. 63. **OPIOID USE AND ACUPUNCTURE STUDY.**
>
>   (a) The commissioner of human services, within the limits of available appropriations, shall study the use of opiates for the treatment of chronic pain conditions when acupuncture services are also part of the treatment for chronic pain as compared to opiate use among medical assistance recipients who are not receiving acupuncture. In comparing the sample groups, the commissioner shall look at each group's opiate use and other services as identified by the commissioner.
>
>   (b) The aggregate findings of the study shall be submitted by the commissioner to the chairs and ranking minority members of the legislative committees with jurisdiction over health and human services policy and finance by February 15, 2018. The report shall not contain or disclose any patient identifying data.

DHS has completed a thorough investigation into this topic and describes the findings in this report.

Evidence-based research on the effectiveness of acupuncture in treating chronic pain

Clinical research finds some positive effects of acupuncture on patients with chronic pain

The effectiveness of acupuncture in addressing chronic pain has been studied in numerous clinical trials. The findings are not consistent, however, and when acupuncture is found to be effective, the effect tends to be mild or moderate in size.

Prospective research design (randomly assigning patients to a treatment or control group before the intervention) is a challenging issue in this area of clinical research due to the need to ensure that patients do not know (are blinded as to) whether they are in the treatment or control group. To do this, researchers sometimes provide real acupuncture to the treatment group and 'sham' acupuncture

Is Acupuncture associated with Reduced Opiate Use?

on the control group so neither group knows which they are receiving. Sham acupuncture refers to superficial needling at acupuncture or non-acupuncture points, or non-penetrating pressure at acupuncture points.

In published studies of chronic low back pain, patients do better with acupuncture than with usual care, but surprisingly, they do just as well with acupuncture as with sham acupuncture. According to public testimony provided during 2015 Health Services Advisory Council meetings, this may be due in part to study methodology.[1] In some sham studies, the "sham" arm is not really a placebo; some of the so-called sham studies were actually comparing acupressure to acupuncture, rather than placebo treatment to acupuncture. The Institute for Clinical and Economic Review (2017) reviewed studies on acupuncture and low back pain and found small to moderate improvements in function and pain, compared with people who received usual care. However, people receiving sham acupuncture showed the same level of improvement as those receiving acupuncture:

> The evidence for the effectiveness of acupuncture for the treatment of chronic low back pain is complex. The majority of trials and meta-analyses confirm small to moderate improvements in function and pain compared with usual care immediately following the completion of therapy. However, the differences in outcomes are smaller and often non-significant clinically when compared to sham acupuncture, suggesting that much of the benefit may be from the placebo effect. For example, the largest and longest randomized trial reported that 60% of patients treated with individualized acupuncture, standardized acupuncture, or sham acupuncture had clinically meaningful improvements in function compared with only 39% of patients in the usual care group(p<0.001) (p. ES2, Institute for Clinical and Economic Review, 2017).

The Institute finds similar results for acupuncture in chronic neck pain. There were small to moderate improvements in function and pain immediately following the completion of therapy, compared with patients who received usual care.

The Agency for Healthcare Research and Quality (2016), in a review of non-invasive treatments for low back pain had a more positive conclusion regarding acupuncture. They concluded that there *is* reduced pain intensity immediately after a completed course of acupuncture, as well as 12 weeks following treatment, compared with sham acupuncture. They found no differences in function, when comparing acupuncture with sham acupuncture.

---

[1] In 2015 DHS' Health Services Advisory Council recommended that the Commissioner of Human Services expand the covered indications for acupuncture treatment to include pain (acute and post-acute, because acupuncture was already covered for chronic pain), Insomnia, smoking cessation, nausea and vomiting (post-operative, pregnancy, cancer care), restless legs, depression, schizophrenia, anxiety, post-traumatic stress syndrome (PTSD), xerostomia (Sjogren's syndrome, radiation therapy) and menstrual disorders. Minutes of the relevant meetings (April, June and September 2015) are available on HSAC's webpage.

Is Acupuncture associated with Reduced Opiate Use?

The clinical trials indicate that patients experiencing acupuncture have reduced pain and possibly better functioning, right after treatment and maybe longer, compared with people who receive usual care. However, this positive effect may be due to the placebo effect, or it may be due to something else that is present in the acupuncture service (e.g. talking to a clinician), as the positive effect is often also present for sham acupuncture.

Acupuncture and opioid use in a Medicaid population

DHS' investigation was limited to a retrospective analysis of Medicaid claims. This type of analysis can reveal a correlation between prior interventions (acupuncture) and later utilization practices (opioid use). Our available claims data does not directly allow for conclusions about causation.

Clinical trials, such as those described above, include randomized treatment and control groups and therefore provide the most reliable, valid conclusions on the impact of acupuncture on pain, functioning, and opiate use. DHS and other payers do not generally conduct clinical trials such as these, as that would require clinicians with a clinical caseload. To help prepare for this study, DHS reviewed a study about acupuncture among Medicaid recipients conducted by the state of Vermont. The results of their study are described below.

In a pre- post design study of Vermont Medicaid recipients, the State of Vermont (2017) found that after being offered acupuncture, (they received an average of 8 sessions per patient in the 60 day period), recipients reported improvements in areas such as pain intensity, pain interference, physical function, and sleep disturbance. Acupuncture recipients also reported decreased medication use (by 57%) and for those who had previously used opiates, there was a 32% reduction in their opiate use. In their review of the medical claims of 109 recipients who received at least four acupuncture treatments, they found a non-statistically significant drop in opiate pharmacy costs.

The Vermont study tells us that acupuncture recipients showed improvement in their level of pain, physical functioning and sleep. However, the pre-post methodology limits causal inferences such that it is impossible to know *which intervention, if any,* led to the improvement. For example, these recipients had greater (though again, not statistically significant) physical therapy and pharmacy costs in the post-test time period compared with the pre-test. It may be the acupuncture, the physical therapy, the non-opiate pharmaceuticals, or something else entirely that is responsible for the improvements. Additionally, this study had no comparison group to contrast with those who received acupuncture services.

Is Acupuncture associated with Reduced Opiate Use?

Is Acupuncture Associated with Reduced Opiate Use? – A review of Minnesota Medicaid Claims

Because of these limitations of doing a pre-post design, and because the legislative mandate specified a comparison group, DHS decided to compare acupuncture users' use of opiates to a *comparison group* of non-acupuncture users' use of opiates. We begin this investigation by reviewing the Medicaid enrollees who use acupuncture, and any differences they may have with enrollees who don't use acupuncture. All individuals had a diagnosis that would have made them eligible to receive acupuncture, were age 18-64 as of Dec. 31, 2016, were continuously enrolled in Minnesota Health Care Programs (MHCP) during State Fiscal Year (SFY) 2017, and received no opioid prescriptions during the first half of SFY 2017 (see the "Identifying the Sample Frame" section below for explanation of these criteria). These comparisons will inform us on whether acupuncture users resemble the non-users or if statistical adjustments will be needed to ensure that they do.

Minnesota Medicaid enrollees who use acupuncture differ in important ways from those who don't use acupuncture

Table 1 shows that there are many differences between these populations. In fact, with the exception of the prevalence of Serious Mental Illness (SMI), the differences between the acupuncture user group and the non-user group are all highly statistically significant and in many cases quite large substantively.[2] Acupuncture users are older on average, more likely to live in the 7-county metro area than are non-users (73.1% among acupuncture users vs. 53.0% among non-users), and much more likely to have used any chiropractic services during the treatment period (52.9% among acupuncture users; 12.5% among non-users). The average acupuncture user also had a much lengthier claims history (average 23.7) than non-users (average 7.2). Acupuncture users are also more likely to be female, Black or Asian/Pacific Islander, immigrants, and to speak Somali or Hmong as their primary language.[3] Conversely, acupuncture users were significantly less likely to have had a Substance Use Disorder diagnosis during the treatment period.

---

[2] A standard of p < .05 was used to determine statistically significant differences, consistent with conventional statistical practices.

[3] Although all languages and all races were included in the analyses presented in this study, only Hmong/Somali and Asian/Black are highlighted as the acupuncture population showed higher proportions of these groups.

Table 1 – Baseline Characteristics of Acupuncture Users and Non-Users^

	Treatment (6+ Uses of Acupuncture)	No Acupuncture Use	
	N (%)	N (%)	P-Value
Total Enrollees	**1,498**	**205,891**	
Age in years (Mean ± S.D.)	44.4 ± 12.0	40.4 ± 13.6	< 0.0001*
Female	1,114 (74.4)	127,097 (61.7)	< 0.0001*
Asian/Pacific Islander Race	187 (12.5)	10,707 (5.2)	< 0.0001*
Black/African-American Race	348 (23.2)	30,966 (15.0)	< 0.0001*
Primary Language Hmong	106 (7.1)	2,286 (1.1)	< 0.0001*
Primary Language Somalian	195 (13.0)	4,688 (2.3)	< 0.0001*
Immigrant	223 (14.9)	15,870 (7.7)	< 0.0001*
Resident of 7-county Metro Area	1,095 (73.1)	109,140 (53.0)	< 0.0001*
Substance Use Disorder	75 (5.0)	27,350 (13.3)	< 0.0001*
Serious Mental Illness	529 (35.3)	71,303 (34.6)	0.5803
Serious and Persistent Mental Illness	208 (13.9)	15,357 (7.5)	< 0.0001*
Used Chiropractic Services	793 (52.9)	25,796 (12.5)	< 0.0001*
Acupuncturists in County per 100k recipients (Mean ± S.D.)	34.9 ± 10.0	28.1 ± 14.0	< 0.0001*
Count of Claims w/Acupuncture-eligible Dx (Mean ± S.D.)	23.7 ± 20.4	7.2 ± 12.8	< 0.0001*

^All individuals were aged 18-64 as of Dec. 31, 2016, continuously enrolled in MHCP for State Fiscal Year 2017, and had no prescriptions for an opioid medication during the first half of SFY 2017.
*Difference is statistically significant

Designing the research study

A Method to Adjust for the Differences between Acupuncture Users and Non-Users

Because of these dramatic differences between Medicaid recipients who do and do not use acupuncture, researchers were concerned with ensuring that the comparison between these two populations take into account any variables which may confound the relationship between acupuncture and opioid use. To these ends, we utilized a statistical technique called "Propensity Score

Is Acupuncture associated with Reduced Opiate Use?

Matching" which allows the statistician to obtain a control group with similar traits on a host of characteristics which may be correlated with both the treatment variable and the outcome variable. In the first stage of the analysis, a statistical model is used to predict assignment into the treatment category based on variables of the researchers' choosing. Then, the "treated" individuals are matched to "untreated" individuals who have the same predicted probability of having received the treatment. This method reduces the bias introduced by potentially confounding variables.

Two secondary concerns were in maintaining a sample size large enough to statistically detect differences in outcome measures (i.e., opioid use), and in designing an analysis such that the results would be easily interpretable in terms of their implications and conclusions – researchers desired a strong test, such that results in favor of acupuncture use would clearly indicate that acupuncture use can lead to lower rates of opioid use.

This study used the State Fiscal Year (SFY) 2017 period to investigate the effects of acupuncture use in the first half of SFY 2017 (the "treatment period") on opioid medication use in the second half of SFY 2017, among individuals who did not use opioids at all ("opioid-naïve") during the treatment period.[4]

Therefore, this research design examines whether previously opioid-naïve acupuncture users are more or less likely to subsequently use opioids than are similar individuals who did not receive acupuncture services. Researchers believed this approach provided a stronger test of whether acupuncture can reduce opioid reliance than examining outcomes among those currently taking opioids. This is because stakeholders asserted that acupuncture may be more clinically effective if begun prior to starting opioid therapy.

Identifying The Sample Frame: Acupuncture Users and Non-Users Eligible to be Matched to Users

We began by identifying users of acupuncture during the first half of SFY 2017, pulling from the DHS data warehouse all claim lines where the Current Procedural Terminology (CPT) code was 97810, 97811, 97813, or 97814 (consistent with the billable acupuncture CPT codes in the MHCP provider manual). 7,355 distinct individuals had an acupuncture service paid by MHCP during the treatment

---

[4] A policy change regarding payment for acupuncture use in early 2016 as well as the necessary time (6 months) for claims run off limited the time frame to this period.

Is Acupuncture associated with Reduced Opiate Use?

period.[5] Because it was commonplace for many claims to have separate days of service billed on the same claim, we considered services rendered on distinct days to be separate "doses" of acupuncture. The median MHCP acupuncture user had 4 doses; the average was 6.3. We considered individuals that had 6 or more doses of acupuncture to have received the "treatment" of acupuncture, as this is generally considered the floor for acupuncture to have clinical effectiveness.

A list was then compiled of all primary diagnoses associated with recipients' acupuncture visits. We pulled all claims data during the treatment period where the primary diagnosis on the claim was in this list.[6] To obtain a final sample frame that would be eligible for the Propensity Score Matching routine, recipients receiving one of these diagnoses were limited to those who were continuously enrolled throughout SFY 2017, were age 18-64 as of Dec. 31, 2016, and who did not receive a prescription for an opioid medication during the treatment period (first half of SFY 2017). 207,389 enrollees meeting these criteria were identified, including 1,498 individuals who were identified as having received the appropriate dosage of acupuncture. The remaining 205,981 potential control individuals received no acupuncture services (that were paid for by MHCP).

Propensity Score Matching Step 1: Predicting Acupuncture Use among the Sample Frame

In the first step of propensity score matching, a logistic regression equation is estimated. Logistic regression is a statistical tool used to estimate the probability of a binary outcome, such as assignment to a medical intervention, given a set of predictor variables. In this case, researchers estimated the probability of having received acupuncture services. The ability to predict which recipients use acupuncture was limited to measures which could be found in the DHS data warehouse or could be constructed from that data.

Researchers used a host of demographic and other variables to predict enrollees' acupuncture use:[7]

- Enrollee Age

---

[5] This includes all individuals who had at least one acupuncture service paid for by MHCP, regardless of age, continuous enrollment status.

[6] Thus these individuals had a diagnosis which would have made them eligible to receive an acupuncture service under MHCP.

[7] Although education and income have been identified as predictors of acupuncture use (Upchurch and Rainsich 2014), this data is incomplete and unreliable in the DHS data warehouse and therefore not included.

Is Acupuncture associated with Reduced Opiate Use?

- Enrollee Gender
- Enrollee Race/Ethnicity[8]
- Enrollee Immigration Status
- Enrollee Primary Language
- Enrollee County of residence (7-county Metro area vs. Non-Metro)
- Substance Use Disorder during treatment period
- Serious Mental Illness (SMI) during treatment period
- Serious and Persistent Mental Illness (SPMI) during treatment period
- Use of chiropractic services during treatment period
- Count of claims with an acupuncture-eligible diagnosis
- Rate of MHCP-enrolled Acupuncturists per 100,000 recipients in enrollee's county of residence

DHS researchers attempted to control for severity of condition by including recipients' count of claims with an acupuncture-eligible diagnosis, lacking a more refined measure of chronicity of pain or medical condition. We also constructed a blunt measure of access to acupuncture services by calculating the rate of MHCP-enrolled acupuncturists per 100,000 recipients in each county of the state.

Table 2 displays the odds ratios and 95% confidence interval for each variable included in the logistic regression model predicting acupuncture use among our sample of 207,389 enrollees. The odds ratio represents the change in the relative odds of having used acupuncture to not having used acupuncture, controlling for the effects of the other variables in the model. Odds ratios greater than 1 indicate that the variable or trait increases the likelihood of having used acupuncture; below 1 indicates that the variable or trait decreases the likelihood of having used acupuncture. For example, the odds ratio of 1.625 for females relative to males indicates that females have 1.625 times higher odds of having used acupuncture than males, controlling for all other variables in the model. If the 95% confidence interval excludes 1, this indicates that the effect was statistically significant in predicting acupuncture use.

Effects for all variables were statistically significant. All variables except for Substance Use Disorder increase the odds of having used acupuncture; those with a Substance Use Disorder are significantly less likely to have used acupuncture, consistent with some literature (Upchurch and Rainisch, 2014). The odds ratio above 1 for Age indicates that as one's age increases, so do the odds of having

---

[8] This was coded to a single race/ethnicity, with Hispanic ethnicity taking precedence over racial categories (i.e., all other categories are non-Hispanic).

Is Acupuncture associated with Reduced Opiate Use?

acupuncture. However, the odds ratio below 1 on the Age-Squared variable indicates that this relationship reverses at the highest ages. Use of chiropractic services increases the odds of having also utilized acupuncture by a factor of 5.7. As expected, recipients living in areas with higher concentrations of acupuncturists were more likely to use these services (O.R. 1.022, 95% Confidence Interval 1.020 – 1.024).

The overall model fit could be improved with additional explanatory variables. The Pseudo R-squared, a measure of how much variation in the dependent variable is explained by the set of independent variables, was low, at 0.018.[9] This indicated that there may be other non-measured variables which predict acupuncture use. Researchers were not able to include personal health practices variables (such as physical activity) and included only crude measures of need (i.e., count of claims and chiropractic use).

---

[9] This value can range between 0 and 1, with higher values indicating that a higher proportion of the variance in the variable being predicted was explained by the predictor variables.

Is Acupuncture associated with Reduced Opiate Use?

Table 2 – Odds Ratios for Variables in Predicting Acupuncture Use

Effect^	Odds Ratio	Lower 95% Confidence Limits	Upper 95% Confidence Limits
Age	1.109	1.074	1.145
Age Squared	0.999	0.999	0.999
Sex F vs M	1.625	1.437	1.837
Asian/Pacific Islander vs White	1.936	1.476	2.539
Black/African-American vs White	1.593	1.341	1.891
Primary Language Hmong vs. English	2.862	2.070	3.958
Primary Language Somalian vs. English	4.931	4.000	6.077
Resident of 7-county Metro Area	2.182	1.913	2.488
Substance Use Disorder	0.456	0.356	0.584
SMI/SPMI Status	1.091	1.002	1.188
Used Chiropractic Services	5.742	4.986	6.613
Acupuncturists in County per 100k recipients	1.034	1.029	1.040
Count of Claims w/Acupuncture-eligible Dx	1.022	1.020	1.024

^ All effects statistically significant at $p < 0.05$.

Propensity Score Matching Step 2: Matching Acupuncture Users to Non-Users

The logistic regression model estimates will produce for every enrollee in the sample frame a predicted probability of having used acupuncture, which ranges between 0 and 1. In the second step of propensity score matching, the enrollees who used acupuncture will be matched to a non-user with the same (or similar) predicted probability. This matching process ensures a "control" group to compare with the acupuncture users that shares similar traits across the measured confounding

Is Acupuncture associated with Reduced Opiate Use?

variables (i.e., differences between the acupuncture-users and the control group should be due to random chance).[10]

Researchers attempted to match each of the 1,498 acupuncture users to a non-user with an equivalent predicted probability. First, a data set was created of all potential matches where a treatment and control recipient shared the first 3 digits past the decimal of the predicted probability. Because of the large overall sample size, nearly 7 million possible pairs of acupuncture users and non-users were created where this was the case.

Then, for each recipient who used acupuncture, the matched pair with the lowest difference between predicted probabilities was accepted. This process produced 1,361 matched pairs of individuals, for a match rate of 90.9%. There were 102 pairs of treatment-controls where the predicted probabilities matched exactly out to 10 digits past the decimal point. A final data set was created from the original 207,389 individuals containing 2,722 observations (1,361 with acupuncture use and 1,361 without).

Propensity Score Matching Step 3: Verifying that the Matched Samples are Statistically Similar

The third stage of propensity score matching entails checking whether the process successfully reduced differences between the treatment and control groups across the variables included in the logistic regression model.[11] This section compares the set of matched treatment and control individuals to determine whether statistically significant differences remain between the two.

Table 3 displays the post-matching characteristics of the treatment and control groups. The reason for creating this matched sample was to eliminate or reduce statistically significant differences between the two groups. For all but 3 variables, the differences between the acupuncture users and the non-users are no longer statistically significant. The three variables that are still significant after matching are SMI status, the use of chiropractic services, and the count of claims with acupuncture-eligible

---

[10] It is important to note that statistically significant differences would still remain between the treatment and control groups on variables that are not measured or included in the logistic regression model. Results of the logistic regression indicate that this may be the case.

[11] In a randomized controlled trial, the randomization process ensures that there are no statistically significant differences across any and all potential confounders. In an observational study using Propensity Score Matching, the matching process can only ensure that treatment and control groups are similar across variables that are included in the first stage predicting assignment into the treatment group.

Is Acupuncture associated with Reduced Opiate Use?

diagnoses. It is not uncommon to see one or two variables remain statistically significant even after matching if the number of covariates is high, as in this study.[12]

While differences in these 3 variables are statistically significant, the magnitude of the difference is not large. For example, 50.0% of our matched acupuncture users used chiropractic services, while 54.5% of the matched controls did so. In addition, the count of claims is statistically significantly lower for non-users than for users. However, this difference is drastically smaller than the difference between acupuncture users and the pool of all eligible non-users (see Table 1 above). Use of chiropractic services indicates that non-users might be more likely to use opiates, whereas the count of claims indicates the opposite. On net, then, these biases likely counteract one another.

Overall, these results indicate that the matching process was reasonably successful at reducing the differences between the treatment and control groups, and that the control group statistically resembles the acupuncture users.

---

[12] For example, if there are 20 comparisons being made, one would expect one of those differences to be statistically significant (at $p < .05$) by random chance alone.

Is Acupuncture associated with Reduced Opiate Use?

Table 3 – Characteristics of Matched Treatment and Control Groups

	Treatment (6+ Uses of Acupuncture)	Control (No Acupuncture Use)	
	N (%)	N (%)	P -Value
Total Enrollees	**1,361**	**1,361**	
Age in years (Mean ± S.D.)	44.0 ± 12.1	44.8 ± 11.9	0.0964
Female	1,003 (73.7)	1,011 (74.3)	0.7267
Asian/Pacific Islander Race	146 (10.7)	140 (10.3)	0.7083
Black/African-American Race	309 (22.7)	296 (21.8)	0.5512
Primary Language Hmong	75 (5.5)	71 (5.1)	0.7371
Primary Language Somalian	159 (11.7)	166 (12.2)	0.6758
Immigrant	195 (14.3)	177 (13.0)	0.3152
Resident of 7-county Metro Area	985 (72.4)	996 (73.2)	0.6357
Substance Use Disorder	71 (5.2)	77 (5.7)	0.612
Serious Mental Illness	462 (34.0)	540 (39.7)	0.0019*
Serious and Persistent Mental Illness	176 (12.9)	166 (12.2)	0.5631
Used Chiropractic Services	681 (50.0)	742 (54.5)	0.0192*
Acupuncturists in County per 100k recipients (Mean ± S.D.)	34.8 ± 10.2	34.6 ± 10.2	0.6831
Count of Claims w/Acupuncture-eligible Dx (Mean ± S.D.)	22.2 ± 17.2	18.7 ± 29.2	0.0001*

*Difference is statistically significant at $p < 0.05$

Is Acupuncture associated with Reduced Opiate Use?

Results: Acupuncture users subsequently take opiates about as often as acupuncture non-users

DHS identified a list of opioid medications and utilized this list[13] to identify individuals who used opioids during SFY 2017.[14]

Acupuncture users in the first half of SFY 2017 became opiate users in the second half of SFY 2017 about as often as acupuncture non-users. Figures 1-3 display the results of the comparisons between matched acupuncture users and non-users on our 3 outcomes in the second half of SFY 2017. The error bars in each graph indicate the 95% confidence intervals of the rate or average.[15]

Figure 1 displays overall rates of any opioid use by treatment/control group. 10.87% of the 1,361 acupuncture users were prescribed an opioid medication during the second half of SFY 2017 (95% Confidence Interval (C.I.): 9.22% - 12.52%). Among non-users, the percentage was slightly lower, at 9.26% (95% C.I. 7.72% - 10.80%). However, this difference was not statistically significant (Chi-Square = 1.96, P = 0.16).

---

[13] The Healthcare Effectiveness Data and Information Set (HEDIS) published by the National Committee for Quality Assurance (NCQA) also publishes a list of opioid medications. All analyses of this study were re-run using this list instead of the DHS "homegrown" list and virtually identical results were found.

[14] Those who used opioids in the first half were excluded from analysis; opioid use in the second half of SFY 2017 was the primary outcome of interest.

[15] The 95% confidence intervals reflect the uncertainty in estimating statistical parameters and represent a range of values which has a 95% chance of containing the "true" rate or average.

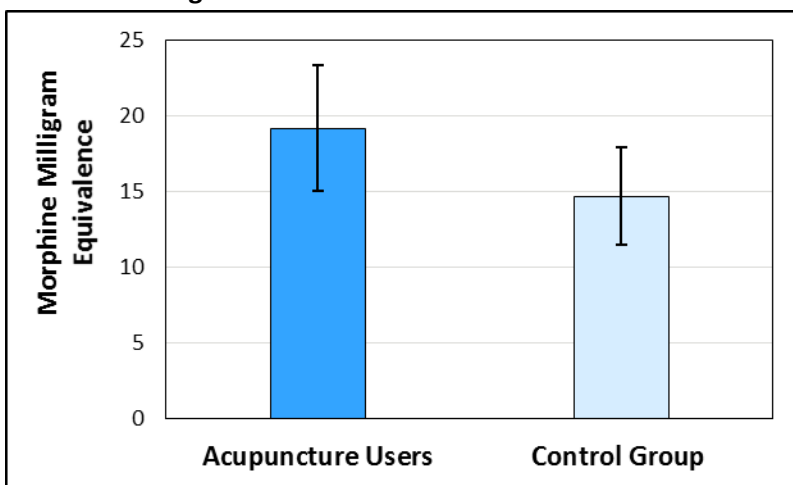Is Acupuncture associated with Reduced Opiate Use?

Figure 1 – Rates of Use of Any Opioid Medication in 2nd Half of SFY 2017 by Treatment Assignment
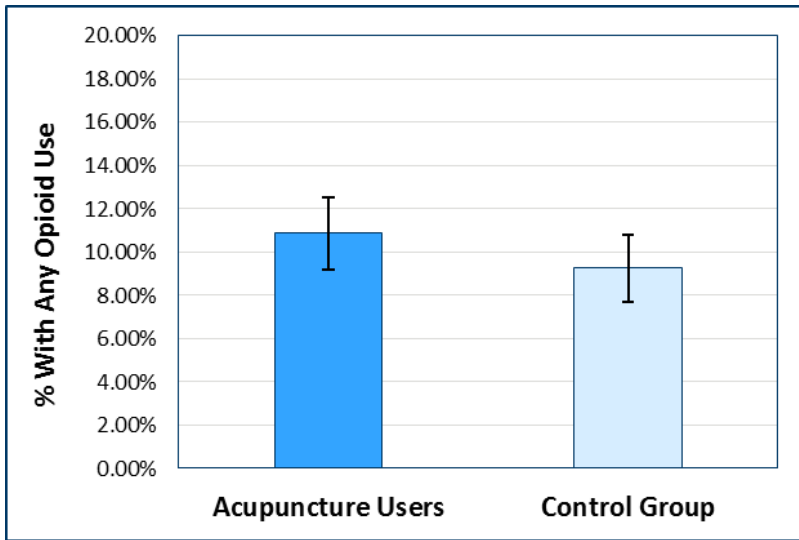
Errors bars indicate 95% confidence interval of rate.

Figure 2 shows the average total MME prescribed by treatment/control group. A dozen outlier observations with unrealistically high amounts of total MME substantially skewed the average dose. Therefore any observation with higher than 750 MME (the top 1 percent of total MME) has been excluded from this analysis. Acupuncture users had a slightly higher average of total MME prescribed in the second half of SFY 2017: 19.2 (95% C.I: 15.0 – 23.4) vs. 14.7 (95% C.I.: 11.5 – 17.9). This difference failed to reach conventional levels of statistical significance (t = -1.69, P = 0.09).

Figure 2 – Average Total Morphine Milligram Equivalence (MME) Prescribed in 2nd Half of SFY 2017 by Treatment Assignment
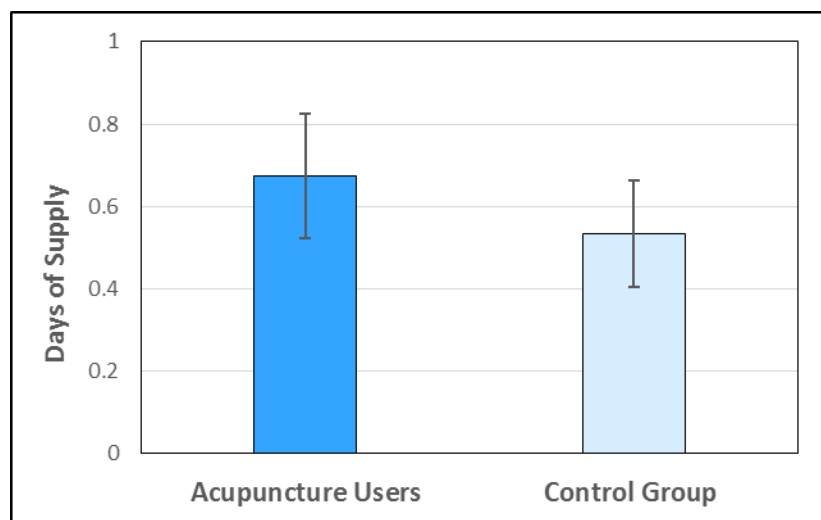

Errors bars indicate 95% confidence interval of average.

Is Acupuncture associated with Reduced Opiate Use?

Average total days' supply prescribed by treatment/control group is shown in Figure 3. The top 1 percent of total days' supply also substantially skewed the averages, thus these observations are excluded from the analysis. These results follow the same pattern: acupuncture users had a slightly higher average of total days of supply prescribed, with 0.675 (95% C.I.: 0.525 – 0.825), vs. 0.533 among the matched control group (95% C.I.: 0.403 – 0.663). Again, this was not a statistically significant difference (t = -1.40, P = 0.16).

Figure 3 – Average Total Days of Supply of Opioids Prescribed in 2nd Half of SFY 2017 by Treatment Assignment

Errors bars indicate 95% confidence interval of average.

Measures of ongoing chronic opioid use which may indicate more problematic or risky prescribing were not compared, as the sample was not large enough to obtain suitable numbers of enrollees with these outcomes. For example, only nine individuals in the matched sample became chronic users (measured as 90 total days' supply) of opioid in the second half of SFY 2017.[16] Other outcomes such as high-dose chronic opioids (50 MME per day for 90 days) or the concurrent use of benzodiazepines were not measured as the research likely would have failed to find any individuals in our sample of acupuncture users with these outcomes.

---

[16] 6 were in the acupuncture-user group; 3 were in the control group.

Is Acupuncture associated with Reduced Opiate Use?

Study Strengths and Limitations

This study has several strengths and limitations. The focus on enrollees who were opioid-naïve during the first half of SFY 2017 and the prospective outcome measurement allows for a look at whether acupuncture use can act as a deterrent for future opioid use for chronic pain and other conditions. Also, propensity score matching provided among the strongest possible methodology, given available data, to identify a comparison group that is similar to acupuncture users. Had this study found that acupuncture users became opiate users at lower rates this would represent strong observational evidence that acupuncture may be effective at reducing opiate use. However, we found no such evidence.

Only 3 outcomes out of a plethora of many potential opioid-related outcomes were measured, which could represent a mix of clinically appropriate and inappropriate use. Due to sample size limitations, researchers were not able to examine whether acupuncture use may lower rates of opioid use across measures which indicate potentially dangerous utilization. Additionally, we did not test whether opiate use is reduced among current opiate users who use acupuncture. It may be the case that acupuncture use could act as an effective pain therapy and therefore substitute for opioids for those currently using opioids. This research design did not address that question; researchers opted for a stronger test of whether acupuncture use can prevent later opioid use.

The results may be sensitive to the Propensity Score Matching design. Post-matching analysis indicated that the treatment and control groups were statistically similar on most variables but there remained 3 with statistically significant differences. Although not large, these differences make it slightly more difficult to claim that this study is comparing similar enough groups to make claims about the effects of acupuncture use. In particular, the acupuncture user group had slightly more claims (average of 22.2) than did the matched controls (average of 18.7), which indicates that this group is slightly more likely to seek care in general, which may of course include opioids. Although we cannot determine this, it is possible that the acupuncture group has more severe pain, or other conditions that make them more likely to use opiates. Acupuncture users may also simply be more comfortable seeking various types of medical care (e.g. doctor visits and opioids). Future research is needed to test whether other research designs or a more robust set of covariates can better elucidate the relationship between acupuncture and opiate use.

Conclusions

This study compared acupuncture users with a matched control group of non-acupuncture users to see if there were differences in their later use of opiates. Everyone in the sample frame was age 18-64,

Is Acupuncture associated with Reduced Opiate Use?

was continuously enrolled during SFY 2017, and was opioid-naïve during the first half of SFY 2017. Outcome indicators included any opiate use, amount of opiate use (measured in Morphine Milligram Equivalents), and total days' supply. The study design allows only for conclusions regarding the association between acupuncture and later opioid use and sample size limitations prevented the measurement of riskier opiate use such as chronic use or chronic use at high doses.

Our analysis suggests that there is no difference in the use of opioids by populations of Medicaid enrollees who used acupuncture, and populations who did not. Across three measures of opioid use, acupuncture users had slightly higher opioid use than did non-users. However, these differences failed to reach conventional levels of statistical significance. This study used a sophisticated methodology but may have lacked some important indicators which could have prevented us from identifying a truly comparable comparison group. Given our results, we cannot conclude whether acupuncture users become opioid users at higher or lower rates than non-users.

References

The Agency for Healthcare Research and Quality (2016). Noninvasive treatments for low back pain. Pacific Northwest Evidence-based Practice Center. Report No. 16-EHC004-EF. Available Online.

Cognitive and mind-body therapies for chronic low back and neck pain: Effectiveness and value. Institute for clinical and economic Review, Nov 6, 2017. Available Online.

State of Vermont (September, 2017). Medicaid Acupuncture Pilot Project Outcomes Report. Report to the House Committees on Health Care and on Human Services; Senate Committee on Health and Welfare Pursuant to Act 173 of 2016, Sec. 15a.

Upchurch, D.M., and Rainisch, BW. (2014). A sociobehavioral wellness model of acupuncture use in the United States, 2007. J Altern Complement Med 20(1): 32-39.

Is Acupuncture associated with Reduced Opiate Use?