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Visit Frequency and Outcomes for Patients Using Ongoing Chiropractic Care for Chronic Low-Back and Neck Pain: An Observational Longitudinal Study

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Abstract

Background.—Chronic spinal pain is prevalent and long-lasting. Although provider-based nonpharmacologic therapies such as chiropractic care have been recommended, healthcare and coverage policies provide little guidance or evidence regarding long-term use of this care.

Objective.—Determine relationships between visit frequency and outcomes for patients using ongoing chiropractic care for chronic spinal pain.

Study Design.—Observational 3-month longitudinal study.

Setting.—Data collected from patients of 124 chiropractic clinics in six US regions.

Methods.—Examined the impact of visit frequency and patient characteristics on pain (pain 0–10 numerical rating scale) and functional outcomes (Oswestry Disability Index or ODI for low-back pain and Neck Disability Index or NDI for neck pain, both 0–100 scale) using hierarchical linear modeling (HLM) in a large national sample of chiropractic patients with chronic low-back pain (CLBP) and/or chronic neck pain (CNP). This study was approved by the RAND Human Subjects Protection Committee and registered under ClinicalTrials.gov Identifier: NCT03162952.

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Results.—1,362 patients with CLBP and 1,214 with CNP were included in a series of HLM models. Unconditional (time-only) models showed patients on average had mild pain and function and significant, but slight improvements in these over the 3-month observation period: back and neck pain decreased by 0.40 and 0.44 points, respectively; function improved by 2.7 (ODI) and 3.0 points (NDI) (all $p<.001$). Adding chiropractic visit frequency to the models revealed that those with worse baseline pain and function used more visits, but only visits more than once per week for those with CLBP were associated with significantly better improvement. These relationships remained when other types of visits and baseline patient characteristics were included.

Limitations.—Observational study based on self-report data from a sample representative of chiropractic patients, but not all patients with CLBP or CNP.

Conclusions.—This 3-month window on chiropractic patients with CLBP and/or CNP revealed that they were improving, although slowly; may have reached maximum therapeutic improvement; and are possibly successfully managing their chronic pain using a variety of chiropractic visit frequencies. These results may inform payers when building coverage policies for ongoing chiropractic care for patients with chronic pain.

Keywords

Chronic low-back pain; chronic neck pain; spinal pain; physical function; hierarchical linear modeling; healthcare utilization; chiropractic visits; insurance coverage

Introduction

Although chronic pain affects over 40 percent of US adults,(1) little information is available on management of that pain with ongoing provider-based care. Chronic spinal pain is one of the most common types of chronic pain (1,2). It is associated with substantial burden to patients (3–7), the healthcare system (3–5,8,9), and employers (7,10). Although use of medications (including opioids) is most common (5,11,12), provider-based nonpharmacologic therapies (5,11), are now recommended in guidelines as first-line therapies for chronic spinal pain (13–16).

According to *NIH Medline Plus*, “chronic pain usually cannot be cured, but it can be managed” (17). Many turn to sustained medication use for this purpose. However, this approach has risks that may outweigh benefits (18,19). We need information on long-term pain management for chronic low back pain (CLBP) and chronic neck pain (CNP) that includes use of provider-based nonpharmacologic therapies. At present there is little guidance and sparse evidence available for this use (20–26).

Chiropractors, osteopaths and physical therapists are the practitioners most likely to use spinal manipulation (27), one recommended provider-based nonpharmacologic therapy. About 30–60 percent of US patients with spinal pain have seen a chiropractor (5,11,28), and over 80 percent of chiropractic patients receive spinal manipulation for their back and neck pain (27). Most chiropractic patients (29) have chronic pain and many are under long-term chiropractic care and very satisfied with this care (27,29–34). Therefore, an examination of visit frequencies and pain and functional outcomes in patients using ongoing chiropractic care could be useful to understanding the use of provider-based nonpharmacologic therapies for pain management.

Available recommendations for provider-based care tend to give a frequency and duration of treatment (e.g., 10 treatments over 8 weeks) and the timing for reassessment before continuing the care plan (20–26). These treatment guidelines also refer to concepts like Maximum Therapeutic Improvement (MTI) (21,23,25,26): the point at which a patient's condition has plateaued and is unlikely to improve further (21). The guidelines all acknowledge that care beyond the point of MTI—i.e., chronic pain management (21) or support care (22)—might be needed under certain conditions, e.g., if symptoms worsen after a therapeutic withdrawal of treatment. One guideline suggests that pain or function must worsen by the minimal clinically important change for more than 24 hours to justify ongoing care (21). However, although duration of care guidelines for chronic pain patients not yet at their MTI seem to be loosely based on treatment frequency and duration used in trials, little guidance and no evidence is offered for care after MTI is achieved. This lack of information and support of ongoing pain management has been cited as one barrier to the use of recommended provider-based nonpharmacologic therapies for chronic spinal pain (35).

This study used a longitudinal dataset gathered over 3 months from a large US sample of patients with CLBP and/or CNP who were using chiropractic care (29). While this sample may not be representative of all patients with CLBP and CNP, it is representative of chiropractic patients with CLBP and CNP (29,36), including pain and function levels seen in trials (37,38). We know from previous analyses of this sample that on average these patients have been in pain for 14 years and using chiropractic care for 11 years (29), and that 70 percent reported their treatment goal as pain management; not cure (39). Their stated willingness-to-pay for pain reduction indicated that what they value is the maintenance of their current pain levels (40). On average they utilized 2.3 chiropractic visits per month, but this varied by the characteristics of the patient (more visits with worse function, just starting care, and with CLBP and insurance coverage) and their treating chiropractor (more visits when chiropractor saw more patients per day or had fewer years of experience) (36).

In this study we examine relationships between patients' pain and functional outcomes over the 3-month study period, and their chiropractic visit frequency, visits to other types of providers, and other characteristics.

Methods

Our longitudinal observational data were collected prospectively via online questionnaires every 2 weeks over 3 months from a large sample of US chiropractic patients under treatment for CLBP and/or CNP. The overall project within which these data were collected is described in detail elsewhere (41,42), including data collection methods (43), patient sample characteristics (29), and clinic and chiropractor characteristics (36). In brief, the sample was selected using multistage systematic stratified sampling over four levels: regions/states, metropolitan areas, chiropractors/clinics, and patients, and data were collected between October 2016 and January 2017. The regions and metropolitan areas were: San Diego, California; Tampa, Florida; Minneapolis, Minnesota; Seneca Falls/Upstate, New York: Portland, Oregon; and Dallas, Texas.

The goal was to recruit 20 chiropractors/clinics per region and 7 CLBP and 7 CNP cases per clinic. Each participating clinic received an iPad containing a short prescreening questionnaire and staff were trained to offer this questionnaire to every patient who visited the clinic during a 4-week period. The questionnaire established initial inclusion criteria (i.e., ≥21 years of age, English-proficient, no current personal injury or workers compensation litigation/claims, have back or neck pain). Those who met these criteria and provided an email address were sent a link to a longer online screening questionnaire to determine whether they had CLBP and/or CNP (i.e., pain for at least 3 months before seeing the chiropractor and/or self-report of chronicity). Patients who met these criteria provided informed consent, answered additional questions, and then received 7 additional online questionnaires: baseline, 5 short every-two-week follow-ups, and endline at 3 months. Participants were incentivized with online gift cards for every step of participation and those who completed all questionnaires received a total of $200. This study uses a subset of the data collected.

Measures

Outcome and visit data were gathered every 2 weeks over 3 months and exact weeks since baseline (based on actual date of data entry) was used as our time variable in the models. At each data collection point all patients reported their pain levels (pain numerical rating scale, NRS(44)) and their function using the Neck Disability Index (NDI) (45) for those with CNP and the Oswestry Disability Index (ODI) (46) for those with CLBP. These measures are considered valid and reliable (pain NRS (47–51); NDI (52–55); ODI (56–58)) and were scored that higher values indicated worse outcomes.

Our primary explanatory variable was chiropractic visit frequency, but we also tested the impact of other types of visits to other complementary therapy (CT) providers (mostly massage) and to medical providers (mostly general practitioners). Average frequency for each type of visit was categorized as: more than weekly, weekly up to biweekly, biweekly up to monthly, and monthly and less than monthly. Not all patients had non-chiropractic visits and few used these more than biweekly, so for non-chiropractic visits we combined the first two categories and added a none category. Variables for clinic (chiropractor) and region (state and metropolitan area) were used to determine whether there were differences in baseline symptoms or symptom change by chiropractor or region.

Our final models also included a number of variables identified by others as reasonable indicators of the need for ongoing care or shown to be predictive of outcomes in CLBP and CNP populations (21,38,59–73). These include pain characteristics (whether have both CLBP and CNP, years with pain, reinjury tendency with heavy labor, previous unsuccessful surgery), use of medications (over-the-counter and prescription pain medications, including narcotics) and self-care (exercise), stage of care (first month or near end of care), pain beliefs (believe pain is chronic, pain level that would occur if didn’t see chiropractor, unsafe to be physically active/fear avoidance), psychological measures (pain management subscale of the Chronic Pain Self-Efficacy Scale (74), two items from the Credibility/Expectancy

Questionnaire relating to expected treatment success and expected pain improvement (75), an item about worry whether pain will end, the 4-item PROMIS-29 depression scale (scores >52.5) (76), 3-item affective distress domain of the Multidimensional Pain Inventory (77), 3 items from Helplessness subscale of the Pain Catastrophizing Scale (78)), and demographics (age, gender, education). Each was chosen for the analysis *a priori*.

Analysis

The goal of our analysis was to examine whether visit frequencies and patient characteristics were associated with patients' baseline pain and function, and with changes in these outcomes (i.e., more improvement) over the 3-month study period. Because we had up to 7 data points for each patient and patients were clustered within clinics and clinics were clustered within regions, we used hierarchical linear modeling (HLM) (79–81) which corrects for error structure violations (e.g., non-independent errors (79,82)), and optimizes estimation in the presence of missing data (80,83).

We first estimated unconditional (time-only) HLM models for each outcome to examine general trends in outcomes and to determine whether baseline patient symptoms or improvement over time varied significantly by chiropractor/clinic, and/or by region.

We then added frequency of chiropractic visit categories to unconditional models that appropriately clustered by patients, clinic, and/or region to examine the relationship between chiropractic visit frequency and outcomes. Next, we added other types of visits and then all explanatory variables in the full models.

Because of the large number of variables considered, at each step we used deviance statistics (measures of model fit based on log restricted-likelihood values of nested models) to separately test whether each block of variables was worth keeping—i.e., added statistically significant ($p<.05$) explanatory power. We separately examined the power of each set of variables to explain baseline outcomes (main effects) and to explain changes in outcomes over the 3-month period (interactions with time/weeks).

Means and frequencies for all variables were compared across pain groups (CLBP only, both CLBP and CNP, and CNP only) using t-tests and χ^2. All analyses were performed in Stata 16.0 (StataCorp, College Station, TX). This study was approved by the RAND Human Subjects Protection Committee.

Results

Of the 2,024 participants who completed the baseline survey (29) 1,708 had non-specific CLBP or CNP, and 1,665 (97.5%) of those had sufficient data to be included in at least one of our HLM models (Figure 1). Table 1 shows the values of each variable considered by chronic pain type. In our sample, it was most common to have both CLBP and CNP, and these participants had more back pain, had their pain longer, were more likely to have had unsuccessful back surgery, were less likely to be a new patient or to be near to ending care, and had lower pain management self-efficacy and more worry about their pain, depression, affective distress, and catastrophizing than those with CLBP or CNP only. On average over the 3-month period patients in the sample had 6 chiropractic visits, 2 CT visits and one-half medical provider visits. Less than half the sample had any CT visits (85% of these received massage, and about 25% each received physical therapy and/or acupuncture) and one-quarter had any medical provider visits (84% of these visited a general practitioner). Patients also consistently reported levels of what their pain would have been if they didn't see their chiropractor that were almost twice that of their current pain.

Tables 2 and 3 show the results of a series of HLM models that start as unconditional (time-only) models and then add chiropractic visits, other visits, and other characteristics as blocks of explanatory variables for each outcome. Tests of the unconditional models indicated that intercept (baseline) estimates varied significantly by patient and clinic, but weeks-since-baseline (time or slope) coefficient estimates varied only by patient and neither varied by region. The intercepts estimated for each unconditional model (Table 2) reflect the average baseline value for that outcome and the estimates for the weeks-since-baseline coefficient show the average change in that outcome per week over the 3-month period. The estimated coefficients for weeks-since-baseline were all statistically significant and negative, indicating that on average these symptoms improve over time. Over the 3-month study period ratings of low-back pain were estimated to decrease an average of 0.03 points per week or 0.40 points over 3 months on a 0–10 scale. Ratings of neck pain decreased an average of 0.03 points per week or 0.44 points over 3 months. The ODI was estimated to decrease (improve) an average of 2.7 points (0.21*13 weeks) and the NDI by 3.0 points (0.23*13) over 3 months both on a 0–100 scale.

The rows labeled Clinic, ID, and residual partition the variance in the data for each model. The row labeled ID (Intercept) had the largest value for each model indicating that most of the variation in outcomes was due to variation in participants' baseline values. The small value given to ID (Weeks) indicates that there was relatively little variance in the rate of improvement over time across participants. The Clinic (Intercept) terms indicate that there was some variance in patients' baseline values across clinics—i.e., clinics attract patients with different symptom severity. However, the weeks-since-baseline variance by clinic was not significant indicating that patients' improvement over time did not vary by clinic. The residual indicates the amount of unexplainable variance.

The significance of the coefficients estimated when adding chiropractic visit frequency to the unconditional models in Table 2 indicate that having more frequent visits is associated with higher levels of pain and disability at baseline (main effects), but only those who see their chiropractor more than weekly had significantly faster improvement (interactions with weeks). The deviance statistics shown in the last two rows indicate the significance of the explanatory power of adding each block of variables to models containing all previous variables. Adding chiropractic visit frequency main effects to the unconditional models (i.e., allowing chiropractic visit frequency to explain baseline symptoms) provided a significant amount of explanatory power to all models. However, adding chiropractic visit frequency interactions with time (weeks) only provided significant explanatory power (i.e., was associated with more improvement in outcomes) for CLBP, but not CNP alone.

Table 3 shows the estimated coefficients and deviance statistics for adding main effects and interaction terms for other types of visits and then for all other explanatory variables. The estimated coefficients for the other explanatory (non-visit) variables are shown in the Appendix. Because the deviance statistics indicated that model fit was not improved by adding interaction terms for all other explanatory variables, coefficients reported for these variables in the Appendix are from models without these interactions. Note that the size of the main effect coefficients for chiropractic visit frequency diminish somewhat after adding all explanatory variables, but the size and significance of the interaction coefficients remain fairly constant.

The coefficients and deviance statistics for adding the effects of other types of visits indicate that they were associated with all baseline outcomes, but only associated with changes in neck function (NDI) over time. Similar to chiropractic visits, the main effects coefficients were positive and generally increased across frequency categories, indicating that more visits were associated with higher (worse) baseline outcomes. Using CT visits monthly to less than monthly was associated with increased improvement in neck function. However, in contrast, the positive significant coefficients for interaction terms for medical provider visits for neck function indicate that patients with those levels of medical visits had less improvement than was seen with patients who did not see medical providers. Adding in all explanatory variables reduced the size of the main effects but had no effect on the interactions.

The partitioned variance statistics at the bottom of Table 3 indicate that these models were able to explain almost all the variance seen in patients' baseline values by clinic and over half the non-clinic-based baseline variance. However, these models reduced little of the variance seen in patients' improvement over time.

Discussion

Our results raise interesting considerations for coverage policies for chronic spinal pain, including visit frequencies associated with better outcomes and appropriate care after patient improvement has plateaued (reached MTI).

If the main goal of patients and clinicians is better symptom improvement, rather than maintaining current symptoms, these data indicate that this might require more than once-per-week chiropractic visits for those with CLBP and possibly the addition of massage to chiropractic care for CNP functional improvement. The more-than-weekly chiropractic visit frequency associated with increased improvement occurred more often in patients with worse baseline pain and function who may have had more room for improvement. Nevertheless, in this sample further symptom improvement may not be the main goal (39).

The slight improvement in symptoms over time and the small variance in that improvement across patients may indicate that most of these patients' symptoms have plateaued at (or near) their MTI. Once MTI is reached treatment focus changes from symptom improvement to maintenance and/or management. Therefore, policies that require documentation of ongoing clinical improvement (21,23–26) for continued care may not be appropriate. This finding of patients reaching MTI is consistent with what other studies have shown for this sample—that they value maintenance of their present symptom levels (40) and that most have a goal of pain management, not cure (39).

While the majority saw their chiropractor every two weeks at most, patients managed their pain using a variety of different visit frequencies. In previous analyses of these data (36), we found that chiropractic visit frequency was predicted by patients' baseline function, stage of care (whether a new patient or near ending care) and the characteristics of the treating chiropractor.

Finally, while most guidelines agree that continued treatment (e.g., chronic pain management (21) or support care (22)) may be needed under certain conditions after MTI is reached, little information is available to determine the treatment appropriate to maintain symptom gains. Some guidelines have suggested that documentation of clinical deterioration with treatment withdrawal be required to identify those who need ongoing care (21,25,26). Five points are offered regarding appropriate ongoing care. First, given that these patients have had their pain an average of 14 years and have used chiropractic care for 11 years (29), consideration must be given to the burden of repeated treatment withdrawals and their requirement to qualify for continued care. Second, only 6.7% of this sample ended care (and half of these also restarted care) during our study period [data not shown]. These may not be formal treatment withdrawals, but 70% of these patients reported they ended care because they were better and no longer needed treatment (most others ended because of lost insurance coverage or relocation). Third, patients reported (0–10 scale) what they believed their pain would be if they did not see their chiropractor and these reports were about 3 points above current pain—more than the 2-point minimal clinically important change for pain (50) suggested by one guideline to justify ongoing care (21). Although these reports could be based on psychosocial factors such as fear/anxiety regarding not receiving treatment, given the length of time these patients have had their pain they could also be based on lived experience with past treatment withdrawals. Fourth, because these patients reported at baseline that their current symptoms were mild (average pain intensity of 3 to 4 on a 0–10 scale with minimal-to-moderate back dysfunction (46) and mild neck dysfunction (55)) (29), but still improving over time, it could be argued that they were successfully managing their CLBP and CNP. Fifth, given this successful management using a variety of visit frequencies, it could be argued that each individual be covered as needed for visits. This need can ebb and flow (84,85), and is tempered by patients' out-of-pocket cost of care: even with some insurance coverage a visit to a chiropractor (or any recommended nonpharmacologic therapy provider) is usually associated with a per-visit out-of-pocket co-payment in addition to the cost of travel to the visit and of missing work (86).

This study benefits from a large longitudinal sample of chronic pain patients, but it also has limitations. Our sample may not be representative of all patients with CLBP and CNP, but it is, representative of chiropractic patients with CLBP and CNP (29) in terms of age (28,31,87–89), gender (31,87–89), race/ethnicity (31,87,88), income (88), education (31,88), and insurance coverage for chiropractic (31,87,88). It is also representative of pain and function levels seen in patients under treatment for CLBP and CNP (37,38). Although similar demographic profiles have also been found for those using other nonpharmacologic therapies for spinal problems,(28) our study's results should not be generalized to patients who are not now using these therapies. Our data were self-report and may be subject to response (e.g., social desirability, recall) biases. Our study was observational; although associations between visits and other key variables and outcomes and their improvement have been shown, without randomization and a control group we cannot say whether a change in allowed visit frequency would make a difference in these patients' choices and outcomes. Our sample excluded patients with work-related injuries or personal injury claims. We did not capture specific treatments received during visits, which could affect outcomes. Finally, our data were restricted to a 3-month window into symptoms and care for a chronic condition. Even though both were fairly consistent over these months, a longer period may have shown different patterns.

It seems that some long-term CLBP and CNP patients may be successfully managing (and slightly improving) their chronic pain while using chiropractic care. These patients do this using a variety of visit frequencies. Treatment algorithms requiring demonstration of continued clinical improvement seem inconsistent with successful pain management, especially if patients have reached a plateau, and requirements of repeated demonstrations of symptom deterioration with treatment withdrawal seem unethical, especially for those with long-term chronic pain. Nevertheless, payers clearly need evidence to support new coverage policies for ongoing nonpharmacologic care for patients with chronic pain (86,90), including chiropractic care. This study may illustrate an example of successful nonpharmacologic pain management that deserves further consideration from a policy perspective. In addition, future studies are needed to clarify the impact of various chiropractic coverage policies on clinical outcomes and costs.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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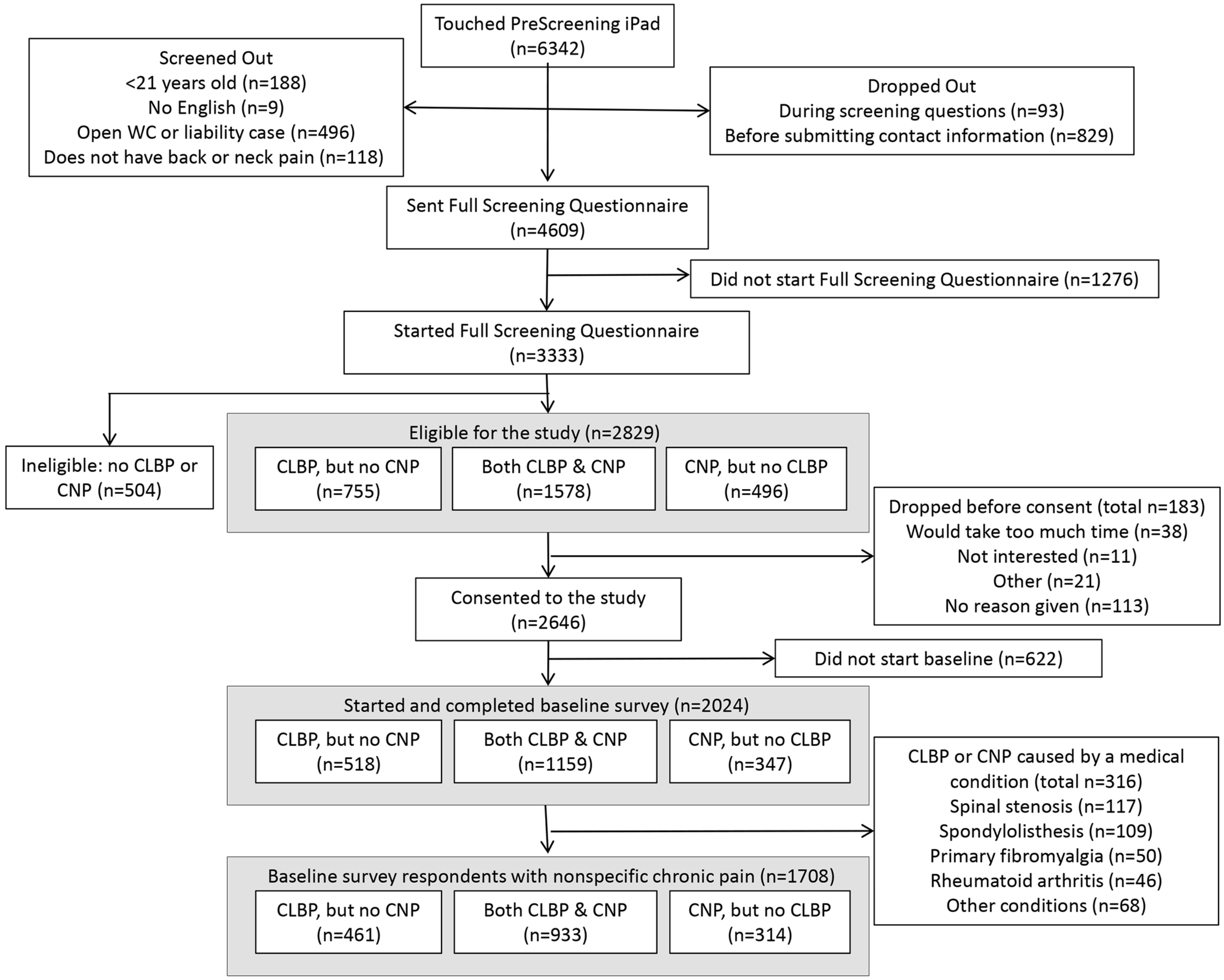

Figure 1. Flow chart of patients into the study

CLBP = Chronic low back pain; CNP = Chronic neck pain; WC = Workers Compensation

Table 1.

Outcomes and patient characteristics predictors by type of chronic pain, Mean (SD) unless otherwise noted

Label	CLBP (N = 451)	CLBP & CNP (N = 911)	CNP (N = 303)	Totals (N =1665)
Rating of Low Back Pain (0–10) **	3.3 (1.9)	3.6 (2.1)		3.5 (2.0)
Rating of Neck Pain (0–10)		3.8 (2.2)	3.5 (2.1)	3.7 (2.1)
Oswestry Disability Index Score (0–100)	18.5 (11.8)	19.8 (12.5)		19.4 (12.3)
Neck Disability Index Score (0–100)		21.8 (13.2)	20.7 (10.9)	21.5 (12.7)
# Chiropractic visits over 3 months *	5.5 (6.1)	5.7 (5.7)	6.3 (5.9)	6.0 (5.9)
Chiropractic visit frequency (categorized) **				
Monthly and less than monthly	190 (42.1%)	295 (32.4%)	107 (35.3%)	592 (35.6%)
Biweekly up to monthly	100 (22.2%)	251 (27.6%)	82 (27.1%)	433 (26.0%)
Weekly up to biweekly	84 (18.6%)	217 (23.8%)	62 (20.5%)	363 (21.8%)
More than weekly	48 (10.6%)	114 (12.5%)	31 (10.2%)	193 (11.6%)
Unknown	29 (6.4%)	34 (3.7%)	21 (6.9%)	84 (5.0%)
# Non-chiropractic complementary therapy (CT) visits over 3 months	1.8 (4.7)	2.2 (4.2)	2.2 (4.8)	2.1 (4.7)
Other CT visit frequency (categorized) **				
None	269 (59.6%)	148 (48.8%)	481 (52.8%)	898 (53.9%)
Monthly and less than monthly	80 (17.7%)	74 (24.4%)	209 (22.9%)	363 (21.8%)
Biweekly up to monthly	36 (8.0%)	24 (7.9%)	89 (9.8%)	149 (8.9%)
More than weekly up to biweekly	37 (8.2%)	36 (11.9%)	98 (10.8%)	171 (10.3%)
Unknown	29 (6.4%)	21 (6.9%)	34 (3.7%)	84 (5.0%)
# Medical care visits over 3 months	0.4 (1.3)	0.3 (1.0)	0.5 (1.4)	0.5 (1.3)
Medical care visit frequency (categorized) **				
None	345 (76.5%)	234 (77.2%)	667 (73.2%)	1246 (74.8%)
Monthly and less than monthly	56 (12.4%)	39 (12.9%)	174 (19.1%)	269 (16.2%)
Biweekly up to monthly	16 (3.5%)	9 (3.0%)	27 (3.0%)	52 (3.1%)
More than weekly up to biweekly	5 (1.1%)	0 (0.0%)	9 (1.0%)	14 (0.8%)
Unknown	29 (6.4%)	21 (6.9%)	34 (3.7%)	84 (5.0%)
Years of Pain ***				
Less than 1 Year	83 (18.4%)	71 (7.8%)	56 (18.5%)	210 (12.6%)
1 Years to Less than 2 Years	36 (8.0%)	50 (5.5%)	18 (5.9%)	104 (6.2%)
2 Years to Less than 5 Years	80 (17.7%)	119 (13.1%)	50 (16.5%)	249 (15.0%)
5 Years to Less than 10 Years	71 (15.7%)	164 (18.0%)	50 (16.5%)	285 (17.1%)
10+ Years	176 (39.0%)	481 (52.8%)	119 (39.3%)	776 (46.6%)
Unknown	5 (1.1%)	26 (2.9%)	10 (3.3%)	41 (2.5%)
% of time spent in heavy labor				
None (0%)	220 (48.8%)	446 (49.0%)	158 (52.1%)	824 (49.5%)
Non-workplace: >0% but <20%	52 (11.5%)	108 (11.9%)	27 (8.9%)	187 (11.2%)
Workplace: >0% but <20%	90 (20.0%)	179 (19.6%)	55 (18.2%)	324 (19.5%)
Non-workplace: ≥20%	14 (3.1%)	26 (2.9%)	7 (2.3%)	47 (2.8%)

Label	CLBP (N = 451)	CLBP & CNP (N = 911)	CNP (N = 303)	Totals (N =1665)
Workplace: ≥20%	45 (10.0%)	86 (9.4%)	29 (9.6%)	160 (9.6%)
Previous back surgery unsuccessful ***	4 (0.9%)		1 (0.1%)	5 (0.4%)
Previous neck surgery unsuccessful		1 (0.3%)	3 (0.3%)	4 (0.3%)
Use of medications over past 6 months:				
Over-the-counter pain medications often/always	188 (41.7%)	392 (43.0%)	136 (44.9%)	716 (43.0%)
Prescription pain medications often/always	26 (5.8%)	77 (8.5%)	17 (5.6%)	120 (7.2%)
Narcotic medications often/always	21 (4.7%)	44 (4.8%)	8 (2.6%)	73 (4.4%)
Exercise in Past 6 Months: Often to Always *	313 (69.4%)	568 (62.3%)	210 (69.3%)	1091 (65.5%)
New patient (<30 days) ***	65 (14.4%)	67 (7.4%)	48 (15.8%)	180 (10.8%)
Ended chiropractic care during 3 mos ***	55 (12.2%)	39 (4.3%)	17 (5.6%)	111 (6.7%)
Believe back pain is chronic	277 (61.4%)	569 (62.5%)		846 (62.1%)
Believe neck pain is chronic		575 (63.1%)	193 (63.7%)	768 (63.3%)
What low back pain would have been	6.4 (2.2)	6.5 (2.3)		6.5 (2.3)
What neck pain would have been		6.5 (2.4)	6.6 (2.3)	6.6 (2.4)
Exercise unsafe: agree to strongly agree	24 (5.3%)	50 (5.5%)	12 (4.0%)	86 (5.2%)
Pain management self-efficacy (1–10) **	7.7 (1.8)	7.4 (1.8)	7.8 (1.7)	7.6 (1.8)
Expect chiropractic very-extremely successful	330 (73.2%)	658 (72.2%)	237 (78.2%)	1225 (73.6%)
Expect a lot to quite a bit of improvement	292 (64.7%)	569 (62.5%)	193 (63.7%)	1054 (63.3%)
Worry about pain: mod to all the time **	72 (16.0%)	176 (19.3%)	36 (11.9%)	284 (17.1%)
Depression according to PROMIS items ***	92 (20.4%)	260 (28.5%)	59 (19.5%)	411 (24.7%)
Affective distress (7-point scale) ***	2.0 (1.1)	2.3 (1.2)	2.1 (1.2)	2.2 (1.2)
Catastrophizing (0–12 scale) ***	2.0 (2.2)	2.5 (2.4)	1.8 (2.0)	2.3 (2.3)
Average age in years	48.4 (15.2)	46.4 (12.6)	47.4 (14.3)	47.5 (14.3)
Gender: Female ***	265 (58.8%)	693 (76.1%)	245 (80.9%)	1203 (72.3%)
Education: Less than a 4-year degree *	194 (43.0%)	429 (47.1%)	118 (38.9%)	741 (44.5%)

CT = complementary therapy providers other than chiropractic—here, most often massage therapists; CLBP = chronic low back pain; CNP = chronic neck pain; LBP = low back pain; NP = neck pain

* The values for the 3 pain categories are statistically different at p<.05.

** The values for the 3 pain categories are statistically different at p<.01.

*** The values for the 3 pain categories are statistically different at p<.001.

Table 2.

Results of hierarchical linear models for each outcome: unconditional models and models of the impact of chiropractic visit frequency

	LBP Rating (n=1361)		ODI (n=1362)		NP Rating (n=1214)		NDI (n=1213)	
	Unconditional	**Adding visit frequency**	**Unconditional**	**Adding visit frequency**	**Unconditional**	**Adding visit frequency**	**Unconditional**	**Adding visit frequency**
Intercept	3.48 (0.1)***	3.15 (0.1)***	19.27 (0.4)***	17.10 (0.6)***	3.64 (0.1)***	3.35 (0.1)***	21.37 (0.4)***	19.57 (0.7)***
Weeks Since Baseline (Weeks)	−0.03 (0.0)***	−0.02 (0.0)**	−0.21 (0.0)***	−0.22 (0.0)***	−0.03 (0.0)***	−0.02 (0.0)**	−0.23 (0.0)***	−0.18 (0.0)***
Visits to Chiropractor (Ref: Monthly to < monthly)								
Biweekly up to monthly		0.25 (0.1)		0.58 (0.8)		0.24 (0.1)		0.54 (0.9)
Weekly up to biweekly		0.60 (0.1)***		4.48 (0.9)***		0.48 (0.2)**		3.97 (0.9)***
More than weekly		0.95 (0.2)***		7.75 (1.1)***		0.72 (0.2)***		5.29 (1.2)***
Unknown		0.41 (0.3)		2.05 (1.6)		0.42 (0.3)		1.63 (1.8)
Weeks* Biweekly to monthly		0.00 (0.0)		0.08 (0.0)		−0.01 (0.0)		−0.07 (0.1)
Weeks*Weekly to biweekly		−0.01 (0.0)		0.05 (0.1)		−0.01 (0.0)		−0.07 (0.1)
Weeks*More than weekly		−0.05 (0.0)***		−0.14 (0.1)*		−0.03 (0.0)*		−0.14 (0.1)*
Partitioned Variance								
Clinic (Intercept)	0.04 (0.0)	0.04 (0.0)	5.26 (2.3)	5.79 (2.3)	0.09 (0.1)	0.10 (0.1)	5.23 (2.8)	5.77 (2.9)
ID (Weeks)	0.01 (0.0)	0.01 (0.0)	0.22 (0.0)	0.21 (0.0)	0.01 (0.0)	0.01 (0.0)	0.25 (0.0)	0.25 (0.0)
ID (Intercept)	2.51 (0.1)	2.40 (0.1)	122.00 (5.5)	114.81 (5.2)	2.82 (0.2)	2.75 (0.2)	127.04 (6.2)	122.85 (6.0)
Residual	1.61 (0.0)	1.61 (0.0)	27.75 (0.5)	27.75 (0.5)	1.60 (0.0)	1.60 (0.0)	32.67 (0.7)	32.67 (0.7)
D (df) for visits main effects		16.2 (4)***		32.0 (4)***		7.1 (4)**		14.7 (4)***
D (df) for visits interactions		7.5 (3)**		6.3 (3)**		2.8 (3)		2.1 (3)

D = Deviance statistic with its degrees of freedom (number of parameters added over previous model), distributed χ^2; LBP = low back pain, 0–10 scale; NDI = Neck Disability Index, 0–100 scale; NP = neck pain, 0–10 scale; ODI = Oswestry Disability Index, 0–100 scale

* The estimated coefficient or deviance statistic is statistically significant at p<.05.

** The estimated coefficient or deviance statistic is statistically significant at p<.01.

*** The estimated coefficient or deviance statistic is statistically significant at p<.001.

Table 3.

Results of hierarchical linear models for each outcome: models adding the impact of frequency of other types of visits and other patient characteristics

	LBP Rating (n=1361)		ODI (n=1362)		NP Rating (n=1214)		NDI (n=1213)	
	Adding other visit frequency	**Adding all other variables**	**Adding other visit frequency**	**Adding all other variables**	**Adding other visit frequency**	**Adding all other variables**	**Adding other visit frequency**	**Adding all other variables**
Intercept	2.82 (0.1)***	0.91 (0.3)**	14.81 (0.6)***	11.80 (2.1)***	3.05 (0.1)***	0.10 (0.4)	17.41 (0.7)***	4.16 (2.3)
Weeks Since BL (Weeks)	−0.02 (0.0)**	−0.02 (0.0)**	−0.25 (0.0)***	−0.25 (0.0)***	−0.02 (0.0)*	−0.02 (0.0)*	−0.21 (0.0)***	−0.21 (0.0)***
Visits to chiropractor (Ref: Monthly to < monthly)								
Biweekly up to monthly	0.24 (0.1)	0.19 (0.1)	0.66 (0.8)	0.51 (0.6)	0.25 (0.1)	0.21 (0.1)*	0.68 (0.9)	0.69 (0.7)
Weekly up to biweekly	0.55 (0.1)***	0.22 (0.1)*	4.13 (0.8)***	2.32 (0.6)***	0.45 (0.1)**	0.19 (0.1)	3.83 (0.9)***	2.53 (0.7)***
More than weekly	0.82 (0.2)***	0.40 (0.1)**	6.59 (1.0)***	3.95 (0.8)***	0.62 (0.2)***	0.24 (0.1)	4.14 (1.1)***	2.18 (0.9)*
Unknown	0.74 (0.3)**	0.51 (0.2)*	4.33 (1.6)**	2.06 (1.3)	0.70 (0.3)*	0.58 (0.2)*	3.69 (1.8)*	3.61 (1.4)*
Wks*Biweekly to monthly	0.00 (0.0)	0.00 (0.0)	0.08 (0.0)	0.08 (0.0)	−0.01 (0.0)	−0.01 (0.0)	−0.06 (0.1)	−0.06 (0.1)
Wks*Weekly to biweekly	−0.01 (0.0)	−0.01 (0.0)	0.04 (0.1)	0.04 (0.1)	−0.01 (0.0)	−0.01 (0.0)	−0.06 (0.1)	−0.06 (0.1)
Wks*More than weekly	−0.05 (0.0)***	−0.05 (0.0)***	−0.16 (0.1)*	−0.16 (0.1)*	−0.03 (0.0)*	−0.03 (0.0)*	−0.16 (0.1)*	−0.16 (0.1)*
Other CT provider visits								
Monthly to < monthly	0.37 (0.1)**	0.22 (0.1)*	0.61 (0.8)	0.16 (0.6)	0.40 (0.1)**	0.23 (0.1)*	1.46 (0.8)	0.55 (0.7)
Biweekly up to monthly	0.42 (0.2)*	0.19 (0.1)	2.21 (1.1)*	1.43 (0.8)	0.33 (0.2)	0.10 (0.1)	0.21 (1.2)	−1.23 (0.9)
> Weekly up to biweekly	0.64 (0.2)***	0.33 (0.1)*	5.66 (1.0)***	4.43 (0.8)***	0.70 (0.2)***	0.45 (0.1)**	4.31 (1.1)***	2.89 (0.9)***
Unknown	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)
Wks* Monthly to <monthly	0.00 (0.0)	0.00 (0.0)	0.04 (0.0)	0.04 (0.0)	−0.01 (0.0)	−0.01 (0.0)	−0.11 (0.1)*	−0.11 (0.1)*
Wks* Biweekly to monthly	−0.01 (0.0)	−0.01 (0.0)	0.00 (0.1)	0.00 (0.1)	0.01 (0.0)	0.01 (0.0)	0.13 (0.1)	0.14 (0.1)
Wks*>Weekly to biweekly	0.01 (0.0)	0.01 (0.0)	0.12 (0.1)	0.12 (0.1)	0.00 (0.0)	0.00 (0.0)	0.11 (0.1)	0.11 (0.1)
Medical provider visit								
Monthly to < monthly	0.58 (0.1)***	0.20 (0.1)	4.75 (0.8)***	1.78 (0.6)**	0.35 (0.1)*	−0.06 (0.1)	4.20 (0.9)***	1.17 (0.7)
Biweekly up to monthly	1.46 (0.3)***	0.78 (0.2)***	15.40 (1.7)***	8.36 (1.3)***	1.41 (0.3)***	0.73 (0.3)**	17.24 (2.0)***	10.02 (1.6)***
> Weekly up to biweekly	1.09 (0.5)*	0.35 (0.4)	13.10 (2.9)***	5.92 (2.3)**	0.30 (0.6)	−0.18 (0.5)	6.79 (3.9)	0.00 (3.1)
Unknown	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)

	LBP Rating (n=1361)		ODI (n=1362)		NP Rating (n=1214)		NDI (n=1213)	
	Adding other visit frequency	**Adding all other variables**	**Adding other visit frequency**	**Adding all other variables**	**Adding other visit frequency**	**Adding all other variables**	**Adding other visit frequency**	**Adding all other variables**
Wks* Monthly to <monthly	0.00 (0.0)	0.00 (0.0)	0.01 (0.1)	0.01 (0.1)	0.00 (0.0)	0.00 (0.0)	0.12 (0.1) *	0.12 (0.1) *
Wks* Biweekly to monthly	−0.02 (0.0)	−0.02 (0.0)	0.17 (0.1)	0.17 (0.1)	−0.01 (0.0)	−0.01 (0.0)	−0.08 (0.1)	−0.08 (0.1)
Wks*>Weekly to biweekly	−0.01 (0.0)	−0.02 (0.0)	0.07 (0.2)	0.06 (0.2)	0.10 (0.1)	0.10 (0.1)	0.99 (0.3) ***	0.99 (0.3) ***
Other patient characteristics		See appendix for coefficients		See appendix for coefficients		See appendix for coefficients		See appendix for coefficients
Partitioned Variance								
Clinic (Intercept)	0.02 (0.0)	0.01 (0.0)	5.48 (2.1)	1.84 (1.1)	0.07 (0.0)	0.00 (0.0)	3.80 (2.3)	0.57 (1.3)
ID (Weeks)	0.01 (0.0)	0.01 (0.0)	0.21 (0.0)	0.21 (0.0)	0.01 (0.0)	0.01 (0.0)	0.23 (0.0)	0.24 (0.0)
ID (Intercept)	2.23 (0.1)	1.02 (0.1)	99.93 (4.6)	52.38 (2.7)	2.64 (0.1)	1.13 (0.1)	111.07 (5.5)	58.86 (3.4)
Residual	1.61 (0.0)	1.61 (0.0)	27.76 (0.5)	27.73 (0.5)	1.60 (0.0)	1.60 (0.0)	32.65 (0.7)	32.62 (0.7)
D (df) for main effects	45.9 (8) ***	300.7 (33) ***	92.1 (8) ***	402.0 (33) ***	25.6 (8) ***	288.4 (33) ***	64.5 (8) ***	355.9 (33) ***
D (df) for interactions	0.8 (6)	−61.5 (32)	3.6 (6)	−25.4 (32)	2.5 (6)	−54.4 (32)	15.3 (6) ***	−12.2 (32)

BL = Baseline; CT = complementary therapy providers—here, most often massage therapists; D = Deviance statistic with its degrees of freedom (number of parameters added over previous model), distributed χ^2; LBP = low back pain, 0–10 scale; NDI = Neck Disability Index, 0–100 scale; NP = neck pain, 0–10 scale; ODI = Oswestry Disability Index, 0–100 scale; OTC = Over-the-counter medications; Rx = Prescription medications

* The estimated coefficient or deviance statistic is statistically significant at p<.05.

** The estimated coefficient or deviance statistic is statistically significant at p<.01.

*** The estimated coefficient or deviance statistic is statistically significant at p<.001.