

ORIGINAL RESEARCH

Description of Common Clinical Presentations and Associated Short-Term Physical Therapy Clinical Outcomes in Patients With Neck Pain



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Abstract

Objective: To determine the effect of clinical presentations of neck pain on short-term physical therapy outcomes.

Design: Retrospective analysis of pair-matched groups from a clinical cohort.

Setting: Thirteen outpatient physical therapy clinics in 1 health care system.

Participants: Patients (N=1069) grouped by common clinical presentations of neck pain: nonspecific neck pain (NSNP) with duration <4 weeks; NSNP with duration >4 weeks; neck pain with arm pain; neck pain with headache; and neck pain from whiplash.

Intervention: Conservative interventions provided by physical therapists.

Main Outcome Measures: Neck Disability Index (NDI) and numerical pain rating scale (NPRS) recorded at the initial and last visits. The main outcome of interest was achieving recovery status on the NDI. Changes in NDI and NPRS were compared between clinical presentation groups.

Results: Compared with patients presenting with NSNP >4 weeks, patients with NSNP <4 weeks had increased odds of achieving recovery status on the NDI ($P<.0001$) and demonstrated the greatest changes in clinical outcomes of pain ($P<.0001$) and disability ($P<.0001$). Patients with neck pain and arm pain demonstrated an increased odds of achieving recovery status on the NDI ($P=.04$) compared with patients presenting with NSNP >4 weeks.

Conclusions: Treating patients with NSNP within <4 weeks of onset of symptoms may lead to improved clinical outcomes from physical therapy compared with other common clinical presentations.

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Neck pain is the second most common musculoskeletal disorder in population surveys and is associated with high injury and disability claims.^{1,2} It is generally accepted that neck pain has a favorable course of care,³ but there is variation in short-term outcomes in patients with neck pain.^{3,4}

Certain factors are known to be prognostic for the course of neck pain, and several interventions, including those provided by physical therapists, are likely to produce a favorable outcome.⁵⁻⁹ Approximately 35% of persons with neck pain reported being seen by a physical therapist, the most frequently visited provider,¹⁰ and evidence suggests that physical therapy can be an

effective secondary prevention strategy for neck pain.¹¹ In recent years, organized efforts have been made to improve clinical outcomes and standardize physical therapy treatment, including using classification system approaches. Fritz and Brennan¹² supported that subgrouping patients with neck pain and providing interventions matched to the patient classification improves short-term outcomes of pain and disability from physical therapy, but this approach has not been validated nor have other classification systems published in the literature been validated.^{13,14}

Therefore in this study, rather than introduce a new classification system, we wished to pragmatically examine a large cohort of patients with common clinical presentations of neck pain. The purposes of this study were to describe the demographics and

Disclosures: none.

clinical characteristics of patients receiving outpatient physical therapy for neck pain with 5 common clinical presentations, determine which clinical presentation groups experienced the greatest changes in clinical outcomes of pain and disability during an episode of care, and ultimately determine whether clinical presentation increases the odds of recovery from an episode of neck pain.

Methods

Participants

Patients included in this study received physical therapy intervention for the primary complaint of neck pain between January 1, 2008, and December 31, 2011, from 13 outpatient physical therapy clinics located in Salt Lake City, Utah and surrounding regions. A retrospective analysis of data was performed. Inclusion criteria for these analyses were as follows: (1) nonsurgical patient; (2) Neck Disability Index (NDI) score ≥ 10 and numerical pain rating scale (NPRS) ≥ 2 at initial evaluation; (3) ≥ 2 visits; and (4) duration of treatment (DOT) between 2 and 180 days. The criteria were implemented to permit the evaluation of clinical outcomes,^{12,15} that exceed measurement error.^{16,17} The study protocol was approved by the Institutional Review Board of Intermountain Healthcare.

Database

Data were extracted for this study from the Rehabilitation Outcomes Management System and the AS-400 financial databases. These databases contain demographic, clinical outcomes, and billing data that are maintained by Intermountain Healthcare, a private, nonprofit integrated health care system.

Outcome measures

At each visit, patients completed a condition-specific disability questionnaire, the NDI, and a pain rating scale, the NPRS. The NDI is a condition-specific outcome measure composed of 10 items; each item is scored from 0 to 5. The total score is expressed as a percentage and is reflective of a level of disability related to neck pain where high percentages are related to higher disability. The NDI is a commonly used outcome measure for people with neck pain and has been found to be reliable and valid in the neck pain population.¹⁸⁻²² The NPRS is an 11-point scale, anchored with 0 rated as “no pain” and 10 rated as “worst pain” imaginable. Patients are asked to rate their current pain using this scale. The NPRS exhibits fair to moderate test-retest reliability in patients with mechanical neck pain and shows adequate responsiveness in this patient population.^{16,23} The minimal clinically important difference for the NDI has been reported as a 19- percentage-point change (9.5 raw score), and the minimal clinically important

difference for the NPRS has been reported as a 1.3-point change in this population.²³

Clinical variables

Demographic and process variables were included in the clinical outcomes database including age, sex, number of physical therapy visits, and DOT. Records from the Rehabilitation Outcomes Management System database were linked to the AS-400 database using an enterprise master patient index number. The billing database contains Current Procedural Terminology (CPT) codes billed for physical therapy services during an episode of care. These codes are billed by the physical therapist and recorded in the AS-400 database at each visit. The billed CPT codes are reflective of the type of intervention provided by the physical therapist at each visit. Physical therapists contributing data to this analysis did not receive additional training on CPT coding for purposes of this study.

Clinical presentation

At initial evaluation, patients seeking care for neck pain were categorized into 1 of 5 clinical presentation groups by a physical therapist. These groups were created as broad categories to describe common clinical presentations of patients with neck pain by the rehabilitation department at Intermountain Healthcare in 2002 to evaluate clinical outcomes. Studies support that the clinical presentation of neck pain with arm pain,^{24,25} neck pain with headache,²⁶ and neck pain from whiplash²⁷ differ in their clinical course compared to patients with acute, subacute, or chronic nonspecific neck pain (NSNP).²⁸ This strategy has been implemented at Intermountain Healthcare since 2002, and there is a 94.5% adherence rate in collecting these clinical data by physical therapists.²⁹ Physical therapists were oriented to using this categorization method at clinical training sessions at the time of hiring and used the criteria in [table 1](#) for categorizing patients. Reliability of the categorization method by the physical therapists was examined by 1 author in this study by reviewing 100 randomly selected charts. The interrater reliability was found to be acceptable ($ICC_{2,2} = .91, P < .001$).

Patients were categorized into 1 of the following groups for comparison: (1) NSNP with duration < 4 weeks (NSNP < 4 wk); (2) NSNP with duration > 4 weeks (NSNP > 4 wk); (3) neck pain with arm pain; (4) neck pain with headache; and (5) neck pain from whiplash. The determination of the clinical presentations of headache, neck pain with arm pain, and whiplash were made based on patient self-report of symptoms related to the appropriate clinical presentation and objective tests found in [table 1](#). Although some patients may present with both temporal and clinical presentations consistent with multiple groups, by default, patients are categorized by their clinical presentation in the following hierarchy: whiplash, neck pain with arm pain, or neck pain with headache, and patients with NSNP are categorized by temporality of symptoms (duration < 4 wk or > 4 wk). Criteria for membership in clinical presentation groups can be found in [table 1](#).

Intervention

A variable, “% active treatment,” was calculated from CPT codes to reflect the type of physical therapy intervention received in lieu of specific data related to treatment. The algorithm used to calculate this variable has been previously published as a method

List of abbreviations:

CI	confidence interval
CPT	Current Procedural Terminology
DOT	duration of treatment
NDI	Neck Disability Index
NSNP	nonspecific neck pain
NPRS	numerical pain rating scale

Table 1 Criteria for membership in clinical presentation groups

Group	Criteria for Group Membership
NSNP <4wk	<ul style="list-style-type: none"> Recent onset of symptoms (<4wk)* No symptoms distal to the shoulder Restricted neck AROM
NSNP >4wk	<ul style="list-style-type: none"> No signs of nerve root compression Longer symptom duration (>4wk)* No peripheralization/centralization with AROM No signs of nerve root compression
Neck pain with arm pain	<ul style="list-style-type: none"> Peripheralization/centralization with AROM† Symptoms distal to shoulder† Signs of nerve root compression† Positive distraction, Spurling's, or upper limb tension testing†
Neck pain with headache	<ul style="list-style-type: none"> Unilateral-dominant headache with neck pain Headache associated with neck movements or positions* Tenderness in upper 3 cervical joints No migraine history or symptoms of migraine
Neck pain from whiplash	<ul style="list-style-type: none"> Recent onset of symptoms (<2wk) related to a traumatic onset (eg, MVC)*

Abbreviations: AROM, active range of motion; MVC, motor vehicle collision.

* Patients must present with this key finding to be categorized in the clinical presentation group.

† Patients may present with any one of these findings to be categorized in this group.

to describe the type of treatment received when using a database to analyze rehabilitation outcomes and to reflect adherence to clinical practice guidelines.^{15,30} CPT codes billed were categorized as “active + manual therapy,” “passive,” or “allowed.” Codes classified as active + manual therapy indicated procedures consistent with clinical guidelines for neck pain and represent interventions such as stretching and strengthening exercises, centralization exercises, upper quarter and nerve mobilization procedures, and spinal manipulation and mobilization (97110, 97350, 97535, 97112, 97150, 97140).¹⁴ The codes classified as passive indicated procedures that were primarily modalities or mechanical traction (97035, 97010, 97032, 97012, 97124, 97024, 97026). Allowed codes represent procedures that could not be adequately categorized to reflect adherence to guidelines and were not included in calculations. The number of active + manual therapy codes and passive codes billed at each visit was recorded. The proportion of active + manual therapy codes to overall codes was calculated and then expressed as a percentage, using the following formula:

$$\% \text{ Active Care} = \left(\frac{[\text{No. of Active + Manual Therapy Codes}]}{[\text{No. of Active + Manual Therapy Codes} + \text{No. of Passive Codes}]} \right) \times 100$$

Outcomes

During an episode of care, patients completed the NDI and NPRS. Scores from the initial visit and final visit were recorded. Change in NPRS and change in NDI scores were calculated for each patient in the sample. This was calculated by subtracting the score at the last visit from the initial score for the NPRS and NDI. The NDI was further dichotomized to reflect disability status at the last visit. Patients reporting an NDI percentage score of 8% or less

were categorized as “recovered,” and patients reporting a score of 9% or greater were further categorized as “not fully recovered.” Vernon,³¹ the developer of the original NDI, cites that a score of 8% points (4 raw points) on the NDI is reflective of no disability related to neck pain.³¹ Sterling and Kenardy³² established 8% points on the NDI as a cutoff to determine if a patient has recovered from an episode of neck pain, and this cutoff is commonly used in clinical practice and research.

An episode of physical therapy was defined as the physical therapy treatment provided from the initial evaluation to the date of the last visit for a patient. For each episode of care included in the sample, the DOT was defined as the number of days between the initial evaluation and the last visit. The last visit was defined as the last visit recorded for a uniquely identified episode of care. The DOT also reflects the follow-up time for the outcome measures. The number of visits was defined as the number of visits that patients attended during an episode of care.

Data analysis

Data analysis was performed using SPSS statistical software (version 21.0^a). The significance level for all analyses was set at .05.

Our main outcome of interest in this study was “recovery” from an episode of neck pain. Preliminary analyses revealed a significant difference in the variable “% active treatment” (a proxy measure for physical therapy intervention) between recovery groups ($t=2.58, P=.01$). Therefore, to reduce the bias associated with potential differences in the physical therapy intervention provided between groups, pair-matched sampling was performed. Pair matching was performed using exact matches between recovery groups on the continuous variable of % active treatment using the method described by Cochran³³ and Rubin.³⁴ This method reduces the bias associated with the effect of treatment and increases the precision of estimates.³⁴ This method was selected over propensity score matching because of the desire to minimize the bias associated with the effect treatment rather than adjust for multiple baseline characteristics.³⁵ After pair matching was performed and incomplete observations were removed, 1069 episodes of care were included in the final analysis. Derivation of the final sample for analysis can be found in [figure 1](#).

Descriptive statistics were calculated to characterize the clinical presentation groups in this sample. Means and SDs were reported for continuous variables, and percentages were reported for categorical variables. Baseline patient characteristics, clinical outcomes, and physical therapy utilization were compared among clinical presentation groups using chi-square analyses for categorical variables and 1-way analyses of variance for continuous variables.

To determine which groups experienced the greatest changes in clinical outcomes during an episode of care, separate analysis of covariance models were performed to examine the effect of clinical presentation group on the dependent variables of change in NDI score and change in NPRS during an episode of physical therapy. Covariates for both models included sex, age, DOT, and visits. To determine the difference in the odds of achieving “recovery” on the NDI, binary logistic regression was performed where clinical presentation group was the main predictor of interest and the covariates in the model included DOT, number of visits, sex, and admission NDI score. Model selection for all analyses was performed using an initial set of potentially confounding variables based on previous literature on prognostic factors^{14,36} and conceptually driven variables.³⁷ Variables were

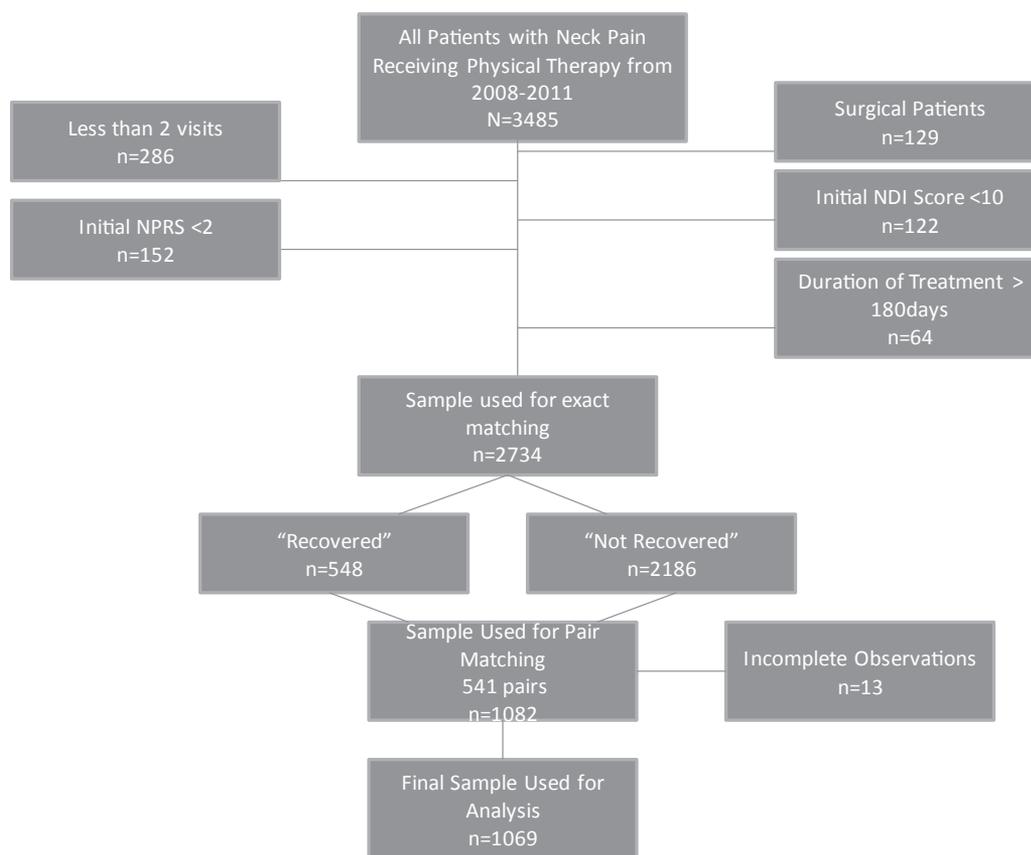


Fig 1 Derivation of sample used in final analysis.

removed if they did not improve model fit as measured by the explained variance in the exploratory models.

Results

The NSNP >4 weeks group comprised 38.7% of the total sample followed by the neck pain with arm pain group (22%), NSNP <4 weeks neck pain (17.3%), headache with neck pain (12.8%), and whiplash (7.8%).

Patients in the whiplash group were the youngest with a mean age \pm SD of 41.82 ± 16.02 years, and the oldest group were patients in the NSNP >4 weeks group aged 53.33 ± 17.14 years. Most of the sample in each clinical group were women with percentages ranging from 56.5% to 79.9%, with the highest percentage of women in the headache group and the lowest percentage of women in the neck pain with arm pain group.

The mean DOT varied between approximately 24 and 40 days. Patients with NSNP <4 weeks had the shortest DOT \pm SD (23.64 ± 21.93 d), and the whiplash group had the longest DOT (39.81 ± 31.83 d). The mean \pm SD number of visits ranged from 5.09 ± 3.21 for patients with NSNP <4 weeks to 7.01 ± 4.34 for patients in the whiplash group (table 2).

There was a significant effect of clinical presentation on change in disability ($F_{4,1053} = 13.577$, $P \leq .0001$), where the greatest change in NDI was demonstrated by the patients in the NSNP <4 weeks group (20.25 points; 95% confidence interval [CI], 18.07–22.44), and the least amount of change was

reported in the NSNP >4 weeks group (10.96 points; 95% CI, 9.46–12.46). There was also a significant effect of clinical presentation on change in pain ($F_{4,1051} = 8.64$, $P \leq .0001$), where again the greatest change was demonstrated by the patients in the NSNP <4 weeks group (3.24 points; 95% CI, 2.87–3.61), and the least amount of change was reported in the NSNP >4 weeks group (2.01 points; 95% CI, 1.75–2.26) (table 3).

When compared with the NSNP >4 weeks group, patients in the NSNP <4 weeks group demonstrated 2.17 times ($P < .0001$; 95% CI, 1.44–3.27) the odds of achieving recovery status on the NDI, and patients in the neck pain with arm pain group ($P = .04$; 95% CI, 1.01–2.07) demonstrated 1.44 times the odds of achieving recovery status (table 4).

Discussion

The purposes of this study were to describe the clinical characteristics and compare clinical outcomes in patients with 5 common clinical presentations receiving outpatient physical therapy services for neck pain. The findings of this study support that patients with 5 common clinical presentations of neck pain vary in their clinical outcomes related to physical therapy intervention. Comparing patients with common clinical presentations of neck pain revealed that patients with NSNP <4 weeks demonstrated the greatest improvements in pain (NPRS) and disability (NDI), and demonstrated increased odds of achieving recovery on the NDI. Conversely, patients with NSNP >4 weeks had the poorest

Table 2 Description of common clinical presentation groups

Variable	Clinical Presentation					P*
	NSNP <4wk (n=187)	NSNP >4wk (n=419)	Neck Pain With Arm Pain (n=239)	Neck Pain With Headache (n=139)	Neck Pain From Whiplash (n=85)	
Age (y)	45.33±15.64	53.33±17.14	51.57±12.23	43.81±15.98	41.82±16.02	<.001
Women (%)	62.6	66.3	56.5	79.9	76.65	<.001
DOT (d)	23.64±21.93	32.29±25.70	30.24±25.07	32.58±25.02	39.81±31.83	<.001
Visits	5.09±3.21	5.36±2.75	6.00±3.98	5.54±3.54	7.01±4.34	<.001
Initial NDI	37.04±16.75	31.01±14.80	32.41±15.37	31.79±15.37	35.33±16.39	<.001
Final NDI	16.37±16.63	19.61±17.11	17.91±16.94	18.32±16.35	17.35±15.74	.25
Change NDI	20.67±16.66	11.41±14.15	14.49±14.57	13.47±13.41	17.98±16.20	<.001
Initial NPRS	5.66±2.23	4.95±2.09	5.41±2.24	5.06±2.34	5.26±2.01	.002
Final NPRS	2.36±2.42	2.92±2.36	2.49±2.31	2.83±2.29	2.55±2.31	.04
Change NPRS	3.29±2.60	2.03±2.36	2.92±2.62	2.23±2.66	2.70±2.41	<.001
% Achieved recovery on NDI	54.0	47.3	53.1	48.9	48.2	.47
% Change in NDI	56.48±56.95	37.29±33.89	46.19±41.70	43.95±38.28	49.19±45.25	<.001
% Change in NPRS	58.82±36.61	39.12±49.89	51.87±41.99	37.28±57.02	51.65±40.19	<.001

NOTE. Values are mean ± SD or as otherwise indicated.

* P value, significant at .05 level.

outcomes across all metrics. Patients with the clinical presentation of whiplash behave similarly to patients with a duration of symptoms <4 weeks when looking at clinical outcomes, but have a longer DOT and a greater number of visits during an episode of physical therapy, which is consistent with the literature.³⁸ Patients in the neck pain with arm pain and headache groups varied in their clinical outcomes, consistent with the literature on general prognostic factors related to these presentations.^{25,39}

Moreover, our sample is consistent with the demographics of patients with neck pain, with patients being primarily women and having a mean age in the mid-40s.⁴⁰ The number of physical therapy visits and DOT reported in our sample was also consistent with the literature for patients with musculoskeletal conditions.²⁹ Short-term disability and pain outcomes³¹ reflect values that are consistent with patients receiving conservative treatment.³¹

Although our findings are consistent with the literature on the general prognosis of neck pain, this study adds valuable information on short-term outcomes from physical therapy. Across all metrics, patients with a duration of symptoms <4 weeks have the greatest improvements and have increased odds of recovery compared with other clinical presentations. Intuitively, one would suspect this could be attributed to natural recovery. Farrar⁴¹ and Vernon⁴² and colleagues found that change scores in pain and disability attributable to natural recovery are not generally greater

than 15% to 20%. In this study, the NSNP <4 weeks group demonstrated a 56.48% improvement in disability and a 58.82% improvement in pain, well surpassing estimates of natural recovery. The finding of improved outcomes with early care has been supported not only in the neck pain literature^{28,43} but also in the low back pain literature.⁴⁴ These convergent findings suggest consideration of practice or policy level changes in the future if more efficient management of spine pain is to be realized.

Study limitations

There are limitations in the current study. The follow-up time in this study was relatively short, ranging from 24 to 40 days in each group, and there were no long-term follow-up data available on outcome measures. Although this is a limitation, it is not inconsistent with studies examining physical therapy short-term outcomes.¹⁷ Patients were categorized based on common clinical presentations, and within each group there is the potential for variability in the type of patient included in that grouping. In the temporally based groups, patients in each group may vary with the actual duration of their symptoms, which may affect outcomes. In the symptom-based groups, the literature supports differential expected outcomes regarding patients with graded whiplash diagnoses,⁴⁵ but data on whiplash grading was not available for use

Table 3 Adjusted mean difference in clinical outcomes between clinical presentation groups

Outcomes	NSNP <4wk (n=187)	NSNP >4wk (n=419)	Neck Pain With Arm Pain (n=239)	Neck Pain With Headache (n=139)	Neck Pain From Whiplash (n=85)
Change in pain (NPRS)	3.24 (2.87–3.61)	2.01 (1.75–2.26)	2.82 (2.50–3.14)	2.28 (1.75–2.81)	2.89 (2.26–3.53)
Change in disability (NDI)	20.25 (18.07–22.44)	10.96 (9.46–12.46)	13.90 (12.03–15.77)	14.04 (11.01–17.07)	19.62 (15.92–23.31)

NOTE. Values are adjusted means (95% CIs). Covariates included in models: (1) change in NDI score: sex, age, DOT, visits; (2) change in NPRS score: sex, age, DOT, visits.

Table 4 Odds of achieving recovery status on NDI

Variable	aOR	P	95% CI for aOR	
			Lower	Upper
Clinical presentation				
NSNP >4wk	Ref	NA	NA	NA
NSNP <4wk	2.17	<.0001	1.44	3.27
Neck pain with arm pain	1.44	.04	1.01	2.07
Neck pain with headache	1.15	.52	0.75	1.77
Neck pain from whiplash	1.35	.26	0.79	2.31
DOT (d)	0.99	.35	0.99	1.00
Visits	1.05	.08	0.99	1.10
Sex				
Male	Ref	NA	NA	NA
Female	1.07	.61	0.81	1.43
Age	1.00	.75	0.99	1.01
Admission NDI score	0.93	<.001	0.92	0.94

Abbreviations: aOR, adjusted odds ratio; NA, not applicable; Ref, reference.

in this study. Additionally, there is a great deal of variability in patients presenting with neck pain and associated arm pain, where symptoms can be mild to severe with complaints of nerve root compression. We fully acknowledge that heterogeneity exists within the groups, but see it rather as a strength of the study. This heterogeneity may be more reflective of general practice, where clinicians may not have access to evidence on whiplash grading or diagnostic techniques to assess the severity of neck pain and arm pain.

Conclusions

Understanding factors that can influence the clinical outcomes from physical therapy in patients with neck pain is paramount to decrease the burden neck pain places on the individual and the health care system, and to inform rehabilitation professionals. The current study supports that there is variation in outcomes from conservative physical therapy intervention between clinical presentations, but receiving physical therapy intervention for NSNP when the duration of symptoms is <4 weeks can lead to improved clinical outcomes. The clinical implications of these findings supports that patients should seek timely care during an episode of neck pain to improve short-term clinical outcomes.

Supplier

a. SPSS statistical software (version 21.0); IBM Corp.

Keywords

Disability evaluation; Neck pain; Outcome assessment (health care); Rehabilitation

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