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ORIGINAL ARTICLE

Exploring the Clinical Course of Neck Pain in Physical Therapy: A Longitudinal Study

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Abstract

Objective: To investigate the short-term trajectory of recovery from mechanical neck pain, and predictors of trajectory.

Design: Prospective, longitudinal cohort study with 5 repeated measurements over 4 weeks.

Setting: Community-based physical therapy clinics.

Participants: Convenience sample of community-dwelling adults (N=50) with uncomplicated mechanical neck disorders of any duration.

Interventions: Usual physical therapy care.

Main Outcome Measures: Neck Disability Index (NDI), numeric rating scale (NRS) of pain intensity.

Results: A total of 50 consecutive subjects provided 5 data points over 4 weeks. Exploratory modeling using latent class growth analysis revealed a linear trend in improvement, at a mean of 1.5 NDI points and 0.5 NRS points per week. Within the NDI trajectory, 3 latent classes were identified, each with a unique trend: worsening (14.5%), rapid improvement (19.6%), and slow improvement (65.8%). Within the NRS trajectory, 2 unique trends were identified: stable (48.0%) and improving (52.0%). Predictors of trajectory class suggest that it may be possible to predict the trajectory. Results are described in view of the sample size.

Conclusions: The mean trajectory of improvement in neck pain adequately fits a linear model and suggests slow but stable improvement over the short term. However, up to 3 different trajectories have been identified that suggest neck pain, and recovery thereof, is not homogenous. This may hold value for the design of clinical trials.

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Physical therapy is a common treatment for neck-related pain and disability, a condition affecting an estimated one third of North American adults over a 1-year period.[1] Physical therapy refers to nonmedical rehabilitation that may include advice, education, manual treatment, thermal or electrical modalities, and specific exercise. Evidence to support many of these approaches is scant overall.[2,3] Given the nature of physical therapy interventions, empirical research data are drawn from usually nonblinded, pre-post randomized designs. While these designs are appropriate for demonstrating effectiveness, observational designs with repeated measurements at frequent intervals are more able to provide detailed knowledge on the trajectory of change in a condition. Knowing the trajectory of change, or *clinical course* of a condition, facilitates clinical research design, treatment planning, and policy decisions. In order to establish the clinical course, repeated measures designs are required. Since clinical course cannot be assumed to be homogenous between individuals, factors that influence the clinical course are also important to recognize. Evidence of long-term recovery trajectories has been provided previously,[4] but shorter-term (<6wk) trajectories, of the duration often seen in clinical practice, are less explored.

We sought to explore the clinical course of mechanical neck pain and disability as it changed over 1 month of usual care (nonspecialized) outpatient physical therapy treatment. The purpose of this pilot longitudinal study was to identify the standard trajectories of improvement in this heterogenous condition, the relative proportion of subjects within each trajectory, and the clinical variables that may influence this trajectory.

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Methods

This was an observational longitudinal design with 5 repeated measures. Subjects were recruited from 1 of 5 community-based outpatient physical therapy clinics in Canada if they presented for treatment of mechanical neck pain or disability of any duration, were between 18 and 65 years of age, and could speak and understand conversational English. Eligible subjects had to rate their worst level of neck pain intensity over the previous 24 hours between 2 and 9 out of 10. Subjects were excluded if the cause of their symptoms was fracture, dislocation, tumor (benign or malignant), or infection, or if they had neuromuscular disease or rheumatic conditions (eg, fibromyalgia). Informed, written consent was obtained before enrollment, and all methods were approved by the institutional research ethics board at Western University Canada.

Data were collected on initial presentation to the clinician (t0), then every week for the following 4 weeks (t1, t2, t3, t4). When subjects were discharged or discontinued physical therapy before the final follow-up period (n=2), their data for the final period were considered missing for the purposes of statistical analysis. Subjects completed a demographics form and reported the presence of radiating pain to either upper extremity (yes/no), usage of any medication specifically for neck pain within the past 24 hours (yes/no), number of pain locations on a segmented body diagram, worst pain intensity on a numeric rating scale (NRS) (0−10),[5] fear of movement/(re)injury using the Tampa Scale for Kinesiophobia 11-item version (TSK-11, 0−33),[6] and neck-related disability using the Neck Disability Index (NDI) (0−50).[7] The 3 formalized questionnaires (NRS, TSK-11, NDI) have been evaluated in clinical populations with neck pain and have satisfactory psychometric properties.[8,9] When subjects missed a scheduled data collection point, their data for that point were coded as missing, and data collection resumed at the next weekly interval. Treatment was individualized to each patient according to usual physical therapy procedures and included any or all of the following: manual joint mobilization, soft tissue stretching, physical modalities, specific exercise prescription, and advice and education.

Analyses

Descriptive analyses (frequencies, means and SDs) were calculated to describe the sample. Using latent growth curve analysis for each of the primary variables (NRS, NDI), we assessed whether a linear or quadratic growth model provided the best fit to the data while controlling for duration of symptoms. Basic fit indicators were used to determine model fit. They were (including standards for "good" fit) comparative fit index (>.90), Tucker-Lewis Index (>.90), root mean square error of approximation (<.08), and chi-square (P>.05). Latent class growth analysis (LCGA) was then conducted to identify the number of latent NDI and NRS trajectories (latent classes) that were present within the sample. As described by Jung and Wickrama,[10] we started by specifying a single class model without covariates to establish baseline fit indices. Then additional (k) classes were requested until the Bayesian information criterion (BIC) was lowest while the bootstrapped likelihood ratio test (BLRT) no longer showed a significant improvement in model fit over the k-1 class model, and entropy was closest to 1.0. BIC and BLRT have been endorsed as the most accurate model fit statistics for determining the number of latent classes.[11] Sample size for this hypothesis-generating exploratory study was estimated at 50 subjects. Consensus on sample size calculation for latent class analysis has yet to be reached, being dependent on the separation of classes and relative proportions of subjects per class. As an exploratory study, 50 subjects was deemed adequate to provide guidance for future research in the area.

Analysis of variance (continuous data) or chi-square (categorical data) was used to determine the ability of any of the baseline variables (sex, age, duration of symptoms, radiating symptoms, use of pain medication, traumatic cause, number of pain locations, baseline NDI, NRS, or TSK-11) to discriminate between the trajectory classes. The model fitting procedures were conducted using MPlus software version 6.12,[a] and the class membership comparisons were conducted in SPSS version 20.[b]

List of abbreviations:

BIC	**Bayesian information criterion**
BLRT	**bootstrapped likelihood ratio test**
CI	**confidence interval**
LCGA	**latent class growth analysis**
NDI	**Neck Disability Index**
NRS	**numeric rating scale**
TSK-11	**Tampa Scale for Kinesiophobia 11-item version**

Table 1 Characteristics of sample (N=50) and distribution of primary variables

Characteristics	Values
Sex (women)	76.5
Age (y)	39.9±14.3 (18−64)
Duration of symptoms	
<3wk	18
3wk to 6mo	54
>6mo	28
Radiating pain	37.3
Currently taking pain medications	19.6
Cause	
Traumatic	54
Nontraumatic	46
Variables	
NDI	15.5±6.8 (4−33)
NRS	5.5±1.8 (2−9)
TSK-11	12.5±5.9 (0−28)

NOTE. Values are % or mean ± SD (range).

Results

Between January 2010 and January 2012, 50 subjects were enrolled and completed the study. Of the final 50, 1 subject was lost to follow-up after 2 weeks (providing 3 of 5 data points), and 1 additional was lost after 3 weeks (providing 4 of 5 data points). Table 1 presents the descriptive statistics of the final sample and distributions of the primary variables.

Mean NDI at baseline was 15.5±6.8, improving to 10.7±8.3 after week 4 (P<.01). Mean NRS at baseline was 5.5±1.8, improving to 4.0±2.4 after week 4 (P<.01). Figure 1 shows the duration-controlled observed and estimated trajectories of the main outcomes (NDI, NRS). The quadratic term was not significant in