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# Pain Neuroscience Education for Physical Therapy Assistant Students: An Exploratory Study

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## Abstract

**Background:** The chronic pain epidemic requires all healthcare providers to develop an updated, uniform understanding of modern pain science.

**Objective:** To determine if a 2-hour pain neuroscience education lecture to physical therapy assistant (PTA) students yields any positive shifts in pain knowledge and attitudes and beliefs regarding chronic pain.

**Design:** Pre and post-education survey

**Methods:** A convenience sample of PTA students at two schools volunteered for the study. Students received a 2-hour pain neuroscience lecture, either in-person or live, online. Prior to and immediately following the presentation, knowledge of pain (revised neurophysiology of pain questionnaire) and attitudes and beliefs regarding pain (health care provider's pain and impairment relationship scale and pain attitudes and beliefs scale) were administered.

**Results:** Thirty-five students completed the pre- and post-education surveys. No significant changes were found in pain knowledge, ($p = 0.241$). Interestingly, nearly all (94.3%) of the students were exposed to pain neuroscience education prior to the lecture in their PTA program, with high pre-education pain knowledge scores then previous studies investigating student pain knowledge Significant changes were found for the health care provider's pain and impairment relationship scale ($p = 0.01$), and pain attitudes and beliefs scale for biomedical beliefs ($p = 0.014$), but not the biopsychosocial scale ($p = 0.142$).

**Conclusion:** PTA students in this study had a lot of previous exposure to pain education, leading to high pain knowledge levels. A lecture on pain neuroscience can shift physical therapy assistant students away from a pure biomedical view of chronic pain and increase their empathy and compassion towards patients with chronic pain, but it is not able to foster a stronger biopsychosocial view of chronic pain.

**Keywords:** Physical Therapy; Assistants; Pain Neuroscience Education; Chronic Pain

## Abbreviations

COVID-19: Corona Virus of 2019; HC-Pairs: Health Care Provider's Pain and Impairment Relationship Scale; PABS: Pain Attitudes and Beliefs Scale; PABS-BM: Pain Attitudes and Beliefs Scale Biomedical; PABS-BPS: Pain Attitudes and Beliefs Scale Biopsychosocial; PNE: Pain Neuroscience Education; PT: Physical Therapist; PTA: Physical Therapist Assistant; rNPQ: Revised Neurophysiology of Pain Questionnaire; US: Unites States.

## Introduction

Chronic pain is a global epidemic, with epidemiological data showing the rates of chronic pain doubled in the last 4-5 decades [1,2]. In the United States (US), chronic pain was primarily addressed from a pharmacological perspective, which culminated in the well-documented opioid epidemic in the mid-to last part of the previous decade [3,4]. In lieu of the significant attention to the opioid epidemic, including addiction and mortality rates, various initiatives were undertaken to curb the opioid and pain epidemic [4]. Unfortunately, the Coronavirus of 2019 (COVID-19) increased the rates of chronic pain, including higher rates of comorbid mental and behavioral health issues, social isolation, decreased physical activity, and more, resulting in an ever-increasing pain epidemic [5].

To date, very few interventions have shown an ability to curb the opioid and pain epidemic [4] significantly. It can, however, be agreed upon that a solution should favor a safe, non-pharmacological, evidence-based approach aiming to empower self-efficacy in people with chronic pain [6,7]. To this end, institutions such as the National Institute of Health Institute have increased funding for studies exploring non-pharmacological and non-traditional treatments for chronic pain. These treatments, often within the realm of rehabilitation, i.e., physical therapy (PT), occupational therapy, chiropractic, massage therapy, etc., may focus on various forms of movement and exercises, hands-on treatments, breathing, relaxation, improved sleep hygiene, consultation on nutrition, stress-reduction, etc. In PT, as an example, it has been shown that teaching patients more about their pain experience (pain neuroscience education – PNE), combined with different forms of movement-based therapy (i.e., exercises), is able to decrease self-reported pain and disability, improve cognitions (fear-avoidance and pain catastrophizing), and increase movement [8-10].

A key part of any strategy aimed at the chronic pain epidemic will involve the workforce dedicated to delivering the treatments [11]. To truly impact the chronic pain epidemic, it is essential that all healthcare providers develop a unified front, including their base knowledge of pain science [11-13]. Given the advances in the understanding of pain, various studies explored, and continued to explore, pain knowledge in healthcare providers and strategies to educate healthcare providers about modern pain science – PNE. Nearly a dozen studies have shown that teaching healthcare providers more about pain increases their knowledge of pain, increases empathy and compassion towards people in chronic pain and yields some preliminary evidence of improved outcomes [11-15]. To date, however, most studies have focused on primary providers, i.e., physicians, physical therapists, occupational therapists, etc., with little to no studies on extenders, such as physician assistants, physical therapist assistants or occupational therapy assistants. In PT it is common practice that PT assistants (PTA), often see patients with chronic pain, yet no study to date has specifically examined PNE for PTA's. Two recent studies examined the effect of PNE on another extender healthcare professional group – physician assistants [16,17]. In these studies, it was shown that physician assistant students taught PNE increase their knowledge of pain, positively shift attitudes towards people in pain, and shift treatment choices towards more non-pharmacological approaches [16,17]. The aim of this study was to determine what, if any, positive effects a PNE lecture may yield for PTA students.

## Methods

### Participants and Procedure

Participants consisted of a convenience sample of PTA students at 2 PTA schools. Prior to the study, institutional review board approval was obtained at the University of South Dakota for the study. Electronic consent was obtained from students participating in the study through the accepting to complete survey responses.

### Educational Protocol

The content of the lecture has been used in a previous PNE physician assistant study described elsewhere [17]. In short, the PTA lecture was a 2-hour lecture using PowerPoint™ to teach PTA students about the neurophysiology and neurobiology of pain [18]. The presentation was done either live (in person) at one school and synchronous/online at another. The lecture covered content regarding challenges with current biomedical approaches to treating chronic pain and updated neuroscience of pain information (ion channels, nociceptive input, dorsal horn wind-up, neuronal facilitation/inhibition, pain matrix, environmental and stress effects on pain perception) [12,17]. The content focused on pain neuroscience and did not cover any content specific to the pre- and post-education questionnaire. The 2h lecture was chosen due to its ability to positively change pain knowledge, attitudes and beliefs regarding pain and fit

into class schedules [7]. The lecture was delivered by one of the authors (CK), who completed an advanced post-graduate pain certification.

### Instrument

Four different surveys were used in the study:

**Demographics:** Part one focused on demographics including gender, age, race, hours of previous pain education, current pain, numeric pain rating scale (0-10), history of chronic pain, history of family member with chronic pain.

**Pain Knowledge (Revised Neurophysiology of Pain Questionnaire – rNPQ):** The rNPQ was used to measure the individual participant's knowledge of pain [19]. The rNPQ is a 12 question true/false method of assessing an individual's knowledge of why pain is perceived and the biological mechanisms involved in a pain experience. Unmarked or undecided answers are keyed as incorrect responses in accordance with questionnaire instructions. Higher scores demonstrate a higher level of knowledge of current pain neurophysiology principles. The rNPQ has shown good test-retest reliability and adequate psychometric properties [19]. Studies using the rNPQ and original NPQ for healthcare providers show a mean pre-PNE score of approximately 50% and a mean increase of 30% after a typical PNE lecture [13,14,17,20].

**Pain attitudes and beliefs (Health Care Provider's Pain and Impairment Relationship Scale (HC-Pairs):** Attitudes and beliefs regarding chronic (low back) pain were measured using the HC-PAIRS [11,21], Specifically designed to assess attitudes and beliefs about chronic low back pain, the HC-PAIRS was used in this study as an assessment of attitudes and beliefs regarding chronic pain, with the low back provided as one example of chronic pain. The HC-PAIRS has 15 questions with responses marked on a 7-point Likert scale anchored on one end with "Completely Disagree" and on the other with "Completely Agree" [11,22]. When used to measure attitudes and beliefs of healthcare providers regarding chronic low back pain, this scale has been shown to have high reliability, internal consistency, and discriminant validity [22]. Scores vary from low (15) to high (105), with a lower total score suggestive of positive beliefs and attitudes that pain complaints do not justify impairments and disability and a high score denoting a strong conviction that pain and physical impairment are strongly linked together. The HC-PAIRS was previously used with PT and osteopathic medicine students [11,23].

**Pain Attitude and Beliefs:** The Pain Attitude and Beliefs Scale (PABS) is a self-administered questionnaire to evaluate the different treatment orientations with healthcare providers [24,25]. A "biomedical" (BM) treatment orientation is related to the provider believing that pain and disability are direct consequences of a specific tissue pathology. The "biopsychosocial" (BPS) orientation is centered around the provider's beliefs that pain is not always a sign of tissue damage and can be influenced by various psychological and social factors. The 14-item PABS was used with 7 items related to BM orientation and 7 items related to BPS orientation, each scored on a 1-6 Likert scale (1 = totally disagree, 6 = totally agree) [26-28]. The PABS has shown good internal consistency with Cronbach's α mostly > 0.6, with positive construct validity and positive reliability with ICC on biomedical factors at 0.81 and the biopsychosocial factors at 0.65 [28].

The study design was a pre- and post-single cohort measurement. Twenty-four hours prior to the PNE presentation, PTA students were given a link to complete an online (Qualtrics) questionnaire. Students then attended the in-person lecture provided at the university as part of their course work. Afterward, they were invited to complete the post-lecture questionnaire through the online Qualtrics link within 24 hours after the lecture. Students who did not consent to the surveys did receive the education as part of their normal PTA curriculum.

### Statistical Analysis

All statistics were performed using IBM SPSS Statistics, version 28.0 (IBM Corp., Armonk, N.Y., USA) using the significance threshold of $\alpha<0.05$. Descriptive statistics of means, standard deviations, and frequencies were calculated for the sample participants. A sample estimate of 34 subjects was determined using G-Power 3.1 (University of Kiel, Germany), based on an effect size d = 0.5 (medium) and a statistical power of 0.80 for a two-tailed paired samples t-test. A paired sample t-test was performed on the group's rNPQ, HC-PAIRS, PABS-BM, and PABS-BPS to look for significant differences in pre and post-test scores. The mean difference was calculated along with the standard deviation for comparing pretest and post-test scores. The effect size was calculated for each utilizing Cohen's d (difference between the means divided by the pooled standard deviation). Interpretation of the effect size was reported per Cohen [29,30] as small $d\leq0.20$), medium ($d\leq0.50$), and large ($d\leq0.80$).

## Results

Thirty-five total students (Tucson, n=14 and Mesa, n=21) consented and completed the PNE session as part of their coursework and took pre and post-test surveys. Scores were matched pre and post-test based on unique identifying code. See Table 1 for complete demographic information on the students. Thirty-one students had some formal PNE training before this educational session, and 27 had informal training (self-taught) sessions prior to this PNE session.

Two of the four students who did not have formal training before this session did have some informal training. Formal training averaged 3.2 hours (SD=5.73) and informal training averaged 3.54 hours (SD=6.43).

| | N=35 | Tucson (n=14) | Mesa (n=21) |
|---|---|---|---|
| Age, y (mean, SD) | 26.46 (5.74) | 25.43 (3.32) | 27.14 (6.89) |
| Gender, F (N, %) | 21 (60%) | 9 (64.3%) | 12 (57.1%) |
| Race (N, %) | | | |
| Asian | 2 (5.7%) | 1 (7.1%) | 1 (4.8%) |
| Black | 1 (2.9%) | | 1 (4.8%) |
| Hispanic | 8 (22.9%) | 3 (21.4%) | 5 (23.8%) |
| Mid-eastern | 1 (2.9%) | | 1 (4.8%) |
| White | 22 (62.9%) | 10 (71.4%) | 12 (57.1 %) |
| Other | 1 (2.9%) | | 1 (4.8%) |
| Previous PNE (N, %) | 33 (94.3%) | 14 (100%) | 19 (90.5%) |

y=years, SD=standard deviation, F=female, PNE=pain neuroscience education

**Table 1:** Demographics.

Evaluation of pretest scores to post-test scores for NPQ, HC-PAIRS, PABS-BM, and PABS-BPS are found in Table 2. There was a non-significant shift in pain knowledge based on the change of NPQ scores from the pretest to post-test. HC-PAIRS showed a small effect size and significant change with decreased scores from the pretest to the post-test. This decrease in score demonstrates the students had less belief that pain was related to disability after the educational session. Only the PABS-BM score had a small effect from the PNE training session. Students shift to less biomedical beliefs after the training. The biopsychosocial score shift was not significant.

| | Pretest score, mean (SD) | Posttest score, mean (SD) | Mean difference (SD) | p-value | Effect size (Cohen's d) |
|---|---|---|---|---|---|
| NPQ | 8.00 (2.14) | 8.49 (2.22) | 0.49 (2.41) | 0.241 | 0.202 |
| HC- PAIRS | 68.91 (8.86) | 62.91 (14.43) | -6.00 (13.07) | 0.010* | 0.459 |
| PABS-BM | 26.20 (4.48) | 23.29 (6.65) | -2.91 (6.67) | 0.014* | 0.437 |
| PABS-BPS | 28.31 (3.29) | 29.74 (6.09) | 1.43 (5.63) | 0.142 | 0.254 |

NPQ=Neurophysiology of Pain Questionnaire, HC-PAIRS=Health Care Provider's Pain and Impairment Relationship Scale, PABS-BM=Pain Attitudes and Beliefs Scale-Biomedical subscale, PABS-BPS=Pain Attitudes and Beliefs Scale-Biopsychosocial subscale, SD=standard deviation. * Statistically significant

**Table 2:** Pre and Post-test Scores.

## Discussion

To our knowledge, this is the first documented PTA-specific PNE study. The results show that PTA students already have early exposure to PNE in their training and that the addition of a PNE lecture positively shifts their attitudes and beliefs regarding patients with chronic pain and decreases a purely biomedical approach to viewing chronic pain. No significant changes are seen on pain knowledge and shift towards a more biopsychosocial approach.

The study's primary objective was to determine if adding a PNE lecture increases pain knowledge scores in PTAs, comparable to previous studies on PTs. This study showed no significant increase in pain knowledge, compared to previous PT and non-PT studies [12-14]. In this study, however, PTA students started with a pain knowledge of 66.7% and post-education improved to 70.1%. In contrast, Cox, et al. taught PT students a similar PNE lecture, with pre-education levels of pain knowledge as 41.1%, and post-education levels as 87.4% [14]. Similarly, supporting the results of this study, Louw, et al. showed that a multidisciplinary lecture on PNE for healthcare providers, which included PTs, started with a mean pain knowledge score of 80%, and post-education of 88.5%, indicating that a high start score, limited to the possibility of shifting this score meaningfully [13]. This

argument is further fueled by the self-reported data from this study showing that 94.3% of the PTA students reported previous knowledge and exposure to PNE. This finding is encouraging. In PT, there has been a large push for PT (and PTA schools) to adopt (and teach) the International Association for the Study of Pain guidelines for pain [31]. This study may show early adoption of these guidelines within PTA schools. Additionally, as PNE research increases and more papers are published and more regional and national conferences feature PNE-related content, it may also filter its way into the current PT and PTA landscape.

Two belief scales shifted significantly following the PNE lecture. First, the HC-PAIRS shifted positively, which has been shown to correlate to increased compassion and empathy towards patients with chronic pain [14,32]. This is encouraging since empathy and compassion play critical roles in developing trust in the patient and their healthcare provider and strengthen the therapeutic alliance [33,34]. Increased trust and therapeutic alliance have been shown to be critical factors in the successful delivery of PNE in chronic pain [33,34]. In this study, pain attitudes and beliefs shifted after PNE, resulting in a weaker biomedical association with pain. Traditionally, the health of a person's tissues has been correlated to pain and vice versa, with various studies showing a limited correlation [6,35]. In fact, it is postulated that by focusing on a purely tissue-based model, healthcare drove the ever-increasing rates of imaging, surgery and the ultimate opioid epidemic [7,35]. The results show that PTAs can shift, after a PNE lecture to view a person's pain from less of an actual biomedical perspective. Ideally, in line with a more comprehensive biopsychosocial approach, clinicians should shift from a purely biomedical model to a more biopsychosocial model, which did not happen in this study. It could be argued that the presentation, focusing heavily on the underlying neurophysiology and neurobiology of pain, did not aim or achieve the ability to explore the psychosocial aspects of pain more deeply. Future studies may need to examine the ideal education curriculum to shift PTAs to a more biopsychosocial approach to chronic pain.

The study contained various limitations. First, the design of the pre-/post study limits the ability to determine any long-term effects of the PNE. Second, a case series design limits the ability to determine the true effect of PNE, whereas a trial comparing PNE versus non-PNE would have provided the ability to make stronger deductions related to the results. This study contained two different education delivery methods, which were not compared to determine if one is superior over the other or not. Finally, the relatively small sample size limits the interpretation of the results or developing a representative sample of PNE in PTA schools and curriculums.

## Conclusion

PTA students in this study have had a lot of previous exposure to PNE, including high levels of pain knowledge. A lecture on PNE can shift PTA students away from a pure biomedical view of chronic pain and increase their empathy and compassion towards patients with chronic pain, but it is not able to foster a stronger biopsychosocial view of chronic pain. Future studies should explore if these results hold true for other PTA students and programs, have control groups and examine the results for a longer time post-education.

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