11-1-2018

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Journal

Effects of Pain Neuroscience Education on Physician Assistant Students' Understanding of Pain and Attitudes and Beliefs About Chronic Pain

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Abstract

Purpose: Evaluate the effectiveness and efficiency of two different pain neuroscience education (PNE) lectures provided to physician assistant (PA) students. Primary outcomes explored were knowledge of pain and shift in attitudes and beliefs about chronic pain after the lecture.

Methods: A PNE lecture was provided at two separate university PA programs. One program received a two-hour PNE lecture with a case-based example. The other program received a one-hour PNE lecture without the case-based example. Measurement of change for pre and post-test pain knowledge and attitudes and beliefs about chronic pain were recorded.

Results: Students at both universities showed medium effect size improvements in pain knowledge following the lecture. Only students that received the longer two-hour lecture in the case-based example showed significant improvements with their attitudes and beliefs about patients with chronic pain.

Conclusion: PA students can increase their knowledge about current pain science through lecture alone, however, case-based learning along with lecture, may be more effective in improving the attitudes and beliefs of PA students regarding patients with chronic pain.

Introduction

The use of pain neuroscience education (PNE) has been shown to be an effective intervention in the treatment of chronic musculoskeletal disorders for the reduction of pain, improvement in function, and lowering disability.[1-3] PNE is a biopsychosocial educational strategy utilized by healthcare providers to educate patients with pain on the neurophysiology of pain to reduce fear and threat of their current pain experience.[4,5] This method of education has been shown to promote better outcomes compared to traditional patient educational models that utilize biomedical and pathological information to educate patients about their diagnoses and pain.[6] The traditional biomedical models of education have been shown to have limited effectiveness in reducing pain and disability.[7]

Effective PNE in the clinic starts with proper training of healthcare providers. Providers must be able to both recognize the need for the education strategy as well as be able to effectively deliver the content. Various studies have explored the effectiveness of PNE training with licensed healthcare practitioners.[8,9] While it is important to train the current healthcare provider workforce in this newer educational strategy, the future healthcare workforce also needs to be trained during their academic preparation. PNE training with healthcare students has only been researched with physical therapy students to date.[10,11]

Current evidence demonstrates that there are significantly higher rates of chronic musculoskeletal pain in patients within lower socioeconomic and among underserved populations.[12] It has also been shown that individuals from

underserved areas are most likely to receive their primary care from a physician assistant (PA) or other midlevel provider rather than a physician.[13] While all health care providers should have an updated understanding of pain neuroscience, recognizing these two key statistics leads to strong support that training PA students to understand chronic pain problems and better equipping them with evidence-based approaches to care for these patients is warranted. The purpose of this exploratory study was to compare two slightly different educational lecture approaches in providing PNE information to PA students. Areas of interest in this study included assessing the effects on PA students' knowledge of pain and their shift in attitudes and beliefs about pain following PNE training delivered by faculty trained in PNE.

Methods

Design

The study design was an independent sample analysis of PA student pain knowledge and attitudes from two different university programs before and after receiving PNE training. The two PA institutions were selected based on convenience. Instructors from the same educational company and research team were asked to deliver education regarding pain science to PA students at their respective Universities. IRB approval was obtained from University B for exempt review of existing de-identified data set.

Participants

Participants consisted of two PA student cohorts one from University A and the other University B. Both PA programs were 24-month master's programs at Midwestern universities in the U.S. University A students were in the final semester of the didactic phase of the program. The lecture was included in their behavioral medicine course. The PNE lecture aided the course, which covers neurobiological, psychobiological, social, and emotional influences on health and illness in the practice of primary care medicine. University B students were in the second semester of their first year. The PNE lecture was a part of their neurology unit within their clinical medicine course and provided education on the neuro-pathophysiology of pain mechanisms. Both programs are accredited through the Accreditation Review Commission on Education for Physician Assistants.

Instruments

The Revised Neurophysiology of Pain (rNPQ) questionnaire was used to measure each student's knowledge of pain.[14] 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 were keyed as an incorrect response in accordance with questionnaire instructions. Higher scores demonstrate higher level of knowledge of current pain neurophysiology principles. The rNPQ has demonstrated good test-retest reliability and adequate psychometric properties.[14]

Study participants also took the Health Care Provider's Pain and Impairment Relationship Scale (HCPairs) questionaire.[15,16] This scale measures health care providers' beliefs and attitudes about the relationship of pain and disability. The HCPairs utilizes a 7-point Likert scale anchored with "1 = completely disagree" and "7 = completely agree" in response to 15 questions about the provider's attitudes and beliefs regarding chronic low back pain. Some studies have suggested a modified HCPairs, which uses only 13 of the 15 questions from the original HCPairs. Data was calculated for both HCPairs and modified HCPairs in this study to allow for comparisons to other studies.[15] Missing data for the HCPairs was coded at the midpoint of the scale if less than 10 percent of the scores were missing based on the procedure for scoring outlined in the original development of the HCPairs.[15] A final score ranging from 15 to 105 with the HCPairs or 13 to 91 for the modified HCPairs was obtained by adding the individual question responses together. The higher the score, the greater the belief that pain justifies disability. The scale has demonstrated good reliability, internal consistency, and discriminate validity.[16]

Procedure

Two separate lectures (University A lecture and University B lecture) were prepared based on information from the textbook, *Therapeutic Neuroscience Education*.[17] Information was selected to meet the objectives and time allotment required for the class. University A lecture was a two-hour PNE lecture with case-based learning example. University B lectures was a separate one-hour PNE lecture without the case-based learning portion. The time set for each lecture was based on the individual course director's syllabus and schedule determination at the beginning of the course to meet overall course objectives. Both lectures (University A and B) covered similar content regarding challenges with current biomedical approaches to treating chronic pain and updated PNE information (ion channels, nociceptive input, dorsal horn wind-up,

neuronal facilitation/inhibition, pain matrix, environmental, and stress effects on pain perception). The University A lecture added additional information, including a case-based example of the utilization of PNE and exercise to treat an individual with chronic pain. This extra hour allowed more time to be spent on the concepts of treating an individual with pain. Two separate instructors, each with faculty status at their respective university, delivered the lectures at their university. The individual presenters of the material were from the same post-professional continuing education and research group. Both lecturers have over 10+ years teaching the PNE content.

One week prior to the class where PNE was going to be presented, students were given a link to complete an on-line (PscyhData, State College, PA, USA) anonymous questionnaire containing demographic information along with the rNPQ and HCPairs questionnaires. Students then attended the in-person lecture provided at their University as part of their course work. After the lecture, they were requested to complete post-lecture questionnaires for the rNPQ and HCPairs through the on-line PsychData link.

Data Analysis

IBM SPSS Statistics version 24 (SPSS, Chicago, IL, USA) was used for all data analysis. Descriptive statistics were calculated for means and frequencies for each sample population. Independent sample *t*-test was used to compare means of pre and post-test performance on HCPairs, modified HCPairs, and rNPQ questionnaires at each university. Because students completed the questionnaires anonymously, we were unable to match individual pre-test to post-test questionnaires. Levene's test for assumption of variances was used. Effect size was calculated utilizing Cohen's d (difference between the means divided by the pooled standard deviation). Interpretation of effect size was valued per Cohen's suggestion of 0.20 or less representing a small change, 0.50 representing moderate change, and 0.80 representing large change.[18] Level of significance was set at $\alpha = 0.05$.

Results

Fifty-three PA students (n=30 at University A, n=23 at University B) participated in the educational sessions and completion of pre and post-test questionnaires. Four students at University B did not complete post-test questionnaires and no students were lost to follow-up at University A. See Table 1 for demographic information on both groups of students. No significant differences were found between groups with independent sample *t*-test for demographic variables. University A students did score significantly lower at baseline (pre-test) for HCPairs score; $t(51)=-3.19$, $p = 0.002$, but there was no difference for baseline score for rNPQ scores.

Both groups showed improvement in pain knowledge as demonstrated by the improved mean score on the rNPQ. Although only the data from University A reached significance level ($p<.05$) (Table 2), both groups of university students showed moderate effect size changes in their improvement of pain neuroscience knowledge (Table 3). The HCPairs and modified HCPairs scores showed improvement for only the students receiving the educational session at University A (Table 2) with a large effect size noted (Table 3).

Discussion

This exploratory study showed that both a two-hour PNE lecture with a case-based example (University A lecture) or a one-hour PNE lecture only (University B lecture) provided similar gains in pain knowledge for PA students. However, in order to shift attitudes and beliefs regarding patients with chronic pain, PA students needed the 2-hour PNE lecture with the case-based example. The one-hour PNE lecture alone devoid the case-base example was unable to shift attitudes and beliefs as measured through the HCPairs scale.

This is the first study that the authors are aware of regarding PNE with PA students, so comparisons directly to other studies with PA students do not exist. Comparisons can be made with previous research on PNE training involving physical therapy students. Collearya, et al. found that a 70-minute training session with physical therapy students in the United Kingdom and Ireland had a significant improvement in pain science knowledge (mean increase of 4.0 points on rNPQ) and pain beliefs (mean decrease of 17.5 points on modified HCPairs).[11] Interestingly, the starting point, (pre-test), of the students from the Collearya, et al. study was slightly different with their rNPQ (5.8) being much lower than the starting points for both University A and B. In addition, their modified HCPairs (57.9) scores demonstrated stronger beliefs between the relationship of pain and disability. These results compare with our findings from University A with improvement in both pain knowledge and

Table 1.

Demographic information

	University A (n=30)	University B (n= 23)
Gender		
Male	2	6
Female	26	16
Other	2	1
Age (years)		
19-29	29	19
30-39	1	3
40-49	0	1
Race		
White or Caucasian	29	22
Black or African American	0	1
American Indian	1	0
Hours of previous pain education, mean (SD)	5.10 (5.01)	3.04 (3.78)

Table 2. NPQ and HCPairs mean scores and standard deviation of pre and post-test trails for each university

	University A				University B			
Test	Pre-test mean (SD)	Post-test mean (SD)	t-test	p-value	Pre-test mean (SD)	Post-test mean (SD)	t-test	p-value
rNPQ	8.7 (1.6)	9.8 (1.2)	-3.01	.004	8.5 (1.6)	9.4 (1.5)	-1.74	.089
HCPairs	56.9 (8.2)	47.7 (9.0)	4.13	<.001	63.6 (6.6)	64.0 (8.9)	-0.16	.874
Mod HCPairs	47.2 (7.6)	36.9 (8.7)	4.85	<.001	52.7 (6.1)	52.6 (8.5)	0.07	.944

SD = standard deviation, rNPQ = revised Neurophysiology of Pain Questionnaire, HCPairs = Health Care Pain Attitudes and Impairment Relationship Scale, Mod HCPairs = Modified Health Care Pain Attitudes and Impairment Relationship Scale

Table 3. Effect size (Cohen's d) for NPQ and HCPairs for each university

	University A	University B
rNPQ	0.78	0.58
HCPairs	1.07	0.05
Mod HCPairs	1.26	0.01

rNPQ = revised Neurophysiology of Pain Questionnaire, HCPairs = Health Care Pain Attitudes and Impairment Relationship Scale, ModHCPairs = Modified Health Care Pain Attitudes and Impairment Relationship Scale

attitudes and beliefs with inclusion of a case-based learning component embedded into the lecture. University B did not see the improvements in attitudes and beliefs like the Collearya et al. cohort of students did even though the education was delivered over a similar timeframe. University B did not provide a case-based learning component in their lecture. The Collearya et al. study design, like University A, had case-based learning incorporated into their educational session.

When comparing our results to another study completed with physical therapy students in the USA, additional observations were noted. Cox et al. delivered a three-hour lecture to first year physical therapy students and found significant improvements in pain knowledge as has been seen in other studies after PNE training.[19-22] No improvements in attitudes and beliefs were demonstrated, however.[10] The educational session provided during the Cox et al. was based on updated pain neurophysiology

content but no case-based example was delivered. This educational format was similar to University B's content, the main difference being a one versus three-hour PNE lecture. Of interest both University B and Cox, et al. cohorts of students had higher pre-test HCPairs scores of 63.6 and 61.8, respectively compared to University A at 56.9. In their study looking at physical therapy students changes in attitudes and beliefs during their course work, Latimer et al., found improvements in HCPairs scores in three different cohorts, with the cohorts baseline HCPairs score being 54.2, 55, and 50.9.[23] The higher baseline HCPairs score in this group of students could be a factor in the lack of evidence supporting changing beliefs regarding patients with chronic pain. Contradicting this theory, however, is the data showing students in the Collearya et al. cohort, who actually had even higher modified HCPairs baseline scores than University B were able to make shifts in their beliefs.

There are limitations to this exploratory study, which include small sample size with no long-term follow up on changes over time beyond the pre and post-test measure. Most notably, the university students' selection into the two different PNE sessions were not randomized and no a priori for sample size established prior to data collection. In addition, because there was a difference in both the length of time (two-hour compared to one-hour) for delivery of the content and the methods (case-based example compared to no case-based example) direct cause and effect correlations of the PNE on attitudes and beliefs about patients with chronic pain are difficult to fully decipher. This is further clouded by the difference in attitudes and beliefs of each group prior to delivery of the PNE training. Even with these limitations, we think these results still offer important insights and suggest the need for further exploration regarding the optimal delivery of PNE to PA student and potentially other health care students. This is especially evident when the outcomes of this study are compared to other studies.

PA students can increase their knowledge of pain science understanding using an in-person lecture. Our results show that providing the content over a longer period (two-hours compared to one-hour) along with addition of a case-based example improves their attitudes and beliefs regarding patients with chronic pain more than the shorter duration presentation without an additional case-based teaching method. Future studies should continue to explore refining time and content components of PNE material to PA students and other health care providers to most effectively and efficiently prepare them with the evidence-based intervention of PNE so that they can better care for their patients who have chronic pain.

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Conflict of Interest Statement: Dr. Zimney and Dr. Louw both teach and receive honorariums from a continuing education company that provides post professional training to health care providers in pain neuroscience education. They have also written books on the topic and receive royalties from the sales of the books. No conflicts of interest are present for the other authors.