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**Effectiveness of educating health care professionals in managing chronic pain patients through a supervised student inter-professional pain clinic**

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## **Abstract**

### Objective

To address the need for increased and more effective medical education regarding chronic pain and pain management, an inter-professional (IP) training program in the form of a supervised student IP pain clinic was implemented in 2016. In the current study, we evaluated its feasibility and effectiveness in improving health care professional students' skills in 1) managing chronic pain and 2) working in an IP team.

### Methods

From January 2016 to December 2018, we assembled 12 IP teams that included students from the following six professions at the University of New England: nursing, osteopathic medicine (OM), occupational therapy (OT), pharmacy, physical therapy (PT), and social work (SW). During this 12-week training program, each team conducted the initial evaluation, generated treatment plans, and performed follow-up examinations for its assigned patient under the supervision of a pain specialist at the Mercy Pain Center. Surveys were conducted with all participating students and patients.

### Results

Overall, students showed significant improvement in knowledge regarding pain physiology and chronic pain management as well as attitude and perception regarding IP practice and perceived team skills. Specifically, prior to the program, nursing students showed the greatest pain-related knowledge and perceived team skills, while OT students scored the highest in attitude and perception regarding IP practice. Following the program, improvement in various measures were observed in all professions with PT students showing the most significant improvement in all areas. Surveys also indicated patients' satisfaction with their IP pain clinic experience.

### Conclusions

These results demonstrated the feasibility and the effectiveness of this IP training program for all participating professions.

**Keywords:** Chronic pain, Inter-professional education, osteopathic medicine, survey

## **Background**

Chronic pain is a serious health problem that continues to grow in prevalence. A study based on the 2008 Medical Expenditure Panel Survey indicated that chronic pain affects about 100 million adults in the United States with an estimated annual cost that ranges from 560 to 635 billion dollars [1], yet current medical education regarding pain management is extremely lacking [2-4]. This lack of training can lead to health care providers administering insufficient pain care during post-graduate practice [5]. The recently published National Pain Strategy ([https://www.iprcc.nih.gov/sites/default/files/HHSNational\\_Pain\\_Strategy\\_508C.pdf](https://www.iprcc.nih.gov/sites/default/files/HHSNational_Pain_Strategy_508C.pdf)) recognized “Professional Education and Training” as one of the six major objectives and action plans that should be considered in the “effort to reduce the burden of pain in the United States”. The mission of healthcare education at the University of New England (UNE) is aligned with this objective. This is particularly critical as our recent secondary data analysis estimated that about 25% of the total population in Maine suffer from chronic pain [6]. UNE is Maine’s largest private university and home to the College of Osteopathic Medicine, the College of Pharmacy, the College of Dental Medicine, and the College of Health Professions (which includes programs such as physician assistant, physical therapy, occupational therapy, nursing, and social work). UNE also houses a NIH/NIGMS-funded Center of Biomedical Research Excellence (COBRE) for the Study of Pain and Sensory Function. UNE strives to provide all professional students integrated learning experiences as demonstrated by the establishment of the Inter-professional Education (IPE) Collaborative. We believe that in order to improve students’ training on chronic pain and its management, there needs to be more of an emphasis on learning in a clinical setting [7, 8]. Particularly, emerging evidence has recognized the value of IP team-based practice models in managing complex conditions such as chronic pain [2, 3, 9, 10]. Thus, taking advantage of UNE’s unique mix of health profession educational programs, commitment to pain education/research, and our partnership with the Mercy Pain Center (Portland, Maine), we established a supervised student inter-professional (IP) pain clinic (SSIPPC) in the spring semester of 2016. After the first semester of the program, the participating students spoke highly about the training program and emphasized the values of “real” patient contact, built-in follow-up examination with the patient, and meaningful team interactions. The results from patient surveys showed that participating patients enjoyed their experience with their respective student teams, believed they had learned a great deal about chronic pain during this experience, and appreciated the opportunity of contributing to medical education. Based on this initial feedback, the SSIPPC program was continued. Student and patient surveys have been used to evaluate this program, and the results are

reported here. Our results demonstrated the feasibility and effectiveness of this program in training health professional students in chronic pain management and practice in IP teams. Our future goal is to work with multiple pain clinics and pain specialists in the region and incorporate this innovative educational program into the current curricula within the various health educational programs.

## **Methods**

### **Supervised student inter-professional pain clinic (SSIPPC)**

The SSIPPC program was established in the Spring of 2016 as part of the elective activities within the IPE curricula for students within various health professions at UNE. The primary training site was the Mercy Pain Center in Portland, ME (the Pain Center) directed by Stephen Hull, MD, a physiatrist and algiatrist. A total of two student teams were assembled within each semester (2 teams in the Spring and 2 in the Fall). Each student team consisted of 6-8 members that were recruited from the following UNE programs: Nursing, Occupational Therapy (OT), Osteopathic Medicine (OM), Pharmacy, Physical Therapy (PT), and Social Work (SW). Students learned about the program through attending other IPE activities within UNE, from faculty members who were involved in the program, or by visiting the UNE's IPE-related web pages. Students applied for the program if interested. Students were selected based on profession (as various professions were needed within each team to make it truly interprofessional) and their stated interests in IPE and chronic pain management. Faculty mentors from each program helped recruit students from within their profession, served as consultants during the training, and were invited to all team meetings (see below). For each training cycle, the Pain Center would assign a newly referred patient to each student team. The patient would be informed about the training program and give informed consent prior to participation. To avoid overwhelming the patient, a maximum of four students (selected by the team) would be at each appointment, along with the supervising pain specialist (Dr. Hull). All students had the opportunity to meet with their patient during the training cycle. Students actively interacted with the patients (see activities below) rather than purely shadowing or observing at each appointment. Medical notes written by the students would become part of patients' medical record once reviewed and approved by Dr. Hull. The following activities were implemented during the training program:

Week 1: Team meeting 1 (~ 2h): a) Introduction of team members and Pain Center; b) Pain physiology overview; c) Team leader selection; d) Review of the referral information about the assigned patient and discussion of interview questions.

Week 2: Patient appointment 1 (~ 1h): a) Patient interview and physical examination; b) Draft of preliminary diagnoses and preliminary treatment plan.

Week 3: Team meeting 2 (~2 h): a) Case presentation based on the first appointment; b) Introduction of common approaches for managing chronic pain; c) Generation of a management plan with the help of the pain specialist.

Week 4: Patient appointment 2 (~45 min): Discussion of differential diagnoses and treatment options with the patient, and finalization of the management plan with patient's input.

Weeks 5-8: Treatment period (could be up to 6 weeks): No specific action needed by the team. Students were invited to shadow specific treatment procedures with the permission from the patient (such as physical therapy appointment and cognitive and behavioral therapy).

Week 9: Patient appointment 3 (~30 min): Review of patient's progress and negotiation of future management plan.

Week 10: Team meeting 3 (~2 h): a) Report of patient's progress; b) Discussion of current management plan and potential modifications; c) Debriefing of the overall experience. This would be the end of students' time in the clinic. The patient would visit the pain specialist for future treatment as needed. When appropriate, de-identified Pain Center notes were confidentially provided to the respective team members so they could follow their patient's further progress.

Week 12: Presentations by student teams to share their experience with peers, faculty, and the UNE community at an IPE event.

Besides the time specified above, each participating students would spend additional time (ranging between 2-5 hours) to complete required online training on IP team building prior to the first team meeting, review patient information to prepare for team discussion, attend optional additional treatment sessions (such as physical therapy sessions) agreed by the patient, and prepare for the final presentation. The program was designed to minimize time requirements outside of the programmed activities as it was recognized that all professional students already had very busy schedules. All student participants received a certificate upon completion, i.e., after participation in all team meetings, required patient appointments, and the final presentation. There was no additional grading rubric.

Participation in SSIPPC could help students fulfill certain curricular requirements within their own health profession program or for obtaining the IP Honors Distinction upon graduation.

The learning objectives (LOs) for all participating students were: 1) Obtain experience in team-based practice (The team leader would also obtain experience relating to how to lead an IP medical team). 2) Become familiar with the roles of other health care professions. 3) Improve clinical skills learned in class including but not limited to physical exam, effective communication, and promoting behavioral modification. 4) Understand the basic concepts and the complexity of managing patients with chronic pain (including the psychosocial aspects of chronic pain). 5) Review basic science knowledge related to pain including but not limited to relevant knowledge in the anatomy, physiology, pharmacology, pathology, and biochemistry.

### **Outcome measurements**

The program outlined above was evaluated through conducting both pre- and post- surveys with participating students and patients within each training cycle.

1) *Student surveys*: Various previously validated questionnaires were used both before and after participating in the program to determine whether the program improved students' knowledge in the targeted areas. Quantitative comparisons were made between the pre-and post- surveys. Students' knowledge regarding pain physiology was measured via the Revised Neurophysiology of Pain Questionnaire (RNPQ; originally established for educating chronic pain patients) [11]. Knowledge regarding chronic pain management was assessed via KnowPain50 [12]. The KnowPain50 questionnaire, a formative self-assessment tool, was originally created to measure physician educational needs on pain management and the effectiveness of various pain management educational programs [12, 13]. The survey assesses clinician knowledge, attitudes, and beliefs in: 1) initial pain assessment; 2) defining goals and expectations; 3) development of a treatment plan; 4) implementation of a treatment plan; 5) reassessment and management of longitudinal care; and 6) management of environmental issues. It was tested by evaluating physicians with different levels of pain management expertise, including the general physician population, academic physicians, and pain experts. It should be noted that the average scores for pain experts was 177.5 [12]. Students' attitude and perception regarding IP practice and team skills were evaluated using the Interprofessional Education Perception Scale (IEPS) [14] and the modified Team Skill Scale [15], respectively. Further, information regarding students' profession and prior experience in pain management and IP education/practice were collected before the

program. After the completion of the program, open-ended questions were also used for students to assess the program (whether the LOs were met, the strengths / weaknesses of the program, and areas that need to be improved) and their own learning (what surprised them the most and how this training experience might influence their future practice).

2) *Patient survey*: Patient care outcomes were assessed using a modified survey “Patient Satisfaction with the Interprofessional Teaching Clinic” post-program (<https://nexusipe.org/informing/resource-center/patient-satisfaction-interprofessional-teaching-clinic>). In addition, patients could provide comments regarding the program as they wished.

### **Statistical analysis**

All quantitative data were graphed and analyzed using SigmaPlot 10 with SigmaStat embedded (Systat Software, Inc. San Jose, CA). Wilcoxon Signed Rank Test was used for two group comparison (pre- vs. post-). Kruskal-Wallis One Way Analysis of Variance (ANOVA) on Ranks was used for multiple group comparison. When appropriate, two-way repeated measures (RM) ANOVA with profession and time (before and after) as factors was used to identify differences between professions. *Post-hoc* analysis with the Holm-Sidak method was performed when appropriate. All data are presented as mean  $\pm$  SEM.  $p \leq 0.05$  was considered as statistically significant.

## **Results**

### **Demographics of participating students**

From the Spring of 2016 to the Fall of 2018, we assembled a total of 12 teams with 86 students from six health professions. Out of the 86 students, 83 students completed the program (summarized in Table-1). Three students enrolled but did not complete the program due to course scheduling issues. However, they did complete the pre-program survey, and these data were included in the data analysis. The majority of the students were female (67%). All of the students from the OM program and most of the students from the OT program were in the first half of their training (i.e., the years devoted mainly to pre-clinical training), while students from the nursing, pharmacy, and DPT programs were at the later stages of their professional training. SW students were relatively evenly distributed between the pre-clinical and clinical years (Table-1).



Regarding prior relevant experience, of the 86 students, students from OM and SW programs had less experience with IPE activities (29.17% and 15.79%, respectively) than OT (61.54%) and nursing students (50%). As expected, the majority of students (80.23%) did not have experience working with chronic pain patients, with OM students having the most experience working with chronic pain patients (25%) (Summarized in Table-2).

### **Improvements in knowledge of pain and chronic pain management**

In terms of the knowledge of pain physiology, there was a significant increase in the RNPQ score among all participating students (Figure 1A, Wilcoxon Signed Rank Test,  $p < 0.001$ ). Regarding chronic pain management, there was a significant increase in KnowPain50 score when all professions were included despite that the survey was originally created for physicians (Figure 1B, Wilcoxon Signed Rank Test,  $p < 0.001$ ). When individual professions were examined, significant effects with time and profession were observed for both RNPQ and KnowPain50 (Figure 1C, Two-way RM ANOVA,  $p_{\text{time}} = 0.013$ ,  $p_{\text{profession}} = 0.006$ ,  $p_{\text{interaction}} = 0.376$ ; Figure 1D, Two-way RM ANOVA,  $p_{\text{time}} = 0.007$ ,  $p_{\text{profession}} = 0.002$ ,  $p_{\text{interaction}} = 0.501$ ) with OM, pharmacy and PT students showing significant increase in all their respective scores ( $p < 0.05$  for all in *post-hoc* analyses) and SW students showing significant improvement in RNPQ scores ( $p < 0.05$  in *post-hoc* analysis). It should be noted that although not statistically significant, nursing students had the highest scores in both RNPQ ( $9.50 \pm 2.07$ ) and KnowPain50 ( $142 \pm 16.50$ ) surveys when comparing the individual professions prior to the program (Figures 1C and D).

### **Improvements in attitude and perception towards inter-professional practice**

When all participants were included, there was significant overall improvement in students' attitude towards IP practice (IEPS), both in the total score (Figure 2A, Wilcoxon Signed Rank Test,  $p < 0.001$ ) and in scores for the sub-categories of professional competence and autonomy (Figure 2A, Wilcoxon Signed Rank Test,  $p < 0.001$ ) and actual cooperation (Figure 2A, Wilcoxon Signed Rank Test,  $p = 0.002$ ), but not for the sub-category of perceived need for cooperation scores (baseline (i.e., before the program) scores for this sub-category were at near maximal levels; Figure 2A, Wilcoxon Signed Rank Test,  $p = 0.235$ ). When individual professions were examined for IEPS and its sub-categories, significant effects with time and profession were observed for the total IEPS scores and scores for the sub-categories of professional competence and autonomy and actual cooperation (Figure 2B, total score, Two-way RM ANOVA,  $p_{\text{time}} < 0.001$ ,  $p_{\text{profession}} = 0.002$ ,  $p_{\text{interaction}} = 0.186$ ; Figure 2C, professional competence and autonomy,

Two-way RM ANOVA,  $p_{\text{time}} < 0.001$ ,  $p_{\text{profession}} < 0.001$ ,  $p_{\text{interaction}} = 0.193$ ; Figure 2D, perceived need for cooperation, Two-way RM ANOVA,  $p_{\text{time}} = 0.159$ ,  $p_{\text{profession}} = 0.263$ ,  $p_{\text{interaction}} = 0.075$ ; and Figure 2E, actual cooperation, Two-way RM ANOVA,  $p_{\text{time}} < 0.001$ ,  $p_{\text{profession}} = 0.012$ ,  $p_{\text{interaction}} = 0.372$ ). OM, SW, and PT students showed significant improvement in total IEPS scores and scores for selected sub-categories post-program (Figure 2A-E,  $p < 0.05$  for selected measures in *post-hoc* analyses). In addition, it should be noted that although not statistically significant for all group comparisons, of the participating professions, OT students had the highest scores in all IEPS-related scores except perceived need for cooperation (total score:  $67.33 \pm 0.99$ ; professional competence and autonomy:  $27.83 \pm 0.46$ ; and actual cooperation  $28.25 \pm 0.46$ ) before participating in the program (Figures 2A-E).

### **Improvements in perception of team skill**

When all professions were analyzed together, students' perceived team skills were also significantly improved (Figure 3A, Wilcoxon Signed Rank Test,  $p < 0.001$ ). When individual professions were analyzed, significant time effect and interaction between time and profession were detected (Figure 3B, Two-way RM ANOVA,  $p_{\text{time}} = 0.611$ ,  $p_{\text{profession}} < 0.001$ ,  $p_{\text{interaction}} = 0.019$ ) with OM, SW and PT students exhibiting statistically significant improvement post-program (Figure 3B,  $p < 0.05$  for all in *post-hoc* analyses). Again, nursing students had higher scores in the team skill scale ( $71.17 \pm 3.88$ ) compared to other professions prior to the program (Figures 3B)

### **Meeting learning objectives (LOs)**

In the post-program feedback, regardless of professions, students overwhelmingly agreed that the program met all the defined LOs (see methods) with scores ranging from  $3.07 \pm 0.14$  to  $3.83 \pm 0.05$  for each LO and the average of  $3.58 \pm 0.07$  for all LOs in a 1-4 Riker scale system. In particular, the following LOs received the highest ratings: "This training program helped me to obtain experience in team-based practice" ( $3.83 \pm 0.05$ ); "This training program helped me become familiar with the roles of other health care professions" ( $3.79 \pm 0.05$ ); "This training program helped me to understand the complexity of managing patients with chronic pain" ( $3.81 \pm 0.05$ ).

### **Patients' satisfaction**

A 12-question survey was sent to all participating patients after the completion of the program. The survey specifically asked the patient to compare their experience with a single health care provider versus that with the

physician-supervised IP student team. Table-3 summarizes the results from available patients' responses. Patients showed overall satisfaction regarding their experience with the IP student pain clinic, agreed that their needs and concerns were better received by the care team, learned more about their own conditions, and appreciated being part of student education (Table-3).

## **Discussion**

The SSIPPC program was created and established based on the need for improved professional education and training in chronic pain and its management. Through the use of pre- and post- surveys, our evaluation demonstrated the feasibility and overall effectiveness of this newly designed IP training program for all participating professions. Students exhibited significant improvement in their understanding of pain neurophysiology and the complexity of chronic pain (particularly the psychosocial aspects of chronic pain) and its management. Students also showed significant improvement in their perception of IP practice and team skills. The LOs were met, and students valued the experience. In particular, students expressed their appreciation of working with “real” patients and being able to follow the patients' progress during the post-program discussions. Students agreed that working side-by-side with other professions and learning how each profession interacts with patients was an extremely valuable experience for their training. They stated that because of this experience they would be more likely to reach out to other professions in their future practice. Many students, particularly non-OM students, also acknowledged the value of didactic instruction regarding pain neurophysiology and current treatment strategies for chronic pain (including the need for caution regarding opioid use and the philosophy of avoiding or eliminating opioids), as this information is not always emphasized in the curricula of health professions. Most importantly, our program also earned the satisfaction of the participating patients as demonstrated by their survey responses. Many of the participating patients continued to be patients at the Pain Center. This positive feedback motivated us to continue with the program.

The World Health Organization states that “inter-professional education occurs when two or more professions (students, residents and health workers) learn with, about, and from each other to enable effective collaboration and improve health outcomes.” [16] The SSIPPC training program created ample opportunities for students from various health professions to learn with, about, and from each other, and promoted communication and collaboration among team members. SSIPPC also provided a unique multi-dimensional learning environment for health science education as it combined didactic teaching (such as the introductions of pain physiology and common treatment for chronic

pain by the pain specialist), team-based learning, and hands-on practice in the clinic. As such, it facilitated the connection of classroom-textbook knowledge and clinical practice. Students in the pre-clinical training stage could identify the relevance of textbook materials, while students at the clinical training stage could be refreshed on previously learned basic science concepts. Students often received instant feedback from supervising physicians, peers and the patients. Therefore, we believe incorporating programs like this in health science education could help students master the basic science concepts and become more motivated in their own education. Future studies could be designed to evaluate these benefits.

Despite the benefits of IPE being recognized by health care professionals and students, institutional support, organizational barriers, and faculty development remain challenging factors for its implementation [17, 18]. The major challenge of running our program was to schedule events that could fit the curricular schedules of all participating students from the individual health care programs. As a result, all team meetings were during the evening and patient appointments were arranged on different days of the week so that every student could have at least one opportunity to see the patient in-person. When necessary, we offered call-in or video-conferencing options for students who could not attend team meetings in-person. Further, due to limited resources, we initially identified one faculty member from each health program to help with student recruitment and to provide mentorship. Overtime, more faculty were attracted to the program and became involved (see Acknowledgements for details). Further, participation in the program led to the establishment of additional collaborations with the Pain Center for some faculty members. However, most faculty members served as volunteers without additional compensation. In addition, the SSIPPC program was initially established by taking advantages of intramural UNE teaching mini-grants. The continuation of the program was driven largely by the tremendous interest of students and faculty and help from academic centers and departments within UNE (including UNE IPE Collaborative, the UNE Center for Excellence in Health Innovation, the UNE Center for Excellence in Neurosciences, and the Biomedical Science Department, UNE College of Osteopathic Medicine). Although many health profession programs adopted the SSIPPC as an elective IPE activity for their students, due to limited resources, expanding the program to all health professional students remains a major challenge. Nevertheless, we have gradually transformed the student team final presentation into an educational event for non-participating students and faculty by emphasizing the take-home messages regarding IP practice and chronic pain management during the presentation. Furthermore, the value of IPE has been recognized by many health care profession programs within UNE, and many of them have established a

special emphasis on IP practice and education within their curricula over the last few years. This has created a fertile ground for the SSIPPC to continue and grow. We are actively identifying other pain clinics and pain specialists in the region so that many more students could benefit from this innovative educational program.

Despite the overwhelmingly positive response that the SSIPPC has received, the program does have limitations. For example, students expressed the wish to be able to see more patients (beyond the team patient) and shadow more health professions (besides the pain specialist). We have invited students to visit the Pain Center and shadow physicians and patient treatment groups after the program has ended in order to allow them to observe more patients with chronic pain. We have also tried to obtain permission from team patients to allow the team students to observe when they were being treated by other professions such as physical therapy and osteopathic manipulation. In addition, self-evaluative questionnaires were used to assess the effects of the program. We are working on identifying objective measures to help assess students' learning. Particularly, we could refine our current LOs by using strong Bloom's Taxonomy verbs, which could be better linked to existing assessment tools used in the required curricular component within each health professional program, such as those employed to evaluate students' clinical skills. It is worth noting that many of the activities students engaged in during this program, such as interviewing patients, evaluating patient information, making diagnoses, and creating a treatment plan, require high levels of critical thinking. Specific objective assessment of students' achievement of the IPE core competencies could also be designed.

## **Conclusions**

In response to the lack of medical education regarding pain management, an IP training program was established to provide various health professional students knowledge and experience in chronic pain management and IP practice. Pre- and post- assessment using self-evaluative questionnaires demonstrated the feasibility and effectiveness of this innovative IP training program for all participating professions. Specifically, this program provided focused clinical training to health professional students that were both in the preclinical and clinical training stages. This program can be modeled to create IP clinical training programs focused on other chronic illness, such as diabetes and obesity. We aim to work with various health care profession programs and UNE's clinical partners in the region to further establish more IPE programs so that all UNE health profession students will have the opportunity to practice inter-professionally during their training,.

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## **Compliance with Ethical Standards**

This study was approved by the Institutional Review Boards of both the University of New England (Protocol number: 112515-014) and Mercy Hospital (Protocol number: 135).

## **Conflict of Interest**

The authors declare that they have no conflict of interest.

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**Table-1 Student participants who completed the program (Spring 2016-Fall 2018)**

<b>Programs<sup>a</sup></b>	<b>Number of students</b>	<b>Gender (Females/Males)</b>	<b>Years into the program<sup>b</sup></b>
Osteopathic medicine (DO; 4 yrs)	25	11/14	Yr1 (21) + Yr2 (4)
Nursing (BS, 4 yrs)	5	5/0	Yr4 (5)
Occupational therapy (MS, 2 yrs)	14	13/1	Yr1 (12) + Yr2 (2)
Pharmacy (PharmD, 4 yrs)	12	10/2	Yr2 (2) + Yr3 (10)
Physical therapy (DPT, 4 yrs)	9	7/2	Yr2 (2) + Yr3 (2) + Yr4 (5)
Social work (MS, 2 yrs)	18	13/5	Yr1 (10) + Yr2 (8)
Total <sup>c</sup>	83	59/24	First half (51) + Second half (32)

<sup>a</sup> Name of each program (final degree; total number of years taken to obtain the degree)

<sup>b</sup> Numbers of students in each year of their respective program. Yr = year

<sup>c</sup> Three additional students could not complete the program after the first team meeting due to scheduling issues. However, they did completed the pre-program survey.

**Table-2 Prior experience of participating students (Spring 2016-Fall 2018)**

	<i>With prior IPE experience (%)</i>	<i>No prior experience working with chronic pain patients (%)</i>
All	36.05	80.23
Osteopathic medicine	29.17	75.00
All others	38.71	82.26
Nursing	50.00	100.00
Occupational therapy	61.54	76.92
Pharmacy	41.67	100.00
Physical therapy	40.00	80.00
Social work	15.79	78.95

**Table-3 Summary of patient's survey results<sup>a</sup>**

<b>ID</b>	<b>Questions</b>	<b>Average Score<sup>b</sup> (Mean±SEM)</b>
1	Compared to my previous experience with one health care provider managing my condition at any given time, I felt that having a physician-supervised student team improved my care.	4.00±0.44
2	Compared to my previous experience with one health care provider managing my condition at any given time, I would prefer to be treated by one provider rather than the physician-supervised student team.	2.86±0.51
3	Compared to my previous experience with one health care provider managing my condition at any given time, I was given more time to talk about my medical problems because more than one individual appeared to be interested.	4.57±0.30
4	Compared to my previous experience with one health care provider managing my condition at any given time, it was difficult to talk about my medical problems when more than one provider was in the room.	2.29±0.42
5	Compared to my previous experience with one health care provider managing my condition at any given time, I learned more about my medical problems because the doctor was teaching the students.	4.57±0.30
6	Compared to my previous experience with one health care provider managing my condition at any given time, I felt that the doctor spent more time on the students than on me.	1.86±0.40
7	Compared to my previous experience with one health care provider managing my condition at any given time, I felt that my opinions were better considered and reflected in the treatment plan.	4.00±0.22
8	Compared to my previous experience with one health care provider managing my condition at any given time, I felt that my opinions were mostly ignored because there were so many opinions from individual team members.	1.71±0.29
9	As a patient, I like playing a role in teaching students.	3.93±0.44
10	I would like to be seen by a physician supervised student team in the near future.	3.67±0.21
11	I would recommend this type of clinic to other patients.	4.29±0.29
12	Please rate your overall satisfaction with your experience in the physician-supervised student clinic.	4.29±0.29

<sup>a</sup>Seven out of 12 patients responded to the survey;

<sup>b</sup>All scores were in a 1-5 Riker scale system with 5=Strongly agree and 1=strongly disagree.

## Figure legends

**Figure 1 Improvements in knowledge of pain and chronic pain management.** Student survey results from questionnaires RNPQ (A and C) and KnowPain50 (B and D) are shown as collective data (A and B) and by profession (C and D). All data are presented as mean  $\pm$  SEM. Wilcoxon Signed Rank Test was performed for data presented in A and B. \* indicates  $p < 0.001$  comparing before and after groups. In C and D, two-way RM ANOVA was performed followed by the *post-hoc* analysis using Holm-Sidak method. \* indicates  $p < 0.05$  comparing before and after groups;  $p < 0.05$  between groups indicated by & and #. Max. = the maximal scores of the respective questionnaire.

**Figure 2 Improvements in attitude and perception towards inter-professional practice.** Student survey results from questionnaire IPE perceptions scale (IEPS) and its sub-categories are shown as total (A) and by profession (B-E). All data are presented as mean  $\pm$  SEM. Wilcoxon Signed Rank Test was performed for data presented in A. \* indicates  $p < 0.001$  comparing before and after groups. In B-E, two-way RM ANOVA was performed followed by the *post-hoc* analysis using Holm-Sidak method. \* indicates  $p < 0.05$  comparing before and after groups;  $p < 0.05$  between groups indicated by & and #. Max. = the maximal scores of the respective questionnaire.

**Figure 3 Improvements in perception of team skill.** Student survey results from questionnaire perception of team skill are shown as total (A) and by profession (B). All data are presented as mean  $\pm$  SEM. Wilcoxon Signed Rank Test was performed for data presented in A. In B, two-way RM ANOVA was performed followed by the *post-hoc* analysis using Holm-Sidak method. In both A and B, \* indicates  $p < 0.05$  comparing before and after groups. Max. = the maximal scores of the respective questionnaire.