Changes in Student Perceptions and Beliefs, Self-Efficacy, Role Identification, and Behavioral Intentions after Participation in Longitudinal Interprofessional Pain Management Simulation

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Abstract

Purpose Determine how an interprofessional simulation influences learners' perceptions, role-identification, self-efficacy, and intention to collaborate with other professions on pain issues. **Methods** This was a quality improvement initiative. An interprofessional education activity was conducted focusing on pain management student learners from medicine, pharmacy, nursing, physical and occupational therapy. Sequential questionnaires were administered pre- and post-participation in two interprofessional education events utilizing a simulated patient case depicted by standardized patients. **Results** In total, 433 students participated. Across all domains, increased odds of reporting a more favorable response after exposure to each activity was recorded (OR between 1.45 and 9.07). **Conclusion** The results demonstrate significant positive effects after participation in interprofessional education activities. The large number and variety of student participants, response rates on the questionnaire, and high level of overall positive responses make these results valuable for shaping this activity and may inform other university education initiatives.

Introduction

Pain is a major health care concern in the United States, with approximately one in five adults experiencing chronic pain and almost one in ten experiencing "high-impact" (life or work-limiting) chronic pain (Dahlhamer et al., 2018). Along with the impact on individual function and quality of life, chronic pain also negatively affects social and family relationships and places a significant financial burden on health care systems (Dueñas et al., 2016). With increasing rates of drug overdose deaths, most involving opioid use (Hedegaard et al., 2018), there has been focus on both opioid prescription patterns and pain management strategies. The wide-spread impact of pain on health care and society, along with the complexity of pain and its management, necessitate the engagement of multiple healthcare disciplines' perspectives and approaches.

One consistent recommendation to address the wide-spread crisis of pain is to increase training on pain and addiction in health care education (Volkow et al., 2016). Evidence suggests that healthcare providers are inconsistently prepared to manage pain, and that they tend to have negative beliefs and perceptions related to their ability to manage patients with pain. Research on pain management has described that healthcare providers report lack of knowledge (Ung et al., 2016; Patel et al., 2016; Nuseir et al., 2016), uncertainty and lack of preparation (Toye et al., 2017; Gardner et al., 2018), a feeling of concern and reluctance (Blake et al., 2015), and perception of lack of skill and confidence (Gardner et al., 2018). An examination of healthcare providers across a number of disciplines (physicians, nurses, occupational therapists, physical therapists, and psychologists) found that while perceived knowledge in evidence-based pain management practice was high across disciplines; attitudes, behaviors, and decision-making related to evidence-based pain management were consistently lower (Arumugam et al., 2018). Effective educational strategies to address these barriers are needed to enable healthcare providers to face the challenges with pain management from a position of confidence and with requisite skills, knowledge, and behaviors to impact patient outcomes.

Literature Review

Interprofessional education (IPE) has been recommended as a step toward improved patient care for pain man-

agement (Carr et al., 2012; Watt-Watson et al., 2012). IPE is defined as occurring "when students from two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes (WHO, 2010)." Systematic reviews of IPE have found general positive student outcomes (e.g., attitudes, role identification, cultural competency) associated with these activities, but have also identified gaps and limitations in the evaluation of IPE, particularly related to patient- and system-level outcomes (Olson et al., 2014; Reeves et al., 2013; Reeves et al., 2016). As an educational method to decrease barriers of effective pain management, efforts have been made to implement IPE activities using a model for designing interprofessional pain management curricula (Watt-Watson et al., 2017). In addition, an interprofessional executive committee collaborated in 2011 and 2012 to develop a set of interprofessional core competencies to guide IPE on pain management (Fishman et al., 2013). The competencies were developed under four domains: 1) multidimensional nature of pain, 2) pain assessment and measurement, 3) management of pain, and 4) clinical conditions (Fishman et al., 2013).

Guided by a shared understanding that an interprofessional approach is a promising strategy for preparing healthcare students for the complexities of pain management, an interprofessional faculty group at the University of Mississippi Medical Center collaborated on an IPE activity, focused on pain management, using standardized patient methodology. As such, a quality improvement project was undertaken to determine how a longitudinal interprofessional pain management simulation activity would influence student learners' perceived knowledge and skill development, role identification, self-efficacy, and intention to collaborate with other professions on acute pain management, chronic pain management, and opioid dependency issues.

Activity Design

This was a quality improvement (QI) initiative, which included the evaluation of a longitudinal IPE activity focused on pain management. Sequential questionnaires were administered to participating students in selected academic programs at the University of Mississippi Medical Center (UMMC) pre- and post-participation in two IPE events utilizing a standardized and progressive patient case with simulated patients. Because this was a QI initiative, this was exempted from the necessity of ethical

board approval. Because of the nature of this quality design, this will be written as a plan, do, study, act format (Fishman et al., 2013; Barker et al., 2018; AHRQ, 2018; IHI, 2019; Vordenberg et al., 2018).

Plan: The plan was to include student health professionals at UMMC located in Jackson, Mississippi in the spring of 2019 from the following academic programs: School of Medicine (SOM; doctoral students, second year), School of Nursing (SON; bachelor students, junior year), School of Pharmacy (SOP; doctoral students, third year), and School of Health Related Profession's (SHRP) physical therapy (doctoral students, second year) and occupational therapy (master students, second year) departments.

Development of the IPE Activity: The *Core Competencies for Interprofessional Collaborative Practice Report of an Expert Panel* were used to identify the competencies required within interprofessional collaborative healthcare practice (IPEC, 2011). Four core competencies for interprofessional collaborative practice were identified within the report consisting of: 1) Interprofessional Teamwork and Team-based Practice, 2) Interprofessional Communication Practices, 3) Values/Ethics for Interprofessional Practice and, 4) Roles and Responsibilities for Collaborative Practice. Members of the interprofessional faculty met monthly, beginning in 2018, to develop an activity to fit the needs of all academic programs, requiring conceptualization and consolidation of the unique needs for each of the involved disciplines. The overall learning objectives identified, included: 1) learners will differentiate each team member's role in the management of a patient's acute/chronic pain, 2) learners will communicate discipline-specific patient information effectively to other members of the pain management team and, 3) learners will develop a patient-centered, comprehensive acute/chronic pain management plan incorporating each team member's input, using a holistic and evidence-based approach. With attention to the learning objectives, the interprofessional faculty team also developed evaluative methods by which to assess student performance both as individuals and as an interprofessional team. This faculty team also facilitated standardized patient and evaluator training, developed student preparation materials, and organized all accompanying logistics.

Patient Case: The activity included a fictitious yet realistic, two-part standardized patient case, with student groups having contact with the patient in an acute state of pain

and then a chronic state of pain, during two separate encounters. The case was written in a way that fit the learning needs and appropriate learning profiles for each discipline's students, based on their current level of education, while allowing for the natural and realistic progression of the standardized patient case from one time point to the next.

Patient cases were simulated by trained standardized patients at the Judith Gore Gearhart Clinical Skills Center located at UMMC. Standardized patients portrayed the patient case based on faculty instruction and script information. Case content included but was not limited to: 1) patient and family medical history, 2) current and past medication list, 3) social and employment profile, 4) chief concern, and 5) responses to potential student questions and examination techniques.

Development of the IPE assessment: The National Center for Interprofessional Practice and Education assessment and evaluation directory website was utilized to find previously published questionnaires (NexusIPE, n.d.). Questionnaires identified and reviewed included the Interprofessional Attitudes Scale (IPAS), the Perception of Interprofessional Collaboration Model Questionnaire (PINCOM-Q), the University of the West of England, Bristol Entry Level Interprofessional Questionnaire, and the Performance Assessment Communication and Teamwork Tools Set (PACT) (Chiu et al., n.d.; Norris et al., 2015; Ødegård et al., 2006; Pollard et al., 2004; Pollard et al., 2005). Each of the reviewed questionnaires demonstrated reliability but did not fully capture the constructs desired to be measured pre- to post-exposure to the IPE encounter series. The faculty team chose questions (either directly from the above questionnaires or modified to reflect the needs of this project) to measure four constructs: 1) Perception and Beliefs, 2) Self-Efficacy, 3) Role Identification and, 4) Behavioral Intentions. These constructs were established and related specifically to the care of patients in stages of acute pain and chronic pain.

In total, 55 questions (Q1-Q55) were asked in each questionnaire at three specified time points associated with this activity. Each question was answered on a five-point Likert scale from strongly disagree to strongly agree. The baseline questionnaire was completed prior to the first standardized patient encounter (time point 1), the second was completed following the first standardized patient encounter but before the second (time point 2), and

the third was completed after the second standardized patient encounter (time point 3). All questionnaires were completed in Qualtrics. The full questionnaire is available in Appendix A.

DO: *IPE Exposure:* The initial standardized patient encounters were held on February 14-15, 2019, involving a patient experiencing acute lower back pain, and the second standardized patient encounters were held on April 4-5, 2019, with the same patient now experiencing chronic low back pain. Even though there was only seven-week difference between encounters, the patient case indicated six months has gone by. Student IPE teams were selected at random and were comprised of students from each of the participating programs. Due to variances in program student numbers, each team was comprised of one or two medical students, one or two nursing students, one or two pharmacy students, and one physical therapy or occupational therapy student. Teams with a second medical, nursing, or pharmacy student utilized one student as an observer who watched the encounter and provided feedback to their participant team members at the end of the encounter.

Students from each discipline were instructed to conduct a timed initial patient examination and assessment in a specific order. Between each individual encounter, there was a timed patient communication of information using SBAR (Situation, Background, Assessment, Recommendation) principles between the student leaving the patient and the next discipline (AHRQ, 2019). At the end of all individual encounters, the student health care providers on each team collaborated to develop a holistic plan of care including identification of the problem(s), recommendations for additional tests, and development of the pharmacologic (prescription and/or over-the-counter) and non-pharmacologic management plans for the patient. The student team then shared the management plan with the standardized patient.

During each team's standardized patient encounter, faculty members and clinical instructors from the participating schools observed via real-time audio/video-monitoring. Faculty observers received instructions and training in an attempt to make the experience similar for all the learners. To facilitate learning, formative feedback was provided to the learners from multiple perspectives. Following the patient encounter, the standardized patient provided formative feedback to the student team using a checklist; each team received additional formative feedback from their faculty observer and student observer (if applicable) from the perspective of a clinician; and groups of two to four teams participated in a faculty-led debriefing session to facilitate reflection upon the encounter and capture multiple experiences for a deeper discussion of the activity.

Statistical Analysis: Baseline sample characteristics were compiled as count and percentages. Mixed effects random intercept-slope generalized linear models were used to assess change in question response. These models were constructed from the ordinal family with logit link functions and exchangeable covariance structures to account for within-student variation. These models were first pooled across professional programs and then a time x program interaction was included to assess the effect within each program. Marginal expected response probabilities were also calculated to ease interpretations. To examine whether starting response affected probability of move up/down categories, we also calculated the median response on the first administration of the questionnaire. All models were additionally adjusted for sex and race. All analyses were completed in Stata v16.1 (StataCorp, College Station, TX).

Analysis of Activity (Study)

A total of 433 students participated in the IPE activities (433 in the first activity, 430 in the second activity). Of these, the response rate on the questionnaires was high at each time: 92% at time point 1, 90.7% at time point 2, and 85.6% at time point 3. The distribution by sex, race and program is presented in Table 1.

Median response values at time point 1 for each question for the total sample and by each program can be found in Table 2. Overall, the students' median response to the questionnaire indicated agree to strongly agree for 52 of the 55 questions. The median responses across the disciplines were similar. Question 40 ("All members of healthcare professions have equal respect for each discipline") had the lowest median response score across all disciplines, with the physical therapy students scoring the lowest value (disagree). Full comparisons and effects from mixed-model results can be seen in Appendix B.

	Time Point 1 (N=396)	Time Point 2 (N=390)	Time Point 3 (N=368)
Male	129 (33%)	123 (32%)	117 (32%)
Race			
White	327 (83%)	305 (78%)	284 (77%)
Black	32 (8%)	29 (7%)	27 (7%)
Asian	29 (7%)	28 (7%)	28 (8%)
Hispanic	4 (1%)	4 (1%)	3 (1%)
American Indian	4 (1%)	5 (1%)	6 (2%)
Did Not Respond	0 (0%)	19 (5%)	20 (5%)
Program			
Medicine	148 (37%)	138 (36%)	121 (33%)
Nursing	61 (15%)	69 (18%)	66 (18%)
OT	40 (10%)	38 (10%)	34 (9%)
Pharmacy	99 (25%)	98 (25%)	100 (27%)
PT	48 (12%)	47 (12%)	47 (13%)

OT = occupational therapy; PT = physical therapy

Table 1. *Student characteristics at each time point*

	Overall	Medicine	Nursing	Pharmacy	PT	OT
Q1	4	4	4	4	4	4
Q2	4	4	5	4	4	4
Q3	4	3	4	4	4	3
Q4	4	4	5	4	4	4
Q5	5	5	5	4.5	5	5
Q6	4	4	4	4	4	4
Q7	4	4	4	4	4	4
Q8	4	4	4	4	3	4
Q9	4	3	4	4	4	4
Q10	4	3	4	4	4	4
Q11	3	3	4	4	3	3
Q12	4	4	5	4	4	4
Q13	4	4	4	4	4	4
Q14	4	3	4	4	4	4
Q15	4	4	4	4	4	4
Q16	4	4	4	4	4	4
Q17	4	4	4	4	4	4
Q18	4	4	4.5	4	4	4
Q19	4	4	5	4	4	4
Q20	4	3	4	4	4	3
Q21	4	3	4	4	4	3
Q22	3	3	4	4	3	3
Q23	4	4	4	4	4	4
Q24	4	4	4	4	4	4
Q25	4	4	4	4	3	4

Table 2. *Median Response at Time Point 1 both overall and by program. Table 2 continued on next page.*

	Overall	Medicine	Nursing	Pharmacy	PT	OT
Q26	4	4	5	4	4	4
Q27	4	4	5	4	4	4
Q28	4	3	4	3	4	4
Q29	4	4	4	4	4	4
Q30	4	4	4	4	4	4
Q31	4	4	4	4	4	4
Q32	5	5	5	4	5	5
Q33	5	5	5	4	5	5
Q34	5	5	5	4	5	5
Q35	5	5	5	4	5	5
Q36	5	5	5	4	5	5
Q37	4	4	5	4	4	4
Q38	5	5	5	4	5	5
Q39	4	4	4	4	4	4
Q40	3	4	3.5	3	2	3
Q41	5	5	5	4	4.5	5
Q42	4	4	5	4	4	5
Q43	5	5	5	4	4	4
Q44	4	4	5	4	5	5
Q45	5	5	5	4	4	5
Q46	5	5	5	4	4	5
Q47	4	5	5	4	4	5
Q48	5	5	5	4	4	4
Q49	5	5	5	4	5	5
Q50	5	5	5	4	5	5
Q51	5	5	5	4	4	5
Q52	4	4	5	4	4	5
Q53	5	5	5	4	4	5
Q54	4	4	5	4	4	4
Q55	5	5	5	4	5	5

All corresponding questions can be found in Appendix A; OT = occupational therapy; PT = physical therapy

Table 2. *Median Response at Time Point 1 both overall and by program. Table 2 continued from previous page.*

Perception and Beliefs (Q1 – Q12)

Overall: There were significantly increased odds of reporting a more favorable response after exposure to the first IPE than at baseline (effect sizes ranging from 1.92 – 8.09). This significant positive effect continues after exposure to the second IPE (effect sizes ranging between 1.51 – 2.91). This was true for every question except Q5 which started with a high probability of a very favorable response, leaving little room for improvement. Within these results, students indicated the perception that they gained knowledge and skills for communication with patients and other providers about pain. Students believed that they gained knowledge and skills for treatment of acute and chronic pain and people with opioid dependency. They also reported an increased understanding of their own profession's role in interprofessional pain management.

Discipline specific: There were large positive effects among the students in medicine (11 of 12 questions), pharmacy (12 of 12 questions), PT (10 of 12 questions) and OT (11 of 12 questions) after participation in the two IPE activities. Within the nursing student cohort, there were significant effects in 3 of the 12 questions.

Self-efficacy (Q13 – Q25)

Overall: The results demonstrate that students had an increased odds of reporting a more favorable response after exposure to the first IPE than at baseline (effect sizes ranging between 3.68 – 9.07). This significant positive effect continued after the second IPE event (effect sizes ranging between 1.50 – 2.87) for all questions except Q19. Within these findings, the students reported improved confidence in their abilities related to effective communication about pain and the ability to involve patients in their own care. The students also reported greater confidence in conveying their knowledge about pain management, responding to/providing feedback in a professional manner, skill performance and ability to contribute to interprofessional management of acute and chronic pain and in people with opioid dependencies.

Discipline specific: There were large positive effects related to self-efficacy for 13 of 13 questions in the student cohorts from medicine, pharmacy, PT, and OT after participation in the two IPE activities. Significant effects were found for nursing students in 6 of the 13 questions across the three measurement points.

Role Identification (Q26 – Q40)

Overall: Fifteen questions were asked in the section on role identification. Out of these, significant positive effects were observed in 14 between baseline and after exposure to the first IPE activity (effect sizes 1.81 – 7.43). Significant positive effects were also found in seven questions after participation in the second IPE activity (effect sizes 1.59 – 2.39). Question 39 asked about a status hierarchy in health care and showed almost no change across the three measurement times, with most students agreeing and strongly agreeing (that there is a status hierarchy) across all times. There was a significant improvement after both IPE exposures (4.40 at time point 2 and 1.59 at time point 3) for the students perceiving equal respect for each discipline (Q40). Other significant improvements were found for students responses: indicating a clear definition of each profession's role in pain management; understanding of other profession's roles; valuing the roles of other professions in pain management; and belief that the other professions know their role in pain management. Eight of the 15 role identification questions did not have significant findings T3 – T2.

Discipline specific: There were large positive effects among the students in medicine (10 of 15 questions), pharmacy (14 of 15 questions), PT (13 of 15 questions), OT (8 of 15 questions) and nursing (5 of 15 questions) after participation in the two IPE activities

Behavioral Intentions (Q41 – Q55)

Overall: The behavioral intention questions began with the highest overall median scores, many at strongly agree at baseline. Despite this, after the first IPE activity, the results demonstrate significant improvement in behavioral intentions (post-graduation) to consult or work with each discipline for acute and chronic pain management and for patients with opioid dependencies in 15 of 15 questions (effect sizes between 1.85 and 3.26). After the second IPE event, significant positive findings were observed in 3 of 15 questions (effect sizes between 1.45 and 1.74), indicating a continuation of shifting towards more favorable responses related to intention to consult or work with occupational and physical therapy for patients with chronic pain or opioid dependency.

Discipline specific: Within medicine, pharmacy, and PT students, there were significant favorable effects after the first IPE related to the intention to consult and work with the other disciplines on acute and chronic pain and patients with opioid dependencies. There were no significant effects seen in nursing and occupational therapy students after either event.

Discussion (Act):

The purpose of this project was to determine if an interprofessional pain management simulation activity would result in changes of learners' perceived knowledge and skill development, role identification, self-efficacy, and intention to collaborate with other professions on acute pain management, chronic pain management, and opioid dependency issues. The results demonstrate significant positive effects in each of these areas in the overall cohort of learners, with significant positive effects for all constructs evaluated. The large number and variety of student healthcare participants, the high response rates of the participants completing the quality assessment questionnaire, and the high level of overall positive responses following the project make these results particularly valuable for shaping this activity moving forward.

There are a number of recent publications evaluating interprofessional pain management activities and courses using various methodologies, including clinically based small group tutorials, small group assignments, projects, large group workshops, and simulations (Hunter et al., 2015; Simko et al., 2017; Hadjistavropoulos et al., 2015; Ottis et al., 2016). The number of professions involved in these activities ranged from two to eight. Outcomes from these studies examined perceptions, attitudes, and knowledge related to interprofessional pain management with either pediatric or adult patients. Similar to the student outcomes reported here, these investigations generally found positive outcomes related to the interprofessional activities.

When examining responses of student participants from each of the involved disciplines in this present activity, at baseline there was a consistent report of perceived existence of a status hierarchy across the healthcare professions. In addition, there was less perception of equal respect across the health care professions. Post-exposure to the IPE activities, the perception of a hierarchy remained relatively unchanged, but the perception of equal respect rose significantly overall and individually within each profession except nursing. This was a valuable component of this activity, demonstrating that despite continued perceptions of a hierarchical structure in healthcare practice, largely, there were improved perceptions of mutual respect amongst the participating student healthcare professionals. The existence of a status hierarchy has been identified as a barrier to interprofessional team performance (AHRQ, 2019); however, mutual respect is a component that has been identified as necessary for successful communication and collaboration in healthcare practice (AHRQ, 2019). Taken as a whole, our results indicate that mutual respect, awareness, and value of each profession's contribution existed even in the presence of a perceived status hierarchy. Paired with the students' reported intention to collaborate on pain management strategies post-graduation, it appears that this IPE activity served to positively impact future potential for effective interprofessional pain management.

An interesting finding related to the project was the significant positive effects on several of the measured constructs in reference to managing patients experiencing opioid dependency issues, even though there was not an explicit opioid dependency component included in the case scenarios. This suggests a possible effect from exposure to the preparatory work or other curriculum specific content, which was not measured as a part of this project. It is also possible that exposure to the acute case and chronic case (which included a patient requiring an opioid contract) had a compounding positive effect on students' perceptions and beliefs regarding the possession of knowledge and skills necessary to treat patients experiencing opioid dependency related issues. For the next iteration of this pain management IPE, an opioid dependency component has been considered as a third encounter to this patient case series.

The recent public and professional focus on opioid dependency within the United States has led to a directive to change prescribing patterns of opioids amongst providers (Bohnert et al., 2018). To achieve this shift, prescribing providers and pharmacists need to have an awareness and appreciation for effective non-pharmacological approaches that exist for patients experiencing different types of pain. Following this IPE series, most professions reported a significant positive effect for role identification and intention to collaborate in the future with both physical and occupational therapy professionals as part of their approach to the management of patients experiencing pain. This was especially evident with changes in response from the medical students regarding their future collaborative intentions. The positive shift in behavioral intentions related to collaborative clinical practice post-graduation for the management of pain and/or opioid dependency issues is an important outcome from this IPE activity and may serve to increase these future prescribing providers' referral to movement specialists (PT and OT) for patients with musculoskeletal pain.

As is common with many IPE encounters, the academic classification of the learners in this encounter varied with each discipline and may have influenced the students' perceptions and behaviors. Each discipline was at a different point in their academic career, with varying experience with interprofessional interactions, clinical encounters, and depth of clinical knowledge. These differences may in part account for some of the variation in responses observed at baseline, as well as in response to the encounter itself. One consideration for quality improvement would be further analysis of the student groups participating and their level of didactic

knowledge and clinical experience to better align participating student levels for improved outcomes.

Students reported high averages at baseline for questions related to perception and beliefs, indicating that on average they 'agreed' with feeling prepared prior to the encounters. However, the significant positive effects following the two encounters suggest that the encounter helped the students feel better equipped with knowledge and skills related to acute pain, chronic pain, and opioid dependency issues. Difficulty exists in determining whether the positive increases were related to the encounters alone, or whether they were influenced by profession-specific curriculum, since there was not a central didactic interprofessional pain curriculum being utilized.

As such, one consideration for the future of the activity would be implementation of an interprofessional didactic curriculum aimed at topics relevant to interprofessional communication, healthcare team problem solving and practice, as well as pain management. Multiple national professional education and accreditation bodies, as well as the World Health Organization (WHO), are recognizing the essential role and need for further IPE initiatives in order to help prepare the future healthcare workforce for interprofessional and collaborative practice (WHO, 2010; IPEC, 2011). Interprofessional collaborative practice has been linked to improved healthcare costs, improved patient satisfaction, and improved patient outcomes (WHO, 2010; Reeves et al., 2013; Reeves et al., 2016). Efforts have been made to define and develop educational models that optimally improve learning outcomes, producing healthcare practitioners prepared for interprofessional clinical practice to achieve improvements in clinical outcomes (WHO, 2010; IPEC, 2011). Previous educational research has demonstrated that purposeful curriculum development and instruction, in conjunction with interprofessional team-based application and performance activities, results in integrated learning (Carr et al., 2012, Watt-Watson et al., 2012; WHO, 2010; Olson, 2014; Watt-Watson et al., 2017; Fishman et al., 2013). Weaving a unified curriculum among the disciplines could enhance consistency of information exposure and set the stage for increased collaborative discussion and problem solving among the students. This collaboration could potentially increase the relevance of the activity for the students, as well as impact behaviors for future interprofessional clinical practice and patient care management (Reeves et al., 2013; Reeves et al., 2016).

Considerations to enhance the evaluation of this IPE initiative in the future based on the results of this quality improvement initiative include adding a skill assessment with measurement of clinical behaviors and, eventually, patient outcomes once these students participate in clinical pain management. As reported, the current iteration of this longitudinal IPE series only measured students' perceptions and beliefs, role identification, self-efficacy and behavioral intentions. Due to limitations with faculty evaluator training and resources, standardized behavioral and skill assessment could not be executed successfully during these activities. However, the ability to directly assess students' behaviors and skills over the series would provide a valuable learning opportunity for the students. Although interprofessional faculty observers were utilized as evaluators for these two activities, the accuracy and validity of the evaluations could not be determined and were therefore not used for summative evaluations. Finally, the questionnaire as designed did not include validity questions to identify students marking "strongly agree" without reading and comprehending the individual questions. As noted in the results, most of the significant effects were observed between baseline and after the first event, leaving little room for improvement after the second event. It could be beneficial to include validity questions in the survey to confirm students' thoughtful response to each question.

Conclusion

IPE in general is often an ambitious undertaking, especially using a grass-roots approach. However, we have described an implementation of a longitudinal IPE series focused on pain management and incorporating five different but integral health professions. The purpose of this project was to evaluate changes of learners' perceived knowledge and skill development, role identification, self-efficacy, and intention to collaborate with other professions once in clinical practice. The results demonstrate significant positive effects in each of these areas overall. In addition, the lessons learned throughout the development, implementation, and evaluation of the series have the potential to constructively influence this activity moving forward.

Acknowledgments

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Appendix A
Questionnaire

Perception and Beliefs
I have been educated in knowledge necessary for communication about pain management with: Q1. Other health care providers. Q2. Patients.
I have been trained in skills necessary for communication about pain management with: Q3. Other health care providers. Q4. Patients.
Q5. It is important to have a standardized method for sharing information when handing off patients.
Within the scope of my profession, I have been educated in knowledge necessary for the treatment of: Q6. Patients experiencing acute pain. Q7. Patients experiencing chronic pain. Q8. Patients experiencing an opioid dependency.
Within the scope of my profession, I have been trained in skills necessary for the treatment of: Q9. Patients experiencing acute pain. Q10. Patients experiencing chronic pain. Q11. Patients experiencing an opioid dependency.
Q12. I understand my role in inter-professional pain management when participating as a member of a healthcare team.
Self-Efficacy
I am confident in my ability to: Q13. Clearly communicate information about pain to patients. Q14. Effectively explain the roles and responsibilities in pain management of other health care team members to patients. Q15. Actively involve patients in their pain management plans if they so desire. Q16. Clearly convey to patients my roles and responsibilities in pain management.
I am confident in my ability to: Q17. Clearly convey my knowledge of pain management to other health care team members. Q18. Respond to feedback from other health care team members in a professional manner. Q19. Give feedback to other health care team members in a respectful manner.
I am confident in my ability to perform skills necessary for treatment of: Q20. Patients experiencing acute pain. Q21. Patients experiencing chronic pain. Q22. Patients experiencing an opioid dependency.
I am confident in my ability to contribute to an inter-professional healthcare team in the management of: Q23. Patients experiencing acute pain. Q24. Patients experiencing chronic pain. Q25. Patients experiencing an opioid dependency.
Role Identification
Q26. My role in inter-professional pain management is clearly defined.
Considering inter-professional pain management; I have a good understanding of the role of _____. Q27. Nurses Q28. Occupational Therapists Q29. Pharmacists Q30. Physical Therapists Q31. Physicians
Considering inter-professional pain management; I value the contribution of _____. Q32. Nurses Q33. Occupational Therapists Q34. Pharmacists Q35. Physical Therapists Q36. Physicians

Q37. All members of the inter-professional healthcare team (Nurses,   Occupational Therapists, Pharmacists, Physical Therapists, and Physicians) understand their respective roles in pain management.
Q38. We need to inform each other about our roles in pain management in an inter-professional healthcare team.
Q39. There is a status hierarchy in health care that affects relationships between healthcare professionals.
Q40. All members of health care professions have equal respect for each discipline.
Behavioral Intentions

After I graduate, I am likely to consult or work with the following professions when faced with patients experiencing acute pain:
    Q41. Nurses
    Q42. Occupational Therapists
    Q43. Pharmacists
    Q44. Physical Therapists
    Q45. Physicians

After I graduate, I am likely to consult or work with the following professions when faced with patients experiencing chronic pain: Q46. Nurses Q47. Occupational Therapists Q48. Pharmacists Q49. Physical Therapists Q50. Physicians
After I graduate, I am likely to consult or work with the following professions when faced with patients experiencing an opioid dependency: Q51. Nurses Q52. Occupational Therapists Q53. Pharmacists Q54. Physical Therapists Q55. Physicians

Appendix B
Full results of models for change for multilevel mixed ordered logit models

	Overall T2 vs. T1	Overall T3 vs. T2	Medicine T2 vs. T1	Medicine T3 vs. T2	Nursing T2 vs. T1	Nursing T3 vs. T2	Pharmacy T2 vs. T1	Pharmacy T3 vs. T2	PT T2 vs. T1	PT T3 vs. T2	OT T2 vs. T1	OT T3 vs. T2
Q1	7.51 $p<0.001$ (5.34,10.56)	1.51 p=0.014 (1.09,2.11)	9.21 $p<0.001$ (5.53,15.32)	1.68 p=0.057 (0.98,2.87)	2.91 p=0.012 (1.27,6.68)	1.26 p=0.618 (0.51,3.09)	11.22 $p<0.001$ (6.05,20.82)	1.23 p=0.503 (0.67,2.27)	5.43 $p<0.001$ (2.35,12.57)	2.15 p=0.091 (0.89,5.22)	7.78 $p<0.001$ (2.96,20.40)	1.38 p=0.541 (0.49,3.93)
Q2	4.66 $p<0.001$ (3.32,6.53)	1.51 p=0.021 (1.07,2.15)	6.91 $p<0.001$ (4.09,11.70)	1.78 p=0.044 (1.02,3.13)	0.98 p=0.960 (0.42,2.30)	1.28 p=0.604 (0.50,3.30)	7.11 $p<0.001$ (3.76,13.42)	0.99 p=0.987 (0.53,1.87)	4.77 p=0.001 (1.96,11.59)	3.25 p=0.018 (1.23,8.59)	3.80 p=0.009 (1.39,10.38)	1.03 p=0.964 (0.34,3.10)
Q3	8.09 $p<0.001$ (5.77,11.34)	1.74 p=0.001 (1.25,2.43)	10.17 $p<0.001$ (6.16,16.81)	2.87 $p<0.001$ (1.67,4.94)	2.33 p=0.043 (1.03,5.30)	1.21 p=0.670 (0.50,2.97)	13.43 $p<0.001$ (7.29,24.77)	1.07 p=0.818 (0.59,1.96)	6.07 $p<0.001$ (2.64,13.95)	1.68 p=0.255 (0.69,4.12)	9.53 $p<0.001$ (3.75,24.20)	1.55 p=0.406 (0.55,4.38)
Q4	6.09 $p<0.001$ (4.35,8.52)	1.68 p=0.003 (1.19,2.37)	8.60 $p<0.001$ (5.18,14.28)	2.38 p=0.002 (1.38,4.11)	1.24 p=0.619 (0.53,2.93)	1.27 p=0.624 (0.49,3.27)	8.64 $p<0.001$ (4.67,16.01)	1.06 p=0.862 (0.57,1.95)	7.32 $p<0.001$ (3.10,17.28)	1.89 p=0.178 (0.75,4.78)	5.14 p=0.001 (1.95,13.59)	1.66 p=0.353 (0.57,4.80)
Q5	1.34 p=0.129 (0.92,1.95)	1.03 p=0.880 (0.68,1.58)	0.77 p=0.414 (0.42,1.43)	1.45 p=0.298 (0.72,2.90)	1.02 p=0.972 (0.38,2.72)	1.25 p=0.684 (0.43,3.69)	2.32 p=0.013 (1.19,4.52)	0.69 p=0.297 (0.35,1.38)	2.24 p=0.154 (0.74,6.75)	1.70 p=0.425 (0.46,6.28)	1.46 p=0.508 (0.48,4.48)	0.55 p=0.323 (0.17,1.80)
Q6	2.94 $p<0.001$ (2.12,4.07)	2.04 $p<0.001$ (1.43,2.90)	3.86 $p<0.001$ (2.30,6.48)	2.28 p=0.004 (1.30,4.00)	1.09 p=0.852 (0.46,2.58)	2.10 p=0.146 (0.77,5.73)	3.58 $p<0.001$ (1.92,6.68)	1.68 p=0.116 (0.88,3.21)	3.97 p=0.003 (1.62,9.72)	1.37 p=0.508 (0.54,3.50)	1.80 p=0.241 (0.67,4.84)	3.62 p=0.020 (1.23,10.68)
Q7	1.92 $p<0.001$ (1.42,2.60)	2.65 $p<0.001$ (1.89,3.72)	1.53 p=0.084 (0.94,2.47)	4.52 $p<0.001$ (2.62,7.78)	1.01 p=0.975 (0.45,2.30)	1.74 p=0.233 (0.70,4.33)	2.73 p=0.001 (1.52,4.93)	2.10 p=0.017 (1.14,3.85)	2.37 p=0.043 (1.03,5.49)	1.67 p=0.252 (0.70,4.00)	3.59 p=0.009 (1.38,9.33)	2.12 p=0.149 (0.76,5.89)
Q8	2.00 $p<0.001$ (1.50,2.66)	2.38 $p<0.001$ (1.74,3.25)	1.48 p=0.093 (0.94,2.33)	2.62 $p<0.001$ (1.58,4.37)	1.33 p=0.478 (0.60,2.94)	2.45 p=0.045 (1.02,5.88)	2.91 $p<0.001$ (1.66,5.09)	1.54 p=0.142 (0.86,2.76)	5.54 $p<0.001$ (2.51,12.22)	2.90 p=0.010 (1.29,6.50)	1.26 p=0.601 (0.53,2.96)	3.60 p=0.009 (1.38,9.35)
Q9	4.21 $p<0.001$ (3.06,5.79)	2.27 $p<0.001$ (1.61,3.19)	8.16 $p<0.001$ (4.95,13.46)	2.40 p=0.001 (1.40,4.10)	1.12 p=0.793 (0.49,2.55)	2.32 p=0.079 (0.91,5.95)	5.20 $p<0.001$ (2.87,9.40)	1.71 p=0.087 (0.92,3.16)	2.25 p=0.059 (0.97,5.21)	2.00 p=0.126 (0.82,4.88)	2.70 p=0.037 (1.06,6.85)	4.17 p=0.006 (1.49,11.66)
Q10	2.60 $p<0.001$ (1.94,3.49)	2.91 $p<0.001$ (2.09,4.05)	3.06 $p<0.001$ (1.93,4.85)	5.24 $p<0.001$ (3.13,8.79)	1.14 p=0.748 (0.51,2.53)	1.56 p=0.318 (0.65,3.70)	3.15 $p<0.001$ (1.80,5.53)	2.05 p=0.015 (1.15,3.66)	1.93 p=0.113 (0.86,4.33)	2.02 p=0.103 (0.87,4.72)	3.80 p=0.004 (1.54,9.39)	2.48 p=0.070 (0.93,6.64)
Q11	3.02 $p<0.001$ (2.25,4.04)	2.72 $p<0.001$ (1.98,3.75)	3.25 $p<0.001$ (2.04,5.17)	3.40 $p<0.001$ (2.03,5.67)	1.69 p=0.201 (0.76,3.78)	2.24 p=0.081 (0.91,5.54)	3.83 $p<0.001$ (2.19,6.72)	1.64 p=0.099 (0.91,2.94)	6.50 $p<0.001$ (2.98,14.16)	3.71 p=0.002 (1.65,8.35)	1.18 p=0.700 (0.51,2.76)	3.69 p=0.007 (1.43,9.51)
Q12	4.24 $p<0.001$ (3.05,5.89)	2.04 $p<0.001$ (1.42,2.94)	5.79 $p<0.001$ (3.47,9.65)	2.38 p=0.002 (1.37,4.13)	0.99 p=0.983 (0.42,2.32)	1.77 p=0.220 (0.71,4.43)	4.35 $p<0.001$ (2.39,7.89)	2.10 p=0.019 (1.13,3.91)	4.34 p=0.001 (1.82,10.37)	2.69 p=0.050 (1.00,7.26)	10.06 $p<0.001$ (3.60,28.16)	0.76 p=0.616 (0.25,2.26)
Q13	9.07 $p<0.001$ (6.25,13.14)	1.83 p=0.001 (1.27,2.65)	10.33 $p<0.001$ (6.04,17.69)	2.20 p=0.008 (1.23,3.92)	4.18 p=0.002 (1.68,10.41)	2.59 p=0.083 (0.88,7.60)	8.32 $p<0.001$ (4.41,15.69)	1.24 p=0.508 (0.65,2.37)	12.39 $p<0.001$ (4.96,30.96)	2.26 p=0.109 (0.83,6.14)	13.01 $p<0.001$ (4.67,36.25)	1.55 p=0.440 (0.51,4.67)
Q14	8.88 $p<0.001$ (6.31,12.51)	2.09 $p<0.001$ (1.47,2.95)	12.60 $p<0.001$ (7.54,21.04)	2.46 p=0.001 (1.41,4.28)	2.52 p=0.025 (1.12,5.65)	2.35 p=0.069 (0.93,5.90)	10.33 $p<0.001$ (5.68,18.79)	1.46 p=0.220 (0.80,2.66)	11.03 $p<0.001$ (4.66,26.10)	2.24 p=0.096 (0.87,5.77)	8.39 $p<0.001$ (3.21,21.96)	2.58 p=0.082 (0.89,7.52)
Q15	6.53 $p<0.001$ (4.59,9.31)	1.66 p=0.006 (1.16,2.39)	10.21 $p<0.001$ (5.96,17.49)	1.85 p=0.035 (1.05,3.29)	2.33 p=0.062 (0.96,5.69)	1.52 p=0.412 (0.56,4.10)	6.72 $p<0.001$ (3.59,12.57)	1.35 p=0.350 (0.72,2.56)	6.21 $p<0.001$ (2.55,15.13)	3.19 p=0.023 (1.17,8.69)	5.09 p=0.002 (1.82,14.20)	0.90 p=0.857 (0.30,2.73)
Q16	8.67 $p<0.001$ (5.98,12.57)	1.50 p=0.035 (1.03,2.17)	14.05 $p<0.001$ (8.07,24.46)	1.91 p=0.030 (1.07,3.44)	1.66 p=0.262 (0.68,4.02)	1.11 p=0.842 (0.41,2.97)	9.25 $p<0.001$ (4.86,17.60)	1.33 p=0.397 (0.69,2.54)	11.32 $p<0.001$ (4.35,29.44)	1.50 p=0.447 (0.52,4.31)	10.66 $p<0.001$ (3.71,30.59)	0.88 p=0.820 (0.28,2.75)
Q17	9.06 $p<0.001$	1.89 $p<0.001$	10.22 $p<0.001$	2.15 p=0.008	4.19 p=0.001	1.49 p=0.418	10.36 $p<0.001$	1.45 p=0.250	11.36 $p<0.001$	2.37 p=0.088	9.05 $p<0.001$	2.57 p=0.097

	Overall		Medicine		Nursing		Pharmacy		PT		OT	
	T2 vs. T1	T3 vs. T2	T2 vs. T1	T3 vs. T2	T2 vs. T1	T3 vs. T2	T2 vs. T1	T3 vs. T2	T2 vs. T1	T3 vs. T2	T2 vs. T1	T3 vs. T2
Q18	4.38 p<0.001 (3.08,6.22)	1.51 p=0.035 (1.03,2.21)	3.86 p<0.001 (2.26,6.59)	1.85 p=0.047 (1.01,3.40)	1.91 p=0.157 (0.78,4.70)	1.40 p=0.509 (0.52,3.78)	6.93 p<0.001 (3.65,13.15)	1.27 p=0.476 (0.66,2.45)	5.69 p<0.001 (2.22,14.57)	1.74 p=0.305 (0.60,5.00)	4.56 p=0.005 (1.57,13.23)	0.96 p=0.947 (0.30,3.08)
Q19	4.19 p<0.001 (2.97,5.92)	1.35 p=0.106 (0.94,1.96)	4.33 p<0.001 (2.54,7.37)	1.62 p=0.110 (0.90,2.93)	2.35 p=0.067 (0.94,5.87)	0.75 p=0.557 (0.28,1.99)	6.05 p<0.001 (3.23,11.30)	1.12 p=0.723 (0.59,2.12)	4.09 p=0.003 (1.64,10.20)	1.64 p=0.332 (0.60,4.44)	3.05 p=0.035 (1.08,8.57)	1.86 p=0.280 (0.60,5.75)
Q20	7.33 p<0.001 (5.18,10.37)	2.06 p<0.001 (1.44,2.93)	12.70 p<0.001 (7.53,21.41)	2.29 p=0.003 (1.31,3.98)	2.14 p=0.088 (0.89,5.15)	1.65 p=0.331 (0.60,4.55)	6.59 p<0.001 (3.57,12.16)	1.50 p=0.209 (0.80,2.81)	4.60 p=0.001 (1.93,10.96)	3.19 p=0.017 (1.23,8.29)	10.89 p<0.001 (4.23,28.03)	2.24 p=0.131 (0.78,6.42)
Q21	4.81 p<0.001 (3.49,6.63)	2.87 p<0.001 (2.03,4.07)	5.59 p<0.001 (3.44,9.08)	4.63 p<0.001 (2.69,8.00)	1.63 p=0.256 (0.70,3.75)	1.65 p=0.299 (0.64,4.27)	5.16 p<0.001 (2.86,9.31)	1.75 p=0.071 (0.95,3.21)	5.65 p<0.001 (2.46,12.98)	2.68 p=0.033 (1.08,6.62)	7.99 p<0.001 (3.16,20.20)	3.34 p=0.023 (1.18,9.40)
Q22	4.65 p<0.001 (3.42,6.33)	2.70 p<0.001 (1.94,3.76)	6.02 p<0.001 (3.72,9.75)	3.31 p<0.001 (1.95,5.61)	2.37 p=0.035 (1.06,5.28)	1.48 p=0.395 (0.60,3.66)	4.34 p<0.001 (2.46,7.66)	1.74 p=0.063 (0.97,3.11)	9.47 p<0.001 (4.23,21.23)	4.31 p=0.001 (1.84,10.11)	2.63 p=0.028 (1.11,6.21)	4.15 p=0.004 (1.56,11.08)
Q23	6.35 p<0.001 (4.50,8.96)	1.77 p=0.001 (1.25,2.52)	9.23 p<0.001 (5.46,15.58)	2.04 p=0.012 (1.17,3.57)	1.90 p=0.141 (0.81,4.44)	3.20 p=0.022 (1.18,8.68)	7.70 p<0.001 (4.12,14.41)	1.20 p=0.574 (0.64,2.26)	4.48 p=0.001 (1.87,10.74)	2.11 p=0.126 (0.81,5.51)	7.96 p<0.001 (2.93,21.60)	1.29 p=0.634 (0.45,3.75)
Q24	4.04 p<0.001 (2.94,5.56)	2.56 p<0.001 (1.81,3.63)	3.69 p<0.001 (2.27,6.01)	4.42 p<0.001 (2.54,7.72)	1.84 p=0.149 (0.80,4.19)	2.67 p=0.043 (1.03,6.92)	5.58 p<0.001 (3.06,10.17)	1.44 p=0.244 (0.78,2.66)	3.92 p=0.002 (1.68,9.16)	2.57 p=0.048 (1.01,6.58)	8.37 p<0.001 (3.18,22.08)	1.56 p=0.407 (0.54,4.49)
Q25	3.68 p<0.001 (2.72,4.99)	2.48 p<0.001 (1.78,3.45)	3.09 p<0.001 (1.93,4.96)	3.29 p<0.001 (1.94,5.59)	1.91 p=0.113 (0.86,4.23)	2.16 p=0.100 (0.86,5.39)	5.12 p<0.001 (2.87,9.13)	1.32 p=0.354 (0.73,2.39)	8.23 p<0.001 (3.63,18.67)	4.78 p<0.001 (1.99,11.46)	3.26 p=0.010 (1.33,8.02)	2.34 p=0.095 (0.86,6.38)
Q26	2.89 p<0.001 (2.07,4.04)	2.39 p<0.001 (1.62,3.54)	2.92 p<0.001 (1.72,4.96)	3.11 p<0.001 (1.67,5.81)	0.42 p=0.058 (0.17,1.03)	3.19 p=0.021 (1.19,8.58)	5.37 p<0.001 (2.82,10.21)	2.11 p=0.033 (1.06,4.19)	5.82 p<0.001 (2.25,15.06)	0.85 p=0.767 (0.30,2.42)	3.72 p=0.014 (1.31,10.58)	3.41 p=0.036 (1.08,10.74)
Q27	5.98 p<0.001 (4.28,8.35)	1.33 p=0.094 (0.95,1.87)	8.67 p<0.001 (5.21,14.42)	1.88 p=0.023 (1.09,3.23)	1.01 p=0.975 (0.42,2.44)	1.05 p=0.927 (0.40,2.73)	12.71 p<0.001 (6.90,23.42)	0.97 p=0.933 (0.53,1.79)	3.90 p=0.001 (1.70,8.92)	1.18 p=0.707 (0.50,2.80)	4.40 p=0.003 (1.64,11.84)	1.11 p=0.842 (0.39,3.23)
Q28	6.20 p<0.001 (4.52,8.51)	1.89 p<0.001 (1.35,2.63)	6.88 p<0.001 (4.25,11.14)	2.29 p=0.002 (1.35,3.89)	3.21 p=0.003 (1.49,6.91)	2.78 p=0.022 (1.16,6.66)	11.32 p<0.001 (6.34,20.20)	1.58 p=0.127 (0.88,2.85)	2.41 p=0.027 (1.11,5.25)	2.04 p=0.104 (0.86,4.82)	12.98 p<0.001 (3.97,42.47)	0.38 p=0.139 (0.10,1.37)
Q29	4.13 p<0.001 (2.96,5.75)	1.76 p=0.002 (1.22,2.53)	7.35 p<0.001 (4.37,12.34)	1.96 p=0.018 (1.12,3.42)	2.45 p=0.037 (1.05,5.69)	1.45 p=0.437 (0.57,3.68)	2.49 p=0.004 (1.35,4.60)	1.77 p=0.093 (0.91,3.45)	3.58 p=0.004 (1.52,8.43)	2.06 p=0.125 (0.82,5.20)	4.33 p=0.005 (1.55,12.04)	0.90 p=0.846 (0.30,2.72)
Q30	7.43 p<0.001 (5.31,10.41)	1.67 p=0.003 (1.19,2.36)	7.40 p<0.001 (4.49,12.18)	1.96 p=0.015 (1.14,3.36)	4.10 p=0.001 (1.83,9.20)	1.64 p=0.281 (0.67,4.03)	15.57 p<0.001 (8.44,28.73)	1.23 p=0.501 (0.67,2.25)	5.00 p<0.001 (2.05,12.19)	2.19 p=0.147 (0.76,6.33)	4.42 p=0.003 (1.66,11.77)	1.62 p=0.374 (0.56,4.69)
Q31	5.18 p<0.001 (3.67,7.30)	1.35 p=0.096 (0.95,1.94)	4.22 p<0.001 (2.52,7.07)	1.76 p=0.054 (0.99,3.15)	2.76 p=0.022 (1.16,6.59)	1.37 p=0.520 (0.53,3.53)	7.88 p<0.001 (4.16,14.91)	1.04 p=0.899 (0.55,1.98)	6.43 p<0.001 (2.61,15.84)	1.35 p=0.536 (0.53,3.45)	7.27 p<0.001 (2.56,20.64)	1.00 p=0.996 (0.33,3.04)
Q32	2.22 p<0.001 (1.49,3.31)	1.17 p=0.506 (0.73,1.88)	1.86 p=0.043 (1.02,3.40)	1.76 p=0.135 (0.84,3.70)	1.71 p=0.353 (0.55,5.30)	0.76 p=0.655 (0.22,2.56)	2.89 p=0.003 (1.45,5.78)	0.98 p=0.952 (0.47,2.04)	4.67 p=0.009 (1.48,14.80)	0.76 p=0.669 (0.21,2.68)	0.94 p=0.921 (0.25,3.47)	1.00 p=1.000 (0.25,4.00)
Q33	2.26 p<0.001 (1.54,3.34)	1.32 p=0.245 (0.83,2.10)	1.77 p=0.058 (0.98,3.19)	1.71 p=0.146 (0.83,3.52)	1.47 p=0.466 (0.52,4.18)	0.82 p=0.722 (0.27,2.50)	3.16 p=0.001 (1.63,6.11)	1.43 p=0.332 (0.69,2.95)	2.92 p=0.049 (1.00,8.52)	0.94 p=0.916 (0.29,3.01)	2.13 p=0.296 (0.52,8.74)	0.45 p=0.284 (0.10,1.95)
Q34	2.22 p<0.001 (1.50,3.31)	1.23 p=0.400 (0.76,2.00)	1.80 p=0.055 (0.99,3.29)	1.59 p=0.223 (0.76,3.33)	1.42 p=0.537 (0.47,4.29)	0.58 p=0.361 (0.18,1.85)	2.36 p=0.013 (1.19,4.65)	1.56 p=0.254 (0.73,3.34)	7.64 p<0.001 (2.47,23.60)	0.64 p=0.471 (0.19,2.15)	1.37 p=0.637 (0.37,5.12)	0.73 p=0.664 (0.18,2.97)

Q	Overall		Medicine		Nursing		Pharmacy		PT		OT	
	T2 vs. T1	T3 vs. T2	T2 vs. T1	T3 vs. T2	T2 vs. T1	T3 vs. T2	T2 vs. T1	T3 vs. T2	T2 vs. T1	T3 vs. T2	T2 vs. T1	T3 vs. T2
Q35	2.05 p<0.001 (1.40,3.00)	1.35 p=0.210 (0.84,2.16)	1.72 p=0.066 (0.96,3.06)	1.70 p=0.112 (0.88,3.27)	1.44 p=0.495 (0.51,4.07)	0.61 p=0.373 (0.21,1.81)	2.71 p=0.003 (1.42,5.19)	1.53 p=0.221 (0.77,3.04)	3.46 p=0.025 (1.17,10.24)	1.16 p=0.809 (0.35,3.90)	1.34 p=0.645 (0.39,4.63)	0.87 p=0.837 (0.24,3.23)
Q36	2.18 p<0.001 (1.47,3.23)	1.01 p=0.955 (0.64,1.61)	1.74 p=0.072 (0.95,3.18)	1.52 p=0.271 (0.72,3.21)	1.23 p=0.710 (0.41,3.74)	0.58 p=0.355 (0.19,1.83)	2.83 p=0.003 (1.44,5.55)	0.91 p=0.801 (0.45,1.86)	4.65 p=0.006 (1.56,13.84)	0.74 p=0.618 (0.23,2.40)	1.70 p=0.439 (0.44,6.48)	0.71 p=0.641 (0.17,3.00)
Q37	5.01 p<0.001 (3.63,6.93)	1.62 p=0.006 (1.14,2.28)	5.11 p<0.001 (3.12,8.39)	1.75 p=0.050 (1.00,3.06)	0.79 p=0.578 (0.35,1.79)	1.53 p=0.356 (0.62,3.77)	8.10 p<0.001 (4.43,14.79)	1.48 p=0.217 (0.79,2.76)	8.12 p<0.001 (3.45,19.10)	1.37 p=0.492 (0.56,3.33)	11.82 p<0.001 (4.46,31.31)	1.73 p=0.311 (0.60,5.02)
Q38	1.81 p=0.001 (1.26,2.59)	1.71 p=0.019 (1.09,2.69)	1.49 p=0.161 (0.85,2.60)	3.06 p=0.003 (1.48,6.33)	0.86 p=0.758 (0.33,2.26)	1.26 p=0.672 (0.44,3.63)	4.07 p<0.001 (2.06,8.06)	1.01 p=0.973 (0.49,2.10)	1.08 p=0.881 (0.38,3.05)	3.49 p=0.049 (1.01,12.10)	2.02 p=0.259 (0.60,6.80)	0.58 p=0.409 (0.16,2.12)
Q39	1.25 p=0.126 (0.94,1.67)	1.26 p=0.162 (0.91,1.73)	0.95 p=0.843 (0.60,1.52)	1.67 p=0.057 (0.99,2.82)	1.73 p=0.186 (0.77,3.91)	1.82 p=0.215 (0.71,4.70)	1.66 p=0.078 (0.94,2.94)	0.87 p=0.649 (0.49,1.56)	0.95 p=0.911 (0.42,2.19)	1.17 p=0.727 (0.49,2.80)	1.50 p=0.383 (0.60,3.76)	0.93 p=0.881 (0.35,2.49)
Q40	4.40 p<0.001 (3.27,5.92)	1.59 p=0.003 (1.17,2.16)	3.28 p<0.001 (2.06,5.22)	1.86 p=0.020 (1.10,3.15)	1.50 p=0.298 (0.70,3.19)	1.94 p=0.111 (0.86,4.37)	7.01 p<0.001 (4.00,12.29)	1.32 p=0.335 (0.75,2.33)	15.33 p<0.001 (6.82,34.48)	1.31 p=0.514 (0.58,2.94)	4.37 p=0.001 (1.83,10.43)	1.46 p=0.425 (0.58,3.70)
Q41	2.61 p<0.001 (1.82,3.75)	1.01 p=0.977 (0.67,1.51)	1.96 p=0.019 (1.12,3.45)	1.52 p=0.224 (0.78,2.97)	0.90 p=0.861 (0.29,2.78)	0.71 p=0.555 (0.23,2.23)	5.15 p<0.001 (2.70,9.81)	0.68 p=0.243 (0.35,1.30)	4.49 p=0.003 (1.69,11.91)	1.00 p=0.994 (0.35,2.89)	1.29 p=0.641 (0.45,3.72)	0.88 p=0.824 (0.28,2.78)
Q42	2.68 p<0.001 (1.93,3.73)	1.35 p=0.109 (0.94,1.95)	2.49 p<0.001 (1.49,4.15)	1.67 p=0.089 (0.92,3.03)	1.35 p=0.531 (0.53,3.40)	1.14 p=0.799 (0.42,3.07)	4.79 p<0.001 (2.68,8.57)	0.89 p=0.692 (0.49,1.61)	2.47 p=0.048 (1.01,6.04)	2.50 p=0.083 (0.89,7.06)	1.19 p=0.772 (0.37,3.75)	1.29 p=0.692 (0.36,4.57)
Q43	2.10 p<0.001 (1.47,3.00)	1.50 p=0.061 (0.98,2.30)	1.85 p=0.034 (1.05,3.28)	1.54 p=0.217 (0.78,3.06)	0.55 p=0.268 (0.19,1.58)	1.14 p=0.814 (0.39,3.32)	2.68 p=0.003 (1.40,5.11)	1.40 p=0.358 (0.68,2.85)	5.40 p<0.001 (2.20,13.29)	1.55 p=0.377 (0.58,4.13)	1.38 p=0.535 (0.50,3.86)	1.09 p=0.874 (0.37,3.21)
Q44	3.26 p<0.001 (2.31,4.61)	1.26 p=0.243 (0.85,1.87)	2.96 p<0.001 (1.74,5.04)	1.46 p=0.239 (0.78,2.75)	1.63 p=0.317 (0.63,4.21)	1.23 p=0.698 (0.44,3.46)	6.87 p<0.001 (3.74,12.61)	0.89 p=0.726 (0.48,1.67)	2.28 p=0.122 (0.80,6.48)	2.01 p=0.266 (0.59,6.83)	1.32 p=0.613 (0.45,3.94)	1.27 p=0.700 (0.37,4.33)
Q45	2.33 p<0.001 (1.60,3.38)	1.12 p=0.626 (0.72,1.73)	1.61 p=0.106 (0.90,2.86)	1.19 p=0.593 (0.63,2.26)	0.76 p=0.600 (0.26,2.16)	0.92 p=0.885 (0.32,2.70)	3.53 p<0.001 (1.86,6.70)	0.98 p=0.961 (0.51,1.91)	6.19 p<0.001 (2.23,17.16)	0.97 p=0.950 (0.32,2.90)	2.23 p=0.147 (0.75,6.62)	1.06 p=0.927 (0.32,3.49)
Q46	2.40 p<0.001 (1.68,3.43)	1.37 p=0.131 (0.91,2.07)	1.58 p=0.106 (0.91,2.75)	2.09 p=0.034 (1.06,4.11)	0.76 p=0.632 (0.25,2.32)	0.82 p=0.734 (0.26,2.55)	4.42 p<0.001 (2.36,8.28)	0.90 p=0.748 (0.47,1.72)	7.74 p<0.001 (3.00,19.92)	1.27 p=0.645 (0.46,3.54)	0.90 p=0.855 (0.30,2.73)	1.23 p=0.729 (0.38,4.06)
Q47	2.24 p<0.001 (1.58,3.16)	1.55 p=0.033 (1.04,2.31)	1.85 p=0.029 (1.07,3.20)	1.92 p=0.056 (0.98,3.77)	0.76 p=0.584 (0.28,2.03)	1.71 p=0.326 (0.59,4.96)	3.83 p<0.001 (2.11,6.94)	1.02 p=0.960 (0.55,1.88)	2.42 p=0.059 (0.97,6.05)	3.33 p=0.031 (1.12,9.93)	2.54 p=0.144 (0.73,8.83)	0.77 p=0.709 (0.19,3.11)

	Overall		Medicine		Nursing		Pharmacy		PT		OT	
	T2 vs. T1	T3 vs. T2	T2 vs. T1	T3 vs. T2	T2 vs. T1	T3 vs. T2	T2 vs. T1	T3 vs. T2	T2 vs. T1	T3 vs. T2	T2 vs. T1	T3 vs. T2
Q47	2.24 p<0.001 (1.58,3.16)	1.55 p=0.033 (1.04,2.31)	1.85 p=0.029 (1.07,3.20)	1.92 p=0.056 (0.98,3.77)	0.76 p=0.584 (0.28,2.03)	1.71 p=0.326 (0.59,4.96)	3.83 p<0.001 (2.11,6.94)	1.02 p=0.960 (0.55,1.88)	2.42 p=0.059 (0.97,6.05)	3.33 p=0.031 (1.12,9.93)	2.54 p=0.144 (0.73,8.83)	0.77 p=0.709 (0.19,3.11)
Q48	1.85 p=0.001 (1.31,2.61)	1.23 p=0.306 (0.83,1.83)	1.36 p=0.276 (0.78,2.37)	1.46 p=0.232 (0.79,2.71)	0.94 p=0.907 (0.34,2.58)	0.84 p=0.734 (0.30,2.35)	2.48 p=0.005 (1.32,4.65)	1.27 p=0.478 (0.66,2.45)	4.05 p=0.002 (1.65,9.93)	1.14 p=0.782 (0.44,2.94)	1.76 p=0.270 (0.65,4.77)	1.03 p=0.963 (0.36,2.94)
Q49	2.24 p<0.001 (1.58,3.17)	1.49 p=0.057 (0.99,2.24)	1.92 p=0.021 (1.10,3.35)	1.91 p=0.067 (0.96,3.81)	1.05 p=0.930 (0.39,2.81)	1.26 p=0.667 (0.44,3.67)	4.06 p<0.001 (2.22,7.42)	1.03 p=0.921 (0.55,1.93)	1.72 p=0.295 (0.62,4.73)	3.35 p=0.058 (0.96,11.68)	1.77 p=0.304 (0.59,5.28)	1.13 p=0.850 (0.32,3.95)
Q50	2.03 p<0.001 (1.39,2.97)	1.37 p=0.183 (0.86,2.20)	1.44 p=0.227 (0.80,2.61)	1.59 p=0.212 (0.77,3.31)	0.89 p=0.833 (0.30,2.65)	0.94 p=0.922 (0.30,2.97)	3.29 p<0.001 (1.70,6.38)	1.16 p=0.678 (0.57,2.37)	3.07 p=0.030 (1.12,8.44)	1.15 p=0.804 (0.38,3.54)	1.75 p=0.341 (0.55,5.57)	1.22 p=0.763 (0.33,4.51)
Q51	2.16 p<0.001 (1.52,3.08)	1.48 p=0.063 (0.98,2.24)	1.78 p=0.042 (1.02,3.10)	2.37 p=0.015 (1.18,4.75)	0.78 p=0.652 (0.27,2.28)	0.92 p=0.877 (0.30,2.78)	3.31 p<0.001 (1.76,6.21)	0.97 p=0.928 (0.50,1.87)	3.45 p=0.009 (1.35,8.79)	1.56 p=0.402 (0.55,4.38)	1.68 p=0.330 (0.59,4.76)	1.33 p=0.632 (0.41,4.29)
Q52	2.26 p<0.001 (1.65,3.10)	1.74 p=0.003 (1.21,2.50)	2.51 p<0.001 (1.50,4.18)	2.00 p=0.025 (1.09,3.65)	1.09 p=0.853 (0.45,2.63)	2.09 p=0.143 (0.78,5.63)	2.77 p<0.001 (1.56,4.92)	1.13 p=0.692 (0.62,2.05)	3.28 p=0.005 (1.42,7.56)	2.64 p=0.045 (1.02,6.83)	1.17 p=0.765 (0.41,3.33)	2.13 p=0.220 (0.64,7.16)
Q53	2.17 p<0.001 (1.50,3.12)	1.48 p=0.079 (0.96,2.29)	1.53 p=0.147 (0.86,2.72)	1.65 p=0.160 (0.82,3.31)	1.12 p=0.828 (0.41,3.08)	1.00 p=0.999 (0.34,2.94)	2.39 p=0.008 (1.25,4.57)	2.00 p=0.062 (0.97,4.12)	7.86 p<0.001 (2.91,21.25)	1.03 p=0.958 (0.36,2.98)	2.16 p=0.159 (0.74,6.29)	0.72 p=0.575 (0.23,2.23)
Q54	2.08 p<0.001 (1.53,2.83)	1.45 p=0.037 (1.02,2.05)	2.38 p=0.001 (1.44,3.92)	1.68 p=0.077 (0.94,3.00)	1.16 p=0.730 (0.49,2.77)	1.87 p=0.195 (0.73,4.82)	2.82 p<0.001 (1.61,4.95)	1.01 p=0.964 (0.57,1.81)	1.60 p=0.291 (0.67,3.80)	1.82 p=0.222 (0.70,4.78)	1.47 p=0.423 (0.57,3.78)	1.57 p=0.390 (0.56,4.42)
Q55	1.86 p=0.001 (1.28,2.71)	1.48 p=0.101 (0.93,2.36)	1.55 p=0.147 (0.86,2.81)	1.58 p=0.222 (0.76,3.30)	1.11 p=0.849 (0.40,3.09)	1.00 p=0.994 (0.33,2.98)	2.65 p=0.003 (1.38,5.08)	1.48 p=0.283 (0.72,3.02)	2.43 p=0.094 (0.86,6.87)	1.14 p=0.822 (0.36,3.59)	1.40 p=0.551 (0.46,4.26)	1.51 p=0.522 (0.43,5.33)

T1 = baseline; T2 = after exposure to first IPE event; T3 = after exposure to second IPE event; corresponding questions can be found in Appendix A; OT = occupational therapy; PT = physical therapy.