

# An Interdisciplinary Approach to Improve Medical Resident Perceptions of Chronic Pain Management and Primary Care as a Career

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## ABSTRACT

An interdisciplinary approach to improve medical resident perceptions of chronic pain management and primary care as a career. **Aim:** Describe an experiential, interdisciplinary educational model to improve medical resident perceptions of chronic nonmalignant pain (CNMP) and primary care as a career. **Settings and Design:** A descriptive study was carried out in a primary care clinic setting. **Methods and Materials:** An educational CNMP clinic was integrated into medicine residents' continuity clinic, and included clinical pharmacy. Residents were surveyed to evaluate changes in perception of CNMP and primary care and compared to a control group. Changes in resident prescribing and early refill requests were evaluated. **Statistical Analysis used:** Cronbach's alpha coefficient, Two-sample t-tests, and Linear regression. **Results:** 88% of residents completed the pre and post survey. There were no differences in change in resident perceptions compared to control. Confidence was higher for more senior residents ( $p < 0.05$ ), attitudes were associated with perception of primary care ( $p < 0.001$ ) and there were incremental changes in resident prescribing for 38 patients and early refill requests. **Conclusion:** The CNMP clinic is a feasible model for others to implement. Resident attitudes towards managing CNMP are associated with perception of primary care as a career.

**Key words:** Chronic pain; medical resident education; opioids; pharmacy

**Key Messages:** An experiential, educational CNMP pain service with clinical pharmacists can be integrated into medical residents' continuity clinics. Medical resident perception of primary care as a career choice is influenced by attitudes towards CNMP, but not confidence in managing CNMP.

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## INTRODUCTION

More than 116 million US persons suffer with chronic non-malignant pain (CNMP),<sup>[1]</sup> costing \$300 billion in healthcare costs and \$300 billion more in lost productivity costs each year.<sup>[2]</sup> The Institute of Medicine (IOM) states effective pain management is a moral imperative and there is a need for interdisciplinary approaches to treating pain.<sup>[2]</sup> Although some may feel CNMP patients are ideally cared for by pain specialists, there are not enough specialists to care for the number or needs of the CNMP population.<sup>[3]</sup> Therefore, the majority of these patients are managed in primary care, rather than by specialists. The challenge of caring for CNMP is additionally hindered by the shortage of PCPs. Despite the amount of time spent caring for CNMP patients, PCPs do not feel prepared to manage the high-risk and complicated needs of CNMP patients, nor do they find satisfaction in caring for these patients.<sup>[4]</sup>

Medical residents also consistently report feeling unprepared to manage these complex and high-risk patients and have negative attitudes towards these patients.<sup>[5-8]</sup> Further, medical residents report that CNMP patients negatively influence their perception of primary care as a career choice,<sup>[5,8]</sup> which is also concerning given the shortage of PCPs available to care for the needs of the growing population. This negative perception of primary care may be the result of feeling unprepared to manage the complexity of CNMP patients, or because they are confronted with more challenging CNMP patients than attending's.

Compared to attending's, residents have higher proportions of CNMP patients within their patient panels<sup>[9]</sup> and have proportionally more patients displaying aberrant behaviors, suggestive of prescription drug abuse.<sup>[9,10]</sup> Resident patients are more likely to report lost or stolen opioid prescriptions, receive opioids from another provider, display indicators of substance abuse<sup>[9]</sup> and request early refills.<sup>[10]</sup> Further, resident CNMP patients are more likely to receive early opioid

refills than attending patients.<sup>[10]</sup> While studies demonstrate similar proportions of resident and attending patients receiving controlled substance agreements and urine drug testing,<sup>[10]</sup> the disparity in patient aberrant behavior suggests residents would benefit from better training and supervision in methods to effectively and safely manage patients with CNMP.<sup>[9]</sup>

To improve confidence and attitudes of medical residents in managing CNMP, didactic and experiential educational interventions have been implemented and have consistently improved resident attitudes<sup>[11]</sup> and confidence.<sup>[12,13]</sup> Others have reported that CNMP experiences during residency negatively impact residents' decision to pursue primary care as a career.<sup>[8,14]</sup> However, none has evaluated whether changing residents' generally negative attitudes towards CNMP or improving resident confidence in managing CNMP improves their perception of primary care as a career.

One way to further advance the education of medical residents and improve CNMP prescribing in the primary care setting is to implement an educational, interdisciplinary CNMP clinic as a required component of medical residents' continuity clinic, in which pharmacy and medicine disciplines are learning collaboratively. Given that CNMP involves a high degree of complex and high-risk medication management and

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physical assessment, a pharmacy-physician team-based approach is ideal. Such collaborative team-based care models are aligned with the IOM's call for interdisciplinary CNMP care interventions.<sup>[2]</sup> Therefore here we describe an experiential, interdisciplinary educational model to improve medical resident perceptions of CNMP and primary care as a career choice.

## SUBJECTS AND METHODS

We implemented an interventional, educational CNMP clinic and assessed change in medical resident perceptions of CNMP, association between resident perceptions of primary care as a career choice, and, secondarily, change in resident prescribing and early refill requests.

### Setting

Both control and intervention clinics are academic, internal medicine clinics, which serve as continuity clinic sites for medical residents. Medical residents spend one-week blocks in their continuity clinic every five weeks. At the control clinic (CC), there were 18 medical attending's, 26 medical residents and nearly 18,000 patient visits annually. There was no clinical pharmacist at the CC. At the intervention clinic (IC) there were 28 medical attending's, one clinical pharmacy attending, 24 medical residents and nearly 35,000 patient visits annually. The clinical pharmacist has been integrated into the IC for over five years, overseeing pharmacy students, residents and fellows who provide direct care for patients in a layered learning model. The pharmacy team collaboratively manages and prescribes medications for patients, including CNMP, under collaborative practice agreements. Both clinics have had a standard controlled substance policy for five years.

### Interventional CNMP clinic description

The intervention is an interdisciplinary, educational, CNMP clinic integrated into the medical resident continuity care clinic at the IC. The interdisciplinary CNMP clinic followed the standard medical resident continuity clinic visit structure, except that the medical residents collaboratively conducted the visits with a fourth-year pharmacy student and staffed the patients with both pharmacy and physician attending's. Patients seen in the CNMP clinic were limited to CNMP patients assigned to a PCP who was a medical attending and who were prescribed chronic opioids, defined as at least three months of opioid prescriptions. Medical resident CNMP patients were not eligible to be seen in the CNMP clinic to avoid biasing the effect on medical resident prescribing practices. Eligible patients were identified by an automated report of patients taking chronic opioids, generated from the electronic health record. Chart review was performed to confirm that patients were being treated for chronic pain and did not have an active cancer diagnosis. For eligible patients, a referral was pending for the provider. If accepted, the referral served as approval for the pharmacist to manage CNMP independently or collaboratively in the CNMP clinic. Although PCP referral is legally required for patients to be managed independently by the pharmacist, the referral was not legally required for patients to be managed in the CNMP clinic, but served as a sign of collegial respect for a PCP's autonomy. PCPs accepted referrals if they wanted the assistance of the pharmacist in managing CNMP for a specific patient.

The interventional CNMP clinic was held two half days per week, allowing for two residents to cycle through per week. Each resident was exposed to the pain clinic intervention twice over one year. Given attending and resident vacation and holiday schedules, each resident's CNMP sessions were flexible and individualized, with the first and second sessions occurring approximately 15 to 20 weeks apart. Residents were informed of their assigned CNMP days in advance, when they received their continuity clinic schedule. Residents and

pharmacy students were also sent an email approximately seven days in advance of their CNMP sessions to facilitate communication between the trainees, provide guidance on the visit organization and each discipline's responsibilities, and share educational materials. Trainees were encouraged to conduct the visit collaboratively and informed that the medical resident was primarily responsible for the physical assessment, whereas pharmacy was primarily responsible for the therapeutic assessment. Educational materials included an overview of the "4 A's" of pain treatment (analgesia, adverse effects, aberrant behavior, activities of daily living)<sup>[15]</sup> and a written algorithm to guide CNMP prescribing stratified by type of pain (neuropathic, fibromyalgia, musculoskeletal, visceral).

Patients were scheduled using a newly created visit type, "PharmD-MD Pain Clinic", to facilitate clear communication of who they were seeing. Appointments were scheduled for 60 minutes, which is considered an extended visit, to allow adequate time for multiple learners and the complexities of this population. However, visits commonly exceeded 60 minutes. Once a patient arrived for an appointment, the provider type was switched to the medical residents' name to assign responsibility and facilitate billing.

During the CNMP visits, informal education and teaching complemented the experiential education, similar to standard resident clinic presenting. An educational emphasis was placed on 1) conducting a focused examination and pain assessment; 2) optimal medication management of CNMP; and 3) communicating goals and expectations with patients, including controlled substance policies and agreements. For each CNMP clinic session, residents were encouraged to use the "four A's" of pain management to guide clinical assessments. When possible, updates to the literature were reviewed, including the 2016 Centers for Disease Control and Prevention guidelines for CNMP in primary care.<sup>[16]</sup> Further, medical residents and pharmacy students were asked to calculate patients' total daily dose of opioids in morphine equivalents and discuss the risks and benefits of a given patient's use of opioids.

### Outcome measures and data collection

The primary outcomes were resident attitudes and confidence in managing CNMP and perception of primary care as a career, which were measured using a survey. The survey was created *de novo* after reviewing survey questions used in previous studies.<sup>[5-8,11-13]</sup> The initial survey included 46 questions and was piloted by a group of six third-year medical residents who graduated in 2015 and thus were not included in the data analysis. The pilot survey took each resident between two and five minutes to complete. Resident feedback was used to modify the final survey tool. The final survey is included in Appendix 1 and includes 42 questions and four domains assessing demographics (e.g., residency track, year in training), confidence in managing CNMP, attitudes towards managing CNMP, and perception of primary care as a career. Baseline surveys were distributed to residents at both clinics prior to the launch of the CNMP clinic. The survey was distributed electronically using RedCap<sup>[17]</sup> and linked by a unique identifier. The surveys were distributed over eight weeks to all medical residents in graduating classes of 2016, 2017 and 2018. During the eight weeks, residents received up to three reminders to complete the survey, separated by two week intervals. Residents only received a reminder if they did not complete the survey. Post-intervention surveys were distributed to both clinics once all residents at the IC completed two clinic sessions. Residents were entered into a random drawing to receive a gift card for completing the baseline survey and again if they completed both the baseline and post-intervention survey. Post-card consent was included in the electronic surveys.

We also evaluated resident CNMP prescribing practices and patient aberrant behaviors as secondary outcomes at the IC clinic before and after the CNMP intervention. Patient pain type (i.e., musculoskeletal, fibromyalgia, neuropathy, visceral, other) was collected at baseline to evaluate appropriateness of prescribing. To evaluate prescribing practices, we evaluated concurrent prescribing of benzodiazepines and opioids,<sup>[18]</sup> prescribing of non-opioid adjunctive medications to treat neuropathy and fibromyalgia, and total daily dose of opioids in morphine equivalents. Morphine daily doses were stratified by less than and greater than or equal to 90 mg to align with thresholds indicating greater safety risks.<sup>[16]</sup> We also defined a measure of prescribing to evaluate concurrent use of short- and long-acting opioids as “patients taking more than 30 mg of morphine equivalents daily as short acting opioids and no long acting opioids” because the available dosage forms of long acting opioids preclude starting doses lower than 30 mg of morphine equivalents per day. For example, the lowest possible starting doses for morphine ER is 15 mg twice daily and for oxycodone ER is 10 mg twice daily; each is equivalent to 30 mg of morphine daily. Although current opioid guidelines question concurrent use of short and long acting opioids, because of limited evidence,<sup>[16]</sup> the gold standard historical practice has been to use long and short acting opioids together to optimize pain management. To evaluate patient aberrancy, patient requests for early refills were evaluated, including whether they were granted. Medical records of patients with a designated IC resident as a PCP in both the baseline and post-intervention period were reviewed to evaluate prescribing practices and aberrancy. The baseline and post-intervention chart review periods were each three months in duration. The baseline chart review period was the three-months prior to the first CNMP clinic session, independent of each resident’s first exposure. The post-intervention chart review period was defined as the three-month period beginning three months after each resident’s first exposure to the pain clinic intervention; this varied according to each resident’s first exposure to the intervention. The timing of the post-intervention chart review allowed residents time to implement changes before being evaluated. Prescribing behaviors were collected at the end of each chart review period to represent the most current medication regimen for the patient in the three-month period. Data related to early refill requests was collected cumulatively over each three-month chart review period. The chart reviews were completed independently by two investigators to ensure accuracy. All residents at the IC clinic provided informed consent, allowing evaluation of their prescribing practices.

### Statistical analysis

Medical resident characteristics were summarized by clinic location. CNMP pain clinic patient characteristics were summarized at baseline, as well as pre and post intervention. Domain values for residence confidence in managing CNMP (confidence), attitudes of managing CNMP (attitudes), and perception of primary care as a career (perception) were estimated as the mean values of the likert scale responses from individual questions within each domain. Cronbach’s alpha coefficient was used to evaluate internal consistency of each domain at baseline. Two-sample t-tests were used to assess baseline differences in domain values between clinic location, and linear regression was used to evaluate associations between domain outcomes and resident clinic and residency class, and between baseline domain values.

### RESULTS

The CNMP clinic sessions were held September 8, 2015 through April 14, 2016.

#### Survey responses

Baseline and post-intervention surveys were distributed across eight weeks prior to, and at the conclusion of, the CNMP clinical sessions. There were 49 residents who completed the baseline survey (96% at IC and 100% at CC). Of those that completed the baseline survey, 100% at the IC and 81% at the CC completed the post-intervention survey. There was equal representation across each year of residency. Table 1 describes the characteristics of residents who responded to the baseline and post-intervention survey. Table 2 describes their responses to the confidence, attitudes and perception domains.

#### Internal survey consistency at baseline

Cronbach’s alpha coefficient was used to evaluate internal consistency of the three survey domains of confidence, attitudes and perception of primary care at baseline. Within the confidence domain, internal consistency was extremely high, with an alpha of 0.93. Within the domains of attitudes and perception of primary care, consistency was 0.62 and 0.70, respectively.

#### Differences by residency clinic location

At baseline, there were no significant differences in confidence, attitude, or perception of primary care between residency locations. There were

**Table 1:** Medical resident characteristics, n=49 baseline responses

Resident characteristics	Overall n (%), (49/50 responded)	Intervention Clinic n (%), (23/24 responded)	Control Clinic n (%), (26/26 responded)
<b>Year of residency</b>			
Post-graduate year 1 (class of 2018)	18 (36.7)	9 (39.1)	9 (34.6)
Post-graduate year 2 (class of 2017)	12 (24.5)	4 (17.4)	8 (30.8)
Post-graduate year 3 (class of 2016)	19 (38.8)	10 (43.5)	9 (34.6)
<b>Residency track</b>			
Primary care	8 (16.3)	6 (26.1)	2 (7.7)
Hospitalist	10 (20.4)	5 (21.7)	5 (19.2)
Categorical	30 (61.2)	12 (52.2)	18 (69.2)
Physician Scientist Training Program	1 (2.0)	0	1 (3.9)
<b>Gender</b>			
Female	24 (49.0)	15 (65.2)	9 (34.6)
<b>Frequency of checking Prescription Drug Monitoring Program in past year</b>			
0-5 times	26 (53.1)	15 (65.2)	11 (42.3)
6-10 times	12 (24.5)	5 (21.7)	7 (26.9)
11-15 times	2 (4.1)	2 (8.7)	0
More than 15 times	9 (18.4)	1 (4.4)	8 (30.8)

**Table 2:** Resident survey responses: Confidence and attitudes towards CNMP and perception of primary care as a career

		Mean	Standard Deviation	Minimum	Maximum
<b>Intervention Clinic</b>					
Domain 1: Confidence in managing CNMP	Baseline	2.7	0.6	1.7	3.6
	Post-intervention	3.1	0.4	2.4	3.8
	Change	0.4	0.3	-0.4	1.2
Domain 2: Attitudes towards managing CNMP	Baseline	2.8	0.5	2.0	4.0
	Post-intervention	2.8	0.6	1.3	4.0
	Change	0.0	0.4	-1.3	0.8
Domain 3: Perceptions towards primary care as a career	Baseline	2.2	0.4	1.5	3.0
	Post-intervention	2.2	0.4	1.0	3.3
	Change	0.0	0.4	-1.3	1.0
<b>Control Clinic</b>					
Domain 1: Confidence in managing CNMP	Baseline	2.5	0.3	1.8	3.2
	Post-intervention	2.8	0.3	2.4	3.8
	Change	0.3	0.3	-0.2	1.4
Domain 2: Attitudes towards managing CNMP	Baseline	3.0	0.3	2.3	3.5
	Post-intervention	3.1	0.4	2.3	3.5
	Change	0.1	0.3	-0.8	0.5
Domain 3: Perceptions towards primary care as a career	Baseline	2.0	0.4	1.5	2.8
	Post-intervention	1.9	0.4	1.3	2.8
	Change	0.0	0.4	-0.8	0.8

also no significant differences in change between pre and post survey confidence based on residency location ( $p=0.2303$ ). Similarly, there were no differences in change between pre and post survey attitudes or perception based on residency location ( $p=0.5076$  and  $p=0.9119$  respectively). However, among all residents, confidence increased by a mean of 0.35 (SD 0.33), while attitudes and perception of primary care did not appear to change; mean attitude change was 0.03 (SD 0.35), and mean perception of primary care change was -0.03 (SD 0.41). Figure 1 describes change in confidence. Figures 2 describe baseline responses to the survey domains.

### Differences by residency year

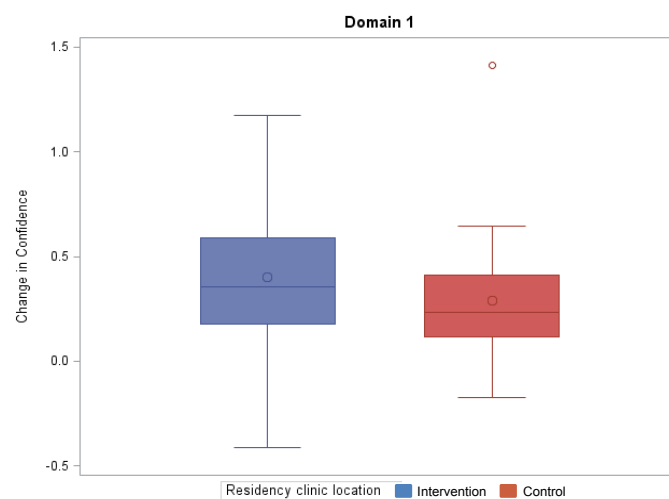
Baseline confidence was significantly associated with residency class ( $p<0.001$ ); class of 2016 residents reported a higher level of confidence (on average 0.86 points higher) than those in the class of 2018. Similarly, class of 2017 residents reported higher confidence (0.46 points higher) than those of 2018. Residency class was not significantly associated with baseline attitude towards CNMP management or perception of primary care as a career ( $p=0.9263$  and  $p=0.1910$ , respectively).

### Associations between domains

Although there was no significant relationship between resident confidence and attitudes towards management of CNMP ( $p=0.4713$ ) or confidence and perception of primary care ( $p=0.6379$ ), there was a significant association between resident attitudes and perception of primary care as a career ( $p<0.0001$ ). On average, residents with a more positive attitude had a 0.57 point higher positive association with primary care as a career.

### Changes in resident prescribing for CNMP patients

The residents at the IC were designated the PCP for 38 unique patients who were in both the baseline and post-intervention periods. All 38 patients were prescribed chronic opioids in the baseline period. Most (90%) patients had musculoskeletal pain and all 29 (76%) patients with neuropathic pain had comorbid musculoskeletal pain. There were three patients (8%) with fibromyalgia; two of three had comorbid neuropathy and all had comorbid musculoskeletal pain. Table 3 summarizes changes in resident prescribing and early refill requests.



**Figure 1:** Change in resident confidence in managing CNMP over time, (change in mean Likert scale scores pre/post CNMP intervention)

### Change in prescribing

The mean change in daily opioid dose in morphine equivalents was an increase of 0.72 (SD 25.3). Although there were 22 patients (57.9%) with no change in dosing, 11 patients (29%) had a decrease in morphine equivalents, ranging from 5 mg to 60 mg (mean decrease 21.4 mg; SD 17.6 mg) and 5 patients (13.2%) had an increase, ranging from 30 to 75 mg (mean increase 52.5 mg; SD 21.2). Of the ten patients (26.3%) prescribed at least 90 mg of morphine equivalents daily at baseline, two were lowered to less than 90 mg in the post-intervention period, while one additional patient was increased from less than 90 mg to at least 90 mg. There were no notable changes in the prescribing long acting opioids overall. There were also no notable changes in prescribing for patients taking at least 30 mg of daily morphine equivalents.

There were nine patients (23.7%) prescribed a benzodiazepine with an opioid at baseline; two (5%) of these patients discontinued their benzodiazepine in the post-intervention period, while one

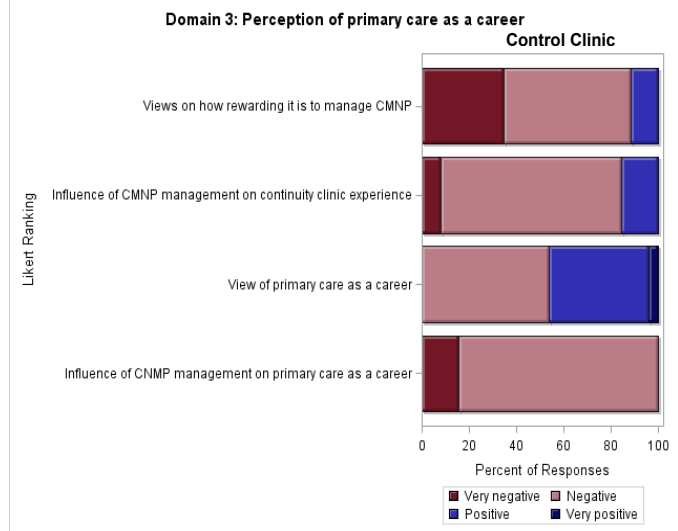
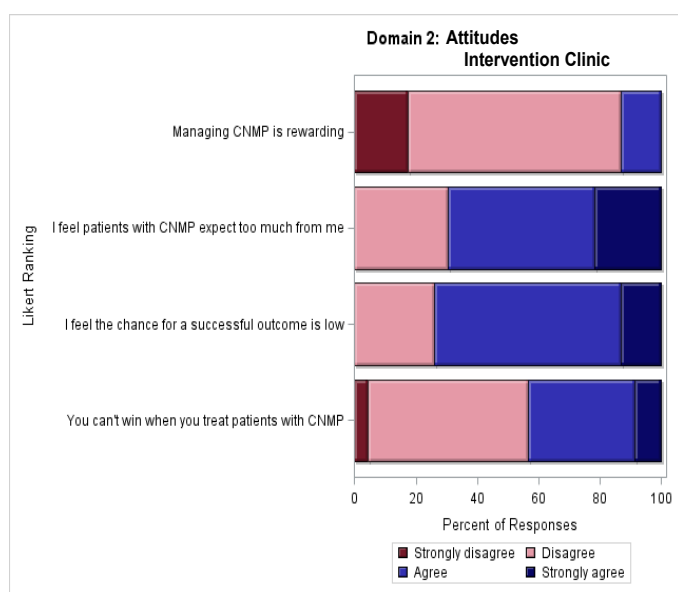
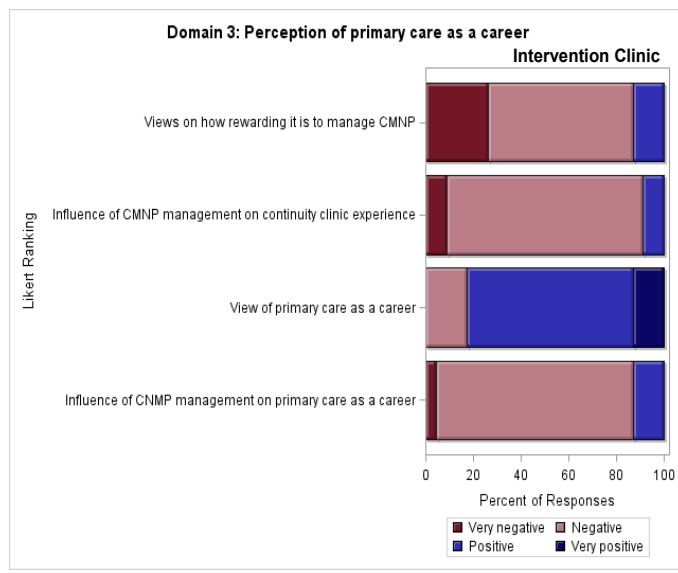
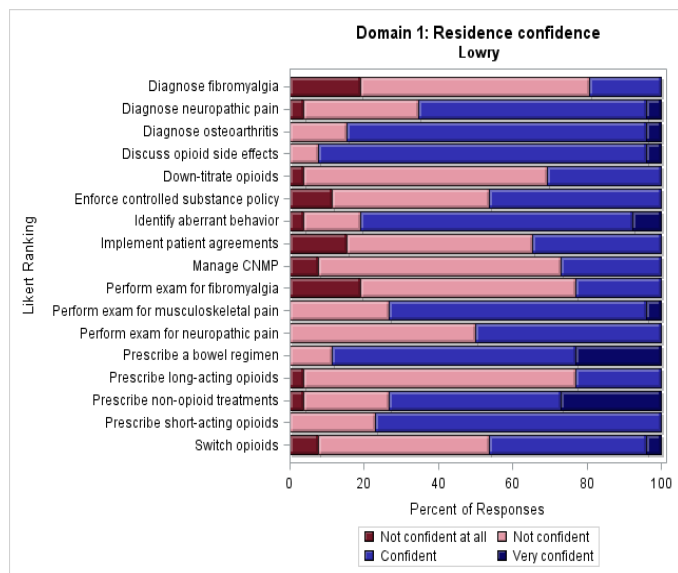
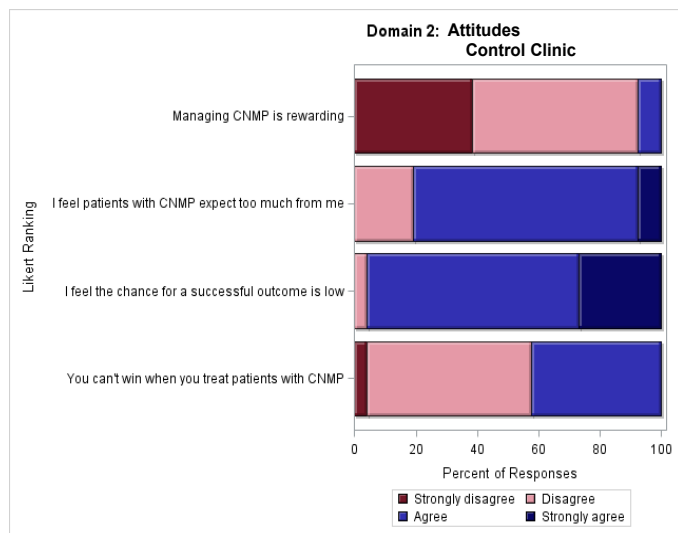
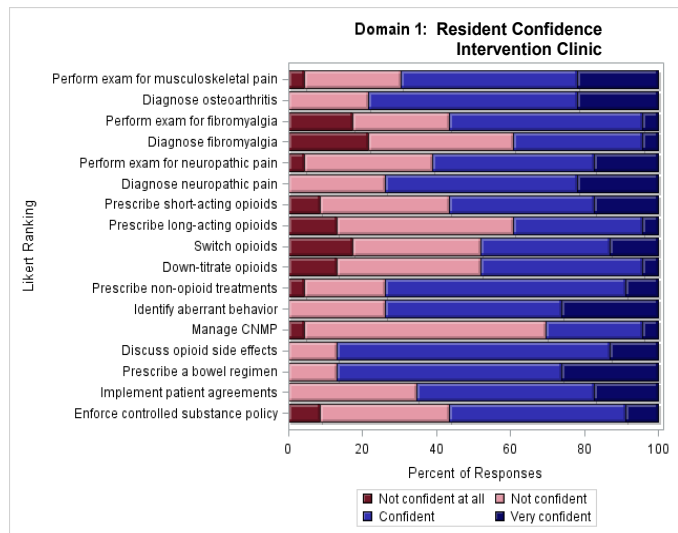


Figure 2: Resident baseline confidence, attitudes and perception of primary care as a career, individual response items

**Table 3:** CNMP prescribing and early refill requests, n=38 unique patients

Characteristic	Baseline n (%) or mean (Standard deviation)	Post-Intervention, n (%) or mean (Standard deviation)
<b>Prescribing practice</b>		
Prescribed benzodiazepine	9 (23.7)	8 (21.1)
Patients with neuropathy (N=29)		
Patients prescribed medication that treats neuropathy	18 (62.1)	21 (72.4)
Neuropathy Medications, Median (IQR)*	1 (1, 2)	2 (1, 3)
Total daily dose of morphine equivalents (mg), Mean (SD)	66.2 (65.0)	66.9 (68.8)
Taking ≥ 90 mg of morphine equivalents daily	10 (26.3)	9 (23.7)
Prescribed long-acting opioid	14 (36.8)	13 (34.2)
Taking >30 mg of morphine equivalents daily without a long-acting opioid**	10 (41.7)	11 (44.0)
<b>Early refill requests</b>		
Requests for early refills of opioids	9 (23.7)	6 (15.8)
Early refill requests granted	3 (33.3)	5 (83.3)

Denominator is patients taking neuropathic medication and diagnosis of neuropathic pain, not all patients with neuropathic pain; Baseline denominator is 24 and post-intervention denominator is 25

additional patient was prescribed a benzodiazepine. All patients with fibromyalgia were prescribed a non-opioid adjunctive medication to treat fibromyalgia pain at baseline and the post-intervention period. However, there was an increase in prescribing a non-opioid adjunctive medication for the 29 patients with neuropathic pain from baseline (62.1%) to the post-intervention period (72.4%).

### Early refill requests

Fewer patients requested early refills in the post-intervention period (23.7% versus 15.8%), but more early refill requests were granted by the residents (33.3% versus 83.3%). In the baseline period, each patient only had one request, but in the post-intervention period, one of the six patients had three early refill requests.

## DISCUSSION

We described an experiential, interdisciplinary approach to teaching CNMP to medical residents during their continuity clinics that can be used by others. Although we did not find significant changes before and after implementation of the CNMP clinic, the model was feasible and informal feedback from attending’s, medical residents and pharmacy students, and patients was positive. Over time, resident confidence towards CNMP management improved across both clinics, but there was no change in attitudes toward CNMP management or perception of primary care. As expected, confidence in managing CNMP was higher in more senior residents, which is likely owing to greater experience. Although there was no significant relationship between other domains, there was a significant relationship between resident attitudes towards managing CNMP and perception of primary care as a career. Residents with more favorable attitudes were more likely to perceive primary care as a career more positively. This is consistent with publications in which medical residents report managing CNMP negatively influences their perception of primary care as a career choice.<sup>[5,8]</sup>

Others have described didactic educational interventions improve resident prescribing of pain medications for hospitalized patients.<sup>[19]</sup> Here we attempted to improve outpatient prescribing and management of CNMP, but were limited by our sample size, thus found no significant changes. We were surprised by the limited number of patients eligible for chart review, given prior findings that residents have greater number of CNMP patients.<sup>[9]</sup> However, the small sample of CNMP patients managed by the residents is likely a multifactorial explanation;

many patients were not followed by the resident or the same resident in the pre and post period, and some patients were inadvertently scheduled with and seen in the CNMP clinic so were excluded. Medical residents expressed strong interest in referring their CNMP patients to pharmacy and the collaborative CNMP clinic and patients were at times scheduled, given there was no hard stop to prevent these patients from being scheduled.

Although we describe large cohorts of medical residents across two continuity clinics, the sample size of residents and their patients were small and we were limited to a short evaluation period prior to the senior residents graduating. These constraints limited our ability to increase duration of exposure to the CNMP intervention and generate meaningful changes with small samples. Future studies with larger sample sizes and longer duration are needed to evaluate the impact of an educational intervention on resident confidence, attitudes and prescribing practices for CNMP for outpatients.<sup>[20]</sup>

While we did not identify significant changes in outcomes as a result of the CNMP clinic, we are confident medical residents and pharmacy students benefit from the experience in terms of comfort with managing CNMP and working in interdisciplinary models of care. From a patient care perspective, some providers would even request complex patients be seen specifically in the CNMP instead of independently by the pharmacist, given the attention from both pharmacy and medicine. Therefore, we are continuing to require a modified version of the CNMP clinic for all medical residents. The modified CNMP clinic will include patients with all chronic diseases and be open to attending and resident patients. These modifications will broaden the experiential learning and overcome barriers to getting CNMP patients to scheduled appointments. One of the lessons we learned was scheduling CNMP patients can be challenging, given CNMP patients are hard to reach and appear to have a higher propensity to no show to appointments. Identification of CNMP patients using our automated report was also challenging, because of limitations of the current report, including inability to accurately capture cancer diagnoses and duration of opioid prescriptions. Similar to the CNMP clinic, in the modified clinic, patients will be limited to those who are referred to the pharmacy team for chronic disease management, thus avoiding visits that are purely diagnostic or focused on physical assessment to ensure rich interdisciplinary learning.

## CONCLUSION

The interdisciplinary, experiential CNMP clinic is a feasible model for others to implement into continuity clinics for medical resident education. Resident attitudes towards managing CNMP are associated with perception of primary care as a career. Additional research is needed to evaluate the impact of a longer educational intervention on resident prescribing, confidence and attitudes towards managing CNMP and corresponding impact on perception of primary care as a career.

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## REFERENCES

1. Tsang A, Von Korff M, Lee S. Common Chronic Pain Conditions in Developed and Developing Countries: Gender and Age Differences and Comorbidity With Depression-Anxiety Disorders. *J Pain* 2008;9:883-91.
2. IOM. *Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education and Research* 2011.
3. Cheatle MD, Klocek JW, McLellan AT. Managing pain in high-risk patients within a patient-centered medical home. *Transl Behav Med* 2012;2:47-56.
4. Upshur CC, Luckmann RS, Savageau JA. Primary care provider concerns about management of chronic pain in community clinic populations. *J Gen Intern Med* 2006;21:652-5.
5. Chen JT, Fagan MJ, Diaz JA, Reinert SE. Is treating chronic pain torture? Internal medicine residents' experience with patients with chronic nonmalignant pain. *Teach Learn Med* 2007;19:101-5.
6. Fox AD, Kunins HV, Starrels JL. Which skills are associated with residents' sense of preparedness to manage chronic pain? *J Opioid Manag* 2012;8:328-36.
7. Yanni LM, McKinney Ketchum JL, Harrington SB. Preparation, Confidence, and Attitudes About Chronic Noncancer Pain in Graduate Medical Education. *J Grad Med Educ* 2010;2:260-8.
8. Khan MI. Management of chronic nonmalignant pain. *Anesthesiology* 1998;89:788-90.
9. Colburn JL, Jasinski DR, Rastegar DA. Long-term opioid therapy, aberrant behaviors, and substance misuse: Comparison of patients treated by resident and attending physicians in a general medical clinic. *J Opioid Manag* 2012;8:153-60.
10. Khalid L, Liebschutz JM, Xuan Z. Adherence to Prescription Opioid Monitoring Guidelines among Residents and Attending Physicians in the Primary Care Setting. *Pain Med* 2015;16:480-7.
11. Evans L, Whitham JA, Trotter DRM, Filtz KR. An evaluation of family medicine residents' attitudes before and after a PCMH innovation for patients with chronic pain. *Fam Med* 2011;43:702-11.
12. Smith CD. A curriculum to address family medicine residents' skills in treating patients with chronic pain. *Int J Psychiatry Med* 2014;47:327-36.
13. Gunderson EW, Coffin PO, Chang N, Polydorou S, Levin FR. The Interface Between Substance Abuse and Chronic Pain Management in Primary Care: A Curriculum for Medical Residents. *Subst Abuse* 2009;30:253-60.
14. Chen JT, Fagan MJ, Diaz JA, Reinert SE. Is treating chronic pain torture? Internal medicine residents' experience with patients with chronic nonmalignant pain. *Teach Learn Med* 2007;19:101-5.
15. Passik SD, Weinreb HJ. Managing chronic nonmalignant pain: overcoming obstacles to the use of opioids. *Adv Ther* 17:70-83.
16. Dowell D, Haegerich TM, Chou R. CDC Guideline for Prescribing Opioids for Chronic Pain - United States. *MMWR Recomm Rep* 2016;65:1-49.
17. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG, *et al.* Research electronic data capture (REDCap)-A metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42:377-81.
18. Dowell D, Haegerich TM, Chou R. CDC Guideline for Prescribing Opioids for Chronic Pain, United States. *MMWR Recomm Rep* 2016;65:1-49.
19. Ury WA, Rahn M, Tolentino V. Pain management and palliative care curriculum improve the opioid prescribing practices of medical residents? *J Gen Intern Med* 2002;17:625-31.
20. Weaver M. In pain or drug-seeking? Resident continuity clinic, chronic nonmalignant pain, and addiction. *J Opioid Manag* 2005;1:123-4.