

# Changes in Opioid Therapy Use by an Interprofessional Primary Care Team: A Descriptive Study of Opioid Prescription Data

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## ABSTRACT

**Objective:** The purpose of this study was to describe changes in opioid-therapy prescription rates after a family medicine practice included on-site chiropractic services.

**Methods:** The study design was a retrospective analysis of opioid prescription data. The database included opioid prescriptions written for patients seeking care at the family medicine practice from April 2015 to September 2018. In June 2016, the practice reviewed and changed its opioid medication practices. In April 2017, the practice included on-site chiropractic services. Opioid-therapy use was defined as the average rate of opioid prescriptions over all medical providers at the practice.

**Results:** There was a significant decrease of 22% in the average monthly rate of opioid prescriptions after the inclusion of chiropractic services ( $F_{1,40} = 10.69$ ;  $P < .05$ ). There was a significant decrease of 32% in the prescribing rate of schedule II opioids after the inclusion of chiropractic services ( $F_{2,80} = 6.07$  for the Group  $\times$  Schedule interaction;  $P < .05$ ). The likelihood of writing schedule II opioid prescriptions decreased by 27% after the inclusion of chiropractic services (odds ratio, 0.73; 95% confidence interval, 0.59-0.90). Changes in opioid medication practices by the medical providers included prescribing a schedule III or IV opioid rather than a schedule II opioid ( $F_{6,76} = 29.81$ ;  $P < .05$ ) and a 30% decrease in the daily doses of opioid prescriptions (odds ratio, 0.70; 95% confidence interval, 0.50-0.98).

**Conclusion:** This study demonstrates that there were decreases in opioid-therapy prescribing rates after a family medicine practice included on-site chiropractic services. This suggests that inclusion of chiropractic services may have had a positive effect on prescribing behaviors of medical physicians, as they may have been able to offer their patients additional nonpharmaceutical options for pain management. (*J Manipulative Physiol Ther* 2021;00:1-10)

**Key Indexing Terms:** *Chiropractic; Family Practice; Analgesics, Opioid; Prescriptions*

## INTRODUCTION

The United States national policy to combat the opioid crisis includes the promotion of safe, effective, nonpharmacologic interventions for pain management.<sup>1,2</sup> Spinal manipulative therapy is a safe and effective intervention for neck and low back pain, as evidenced by modest improvements in pain and function.<sup>3-10</sup> In addition, patient education, self-care, common analgesics, exercise, spinal manipulative therapy, and cognitive behavioral therapy are effective management strategies for chronic back pain conditions.<sup>5,11-13</sup>

Cost-effective conservative approaches to include spinal manipulative therapy are appropriate for the vast majority of people with recurring, non-life-threatening low back pain seen in the primary care setting.<sup>6,11,12,14-17</sup> Research on the integration of nonpharmacologic interventions into an array of clinical settings to manage pain and reduce the use of opioid analgesics seems warranted.

There are a few retrospective cohort studies that have addressed the association between use of chiropractic services and opioid-therapy use. Use of chiropractic services for low back pain significantly decreased the likelihood that New Hampshire residents would fill a prescription for an opioid analgesic (adjusted odds ratio [OR], 0.45)<sup>18</sup> or have an adverse drug event (adjusted OR, 0.49).<sup>19</sup> Use of chiropractic services for low back pain also reduced the annual health care costs of filling prescriptions for opioid analgesics and clinical services by at least 70% in 2013 and 2014.<sup>18</sup> A recent study confirmed the association between use of chiropractic services and filling opioid prescriptions for people with spine pain in Connecticut, Massachusetts, and New Hampshire.<sup>20</sup> Previous retrospective cohort studies using insurance claims data to compare opioid and

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nonopioid claimants report that receiving chiropractic services for low back pain reduced opioid prescription fills by 60% (OR, 0.40).<sup>21,22</sup>

A national retrospective cohort study reports on the association between initial health care provider for a new onset of low back pain and early and long-term opioid-therapy use. The reference group was patients of a primary care physician. If the initial provider for patients with a new onset of low back pain was a physical therapist, chiropractor, or acupuncturist, then there was a reduction of 85% to 90% in the early use of opioid therapy (respective adjusted ORs and 95% confidence intervals [CIs], 0.15, 0.13-0.17; 0.10, 0.09-0.10; 0.09, 0.07-0.12).<sup>23</sup> Long-term use of opioid therapy for low back pain was reduced by 75% for those who initially underwent chiropractic care (adjusted OR, 0.22; 95% CI, 0.18-0.26) and by approximately 50% for those who initially visited a physical therapist (adjusted OR, 0.27; 95% CI, 0.15-0.48) or an acupuncturist (adjusted OR, 0.07; 95% CI, 0.01-0.48), taking into account the large 95% confidence intervals.<sup>23</sup>

Prospective cohort studies provide a higher level of evidence for an association between a treatment and outcome than retrospective cohort studies. To date, there has been 1 prospective cohort study addressing the use of chiropractic services and opioid therapy. The Washington State Disability Risk Identification Study Cohort was a prospective population-based study on opioid-therapy use for chronic back pain.<sup>24</sup> Use of chiropractic services for back pain significantly decreased the likelihood that injured workers would receive long-term opioid therapy by approximately 70% (adjusted OR, 0.29).<sup>24</sup>

Data-driven observations on the translation of clinical guidelines and policies on the use of opioid therapy and nonpharmacologic interventions for pain management in clinical settings are lacking.<sup>1,2,25</sup> A retrospective analysis of prescription drug data from an interprofessional family medicine practice will add to previous findings on the association between use of chiropractic services and opioid therapy. Generalizability of these previous findings to other clinical settings is an important research step to confirm the consistency of this association.<sup>18-20,26</sup> More research is necessary because adherence to a clinical practice guideline is variable across health care systems, geographic locations, and practice groups.<sup>27</sup> A single-clinical-setting design provides descriptive information on knowledge translation within routine primary care. Thus, the purpose of this study was to describe changes in opioid-therapy use after a family medicine practice included on-site chiropractic services.

## METHODS

### Design and Study Sample

This study was a retrospective analysis of de-identified opioid prescription data from a family medicine practice

before and after the inclusion of chiropractic services. The database included opioid prescriptions written for patients seeking care at the family medicine practice from April 2015 to September 2018. In April 2017, the practice began offering on-site chiropractic services. The comparison groups to describe changes in the use of opioid therapy were opioid prescribing practices from April 2015 to March 2017, which was before on-site chiropractic services, and opioid prescribing practices from April 2017 to September 2018, which was after the inclusion of on-site chiropractic services. The New York Chiropractic College institutional review board classified this study of de-identified opioid prescription data as exempt from review.

### Clinical Setting

The location of the family medicine practice is a large suburban city in a mid-Atlantic metropolitan area of the United States. The practice was a partner in a multispecialty medical group of the nation's top independent physicians (ie, a national physician organization). The practice's model was a collaborative, team-based medical group that included physicians, physician assistants, nurse practitioners, nurses, health coaches, nurse educators, pharmacists, and care managers. In June 2016 (which was before the beginning of on-site chiropractic services), the medical group reviewed and changed its opioid medication practices. New guidelines included lowering the dose prescribed, reducing the number of pills prescribed, limiting the number of refills, and prescribing schedule III or IV opioids rather than schedule II opioids.

In April 2017, the medical group began on-site chiropractic services. Chiropractic services were available for half a day, Monday through Friday, with patient referrals increasing over the first 4 months (through July 2017). On-site referral patterns developed as communications between and among providers, staff, and patients improved during those first 4 months. Factors contributing to improved communication were the common goal of the practitioners to reduce opioid-therapy use, the treating chiropractor having over 20 years of experience working in interprofessional clinic settings, the development of an efficient flow of routine office care to include patient referrals from a medical visit to a chiropractic visit at the same appointment time, the development of self-evident criteria for referring patients to chiropractic care, and the opportunity and ability for medical providers to educate their patients about the benefits and risks of chiropractic care. From August 2017 to September 2018, the process of referring a patient from a medical visit to a chiropractic visit reflected efficient practice management characteristics of an interprofessional primary care team,<sup>28</sup> that is, chiropractic services established within the family medicine practice.

The self-evident referral criteria were any and all new onset of musculoskeletal pain of the spine and extremities, chronic musculoskeletal pain of the spine and extremities

while not on prescribed medications, chronic musculoskeletal pain of the spine and extremities while on prescription medication but with the intent to decrease dosage or remove medications, and headaches of nonpathologic origin. Patients reporting musculoskeletal pain or headaches of acute or chronic nature during their primary care visit were asked if they would like to be evaluated by the on-site chiropractor. The purpose of the evaluation was to determine whether chiropractic treatment would be the best option to resolve causative issues. Patient-reported musculoskeletal pain symptoms did not need to be the reason for the primary care visit. Pain symptoms due to red-flag issues such as cancer, severe osteoporosis, or visceral referral were not referred for chiropractic evaluation.

The essential component of this interprofessional primary care team was the ability to refer a patient from a medical visit to a chiropractic visit at the same appointment time. As part of this model, the treating chiropractor had other health care locations throughout the service region of the family medicine practice. These other locations provided opportunities to treat patients with chiropractic care more than once a week to manage their pain.

Interprofessional collaboration initiated the inclusion of on-site chiropractic services at the family medicine practice. Although on-site chiropractic services were only available for half a day at the practice, this health care model met the logistic goal of fostering interprofessional collaboration. Referral of patients between health care facilities was a potential option, but including on-site chiropractic services facilitated communication and care coordination. On-site chiropractic services were also important to demonstrate the clinical outcomes of chiropractic care for pain management to medical providers and patients. On-site chiropractic services allowed patients to receive treatment at their initial medical visit; scheduling of follow-up chiropractic treatments could occur at the same medical facility or at convenient chiropractic office locations within the service area of the family medicine practice.

### Data Source

The national practice management organization sent data analytics on opioid-therapy use to the family medicine practice. The data revealed decreases in the number of opioid prescriptions following the change in opioid medication practices and the inclusion of on-site chiropractic services. The authors requested de-identified opioid prescription data from the family medicine practice to perform statistical analyses. The study dates included 24 months before and 18 months after the inclusion of chiropractic services at the practice.

### Variables

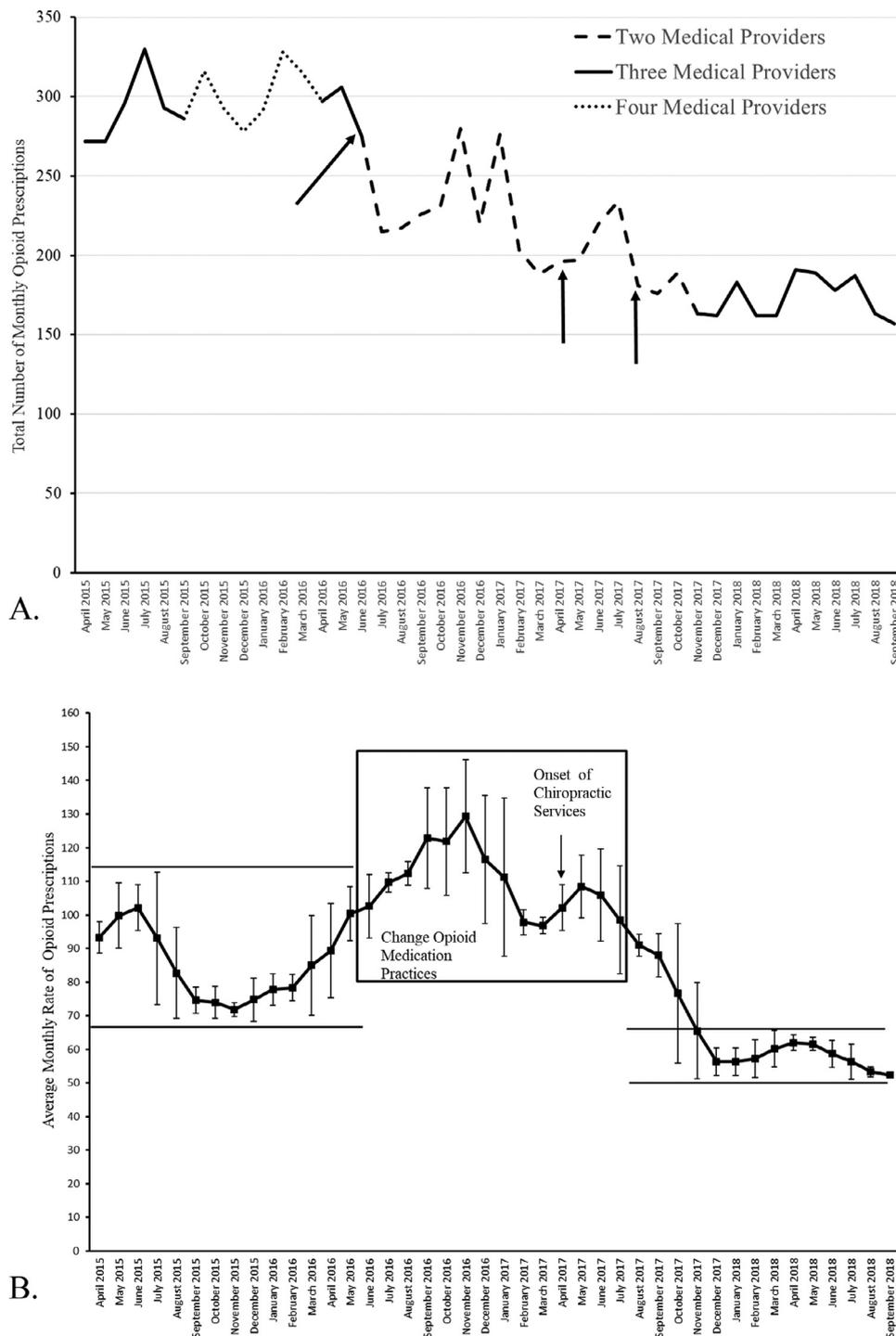
The rate of opioid prescriptions per medical provider per month defined opioid-therapy use, operationalized as

the average monthly rate of opioid prescriptions. Opioid analgesics included all classes of prescription opioid formulations. Opioid formulations included a breakdown of the average monthly rate of opioid prescriptions by controlled-substance schedule: II (high potential for abuse), III (potential for abuse), and IV (low potential for abuse).<sup>29</sup> The morphine milligram equivalent (MME) per opioid prescription was an exploratory outcome measure of opioid-therapy use. Using the Centers for Disease Control and Prevention morphine equivalent coefficients, MME was calculated as the total MME of each opioid prescription, including dose, number of pills, and number of refills.<sup>30</sup> Scaling of the distribution of total MME values to a distribution with a median of 50 MME gave an estimate of daily MME. Opioid dosages at or above 50 MME/day increase the risk of substance abuse and overdose deaths.<sup>30</sup> The only demographic characteristic of interest was age.

### Statistical Analyses

The primary analysis was a binary logistic regression with average monthly rate of opioid prescriptions as the continuous independent variable and the presence or absence of on-site chiropractic services as the dichotomous dependent variable. The reference group for the comparison was the absence of on-site chiropractic services from April 2015 to March 2017. A secondary analysis included 4 practice phases: baseline opioid-therapy use from April 2015 to May 2016, change in opioid medication practices from June 2016 to March 2017, inclusion of chiropractic services from April 2017 to July 2017, and established chiropractic services from August 2017 to September 2018. The secondary analysis was a multinomial logistic regression with average monthly rate of opioid prescriptions as the continuous independent value and the 4 practice phases as the dependent variable. The reference group for comparison was baseline opioid-therapy use. Follow-up binary logistic models included seasonal variations (months coded by standard calendar quarters) and changes in opioid medication practices (months coded before and after the change) as covariates. Follow-up binary and multinomial logistic models also included average monthly rate of opioid prescriptions by controlled-substance schedule as a continuous independent variable.

The statistical outputs for all logistic models were ORs with 95% confidence intervals. The calculated ORs only described a potential association between on-site chiropractic services and opioid-therapy use. The Hosmer–Lemeshow statistic indicated a poor fit for the binary logistic models,  $P < .05$ . A significant likelihood-ratio  $\chi^2$  test ( $P < .05$ ) indicated that the multinomial logistic model predicted significantly better—that is, fit better—than the null model (ie, a model with no predictors). Logistic models with poor fits were indicated in the results.



**Fig 1.** The number of monthly opioid prescriptions across the 42 months of the study by the number of medical providers writing opioid prescriptions (time series). The arrows sequentially indicate the changes in the opioid medication practices, inclusion of chiropractic services, and established chiropractic services (A). Three-point moving-average chart of opioid prescribing rates across the 42 months of the study. The error bars are  $\pm 1$  standard deviation. Solid lines represent  $\pm 1$  standard deviation at baseline and with established chiropractic services. The center box represents the time period for changes to opioid medication practices and inclusion of chiropractic services (B).

One-way analysis of variance (ANOVA) models explored changes in the average monthly rate of opioid prescriptions as a function of absence or presence of on-site chiropractic services and across the 4 practice phases. As a follow-up to these statistical analyses, a mixed ANOVA model included repeated measures across controlled-substance schedules to further explore changes in opioid-therapy use. Bonferroni corrections adjusted for post hoc pairwise comparisons across the 4 practice phases. Analyses of the exploratory outcome, daily MME, included logistic models and ANOVA models. The level of significance was set at .05. The statistical package for all analyses was SPSS Statistics for Windows, version 26.0 (IBM SPSS Statistics for Windows, Armonk, NY).

## RESULTS

The mean age of the participants was  $50.6 \pm 13.98$  years. The distribution of ages followed a normal curve, with 95% of the ages between 25 and 77 years. The interquartile range was 40 to 61 years.

The number of opioid prescriptions during the study period was 10 108 (Fig 1A). There was a significant decrease of 22% in the average monthly rate of opioid prescriptions after the inclusion of chiropractic services ( $F_{1,40} = 10.69$ ;  $P < .05$ ;  $\eta_p^2 = 0.21$ ; Table 1). The likelihood of writing an opioid prescription after the inclusion of chiropractic services decreased by 5% (unadjusted OR; Table 1). Adjusted for seasonal variations and changes in opioid medication practices, the likelihood decreased by 6% and 7%, respectively (Table 1).

There were also significant differences in the average monthly rate of opioid prescriptions among the 4 practice phases ( $F_{3,38} = 21.88$ ;  $P < .05$ ; Table 2). Changes in practice phases accounted for 63% ( $\eta_p^2 = 0.63$ ) of variance in the average monthly rate. Although there was a significant linear decrease in the number of monthly opioid prescriptions across the 4 practice phases ( $F_{3,38} = 80.29$ ;  $\eta_p^2 = 0.86$ ;  $P < .05$ ; Fig 1A), a significant decrease from baseline was only detected after chiropractic services were established (22%;  $P < .05$ ; Fig 1B, Table 2). The likelihood of writing an opioid prescription after chiropractic services were

**Table 1.** Summary of Opioid-Therapy Use Before and After the Inclusion of Chiropractic Services

Statistic	Outcome
Descriptive (mean $\pm$ standard deviation)	Opioid Prescribing Rate
No chiropractic services (April 2015-March 2017)	96.3 $\pm$ 19.58
Chiropractic services on-site (April 2017-September 2018)	75.3 $\pm$ 21.74
Logistic Regression Models (odds ratio [95% confidence interval]) <sup>a</sup>	
Unadjusted	0.95 (0.92-0.99) <sup>b</sup>
Seasonal variation as the covariate	0.94 (0.90-0.98) <sup>c</sup>
Changes in opioid medication practices as the covariate	0.93 (0.88-0.98) <sup>c</sup>

<sup>a</sup> Hosmer–Lemeshow test.

<sup>b</sup>  $P = .047$ .

<sup>c</sup>  $P > .05$ .

established decreased by 8% from baseline (unadjusted ORs; Table 2). There was no impact of seasonal variation on these results.

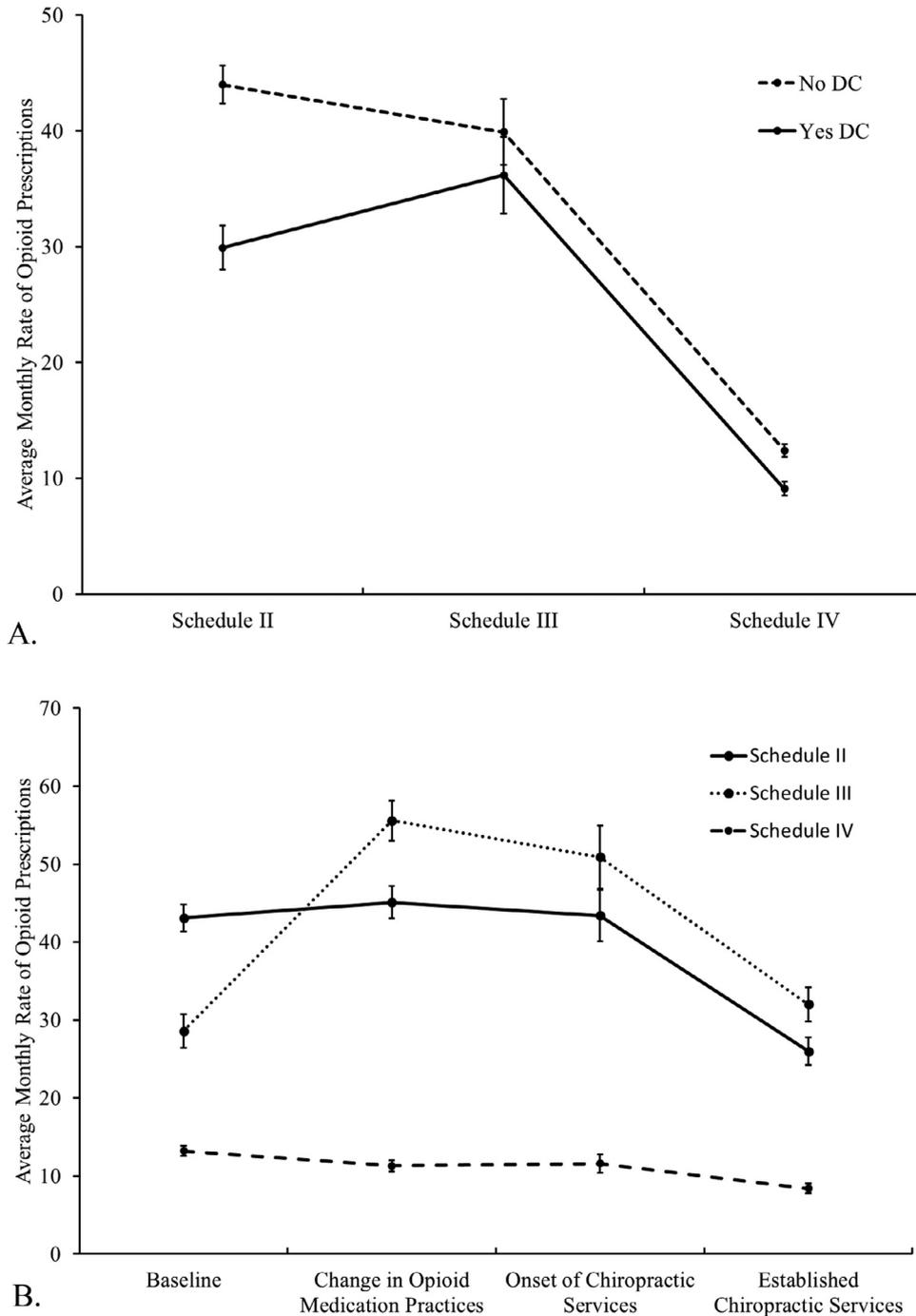
There were significant decreases of 32% and 26%, respectively, in schedule II and IV opioid prescriptions after the inclusion of chiropractic services ( $F_{2,80} = 6.07$  for the Group  $\times$  Schedule interaction;  $P < .05$ ;  $\eta_p^2 = 0.13$ ; Fig 2A, Table 3). The likelihood of writing a schedule II opioid prescription decreased by 27% after the inclusion of chiropractic services (Table 3).

There was also a significant Phase  $\times$  Schedule interaction ( $F_{6,76} = 29.81$ ;  $P < .05$ ; Fig 2B, Table 3). After chiropractic services were established, the average monthly rate of opioid prescriptions for schedule II formulations decreased by 40% from baseline opioid-therapy use ( $P < .05$ ). The interaction accounted for 70% of the variance in the average monthly rate of opioid prescriptions ( $\eta_p^2 = 0.70$ ). The likelihoods of writing opioid prescriptions for the 3 different schedules

**Table 2.** Summary of Opioid-Therapy Use Among the 4 Practice Phases

Practice Phase	Opioid Prescribing Rate	Odds Ratio (95% Confidence Interval) <sup>a</sup>
Baseline (reference group): April 2015-May 2016	85.0 $\pm$ 13.11	1.00
Changes in opioid medication practices: June 2016-March 2017	112.0 $\pm$ 16.18	1.19 (1.05-1.36)
Inclusion of chiropractic services: April 2017-July 2017	105.9 $\pm$ 9.26	1.15 (1.01-1.32)
Established chiropractic services: August 2017-September 2018	66.6 $\pm$ 15.15	0.92 (0.86-0.98)

<sup>a</sup> The likelihood-ratio  $\chi^2$  test was significant ( $P < .05$ ).



**Fig 2.** Changes in the average monthly rate of opioid prescriptions by controlled-substance schedule, before and after the inclusion of chiropractic services (A). Changes in the average monthly rate of opioid prescriptions by controlled-substance schedule across the 4 practice phases. Error bars are the standard error of the mean (B).

individually and by practice phase could not be determined, because of the presence of singularity in the logistic model.

Daily MME was an exploratory variable to address changes in dose, number of pills, and number of refills per opioid prescription. There were 129 opioid formulations. Daily MME decreased after the inclusion of chiropractic

services by 45% (unadjusted OR, 0.55; 95% CI, 0.35-0.87). Unadjusted ORs for daily MME revealed decreases across the 4 practice phases—baseline: OR, 1.0; change in opioid medication practices: OR, 0.70 (95% CI, 0.50-0.98); inclusion of chiropractic services: OR, 0.46 (95% CI, 0.26-0.82); and established chiropractic services: OR, 0.10 (95% CI, 0.02-0.65).

**Table 3.** Summary of Opioid-Therapy Use by Controlled-Substance Schedule

Statistic	Schedule II	III	IV
Opioid prescribing rate (mean $\pm$ standard deviation)			
No chiropractic services: April 2015-March 2017	44.0 $\pm$ 7.39	39.9 $\pm$ 15.51	12.4 $\pm$ 2.49
Chiropractic services on-site: April 2017-September 2018)	29.9 $\pm$ 8.86	36.2 $\pm$ 11.72	9.1 $\pm$ 2.69
Logistic regression models, <sup>a</sup> (odds ratio [95% confidence interval])			
Simple logistic models <sup>b</sup>	0.81 (0.72-0.92)	0.98 (0.94-1.03)	0.62 (0.46-0.84)
Multiple logistic model <sup>c</sup>	0.73 (0.59-0.90)	1.11 (1.01-1.24)	0.83 (0.56-1.22)
Opioid prescribing rate (mean $\pm$ standard deviation)			
Baseline: April 2015-May 2016	43.2 $\pm$ 8.60	28.6 $\pm$ 4.46	13.2 $\pm$ 2.29
Changes in opioid medication practices: June 2016-March 2017	45.1 $\pm$ 5.53	55.6 $\pm$ 10.64	11.3 $\pm$ 2.42
Inclusion of chiropractic services: April 2017-July 2017	43.4 $\pm$ 6.55	50.9 $\pm$ 3.25	11.6 $\pm$ 2.17
Established chiropractic services: August 2017-September 2018	26.0 $\pm$ 4.55	32.0 $\pm$ 9.57	8.43 $\pm$ 2.44

<sup>a</sup> Logistic models to describe the association between opioid-therapy use by controlled-substance schedule, before and after the inclusion of chiropractic services.

<sup>b</sup> Simple logistic models to describe the association within each controlled-substance schedule. Hosmer–Lemeshow tests for schedules II, III, and IV, respectively:  $P = .026$ ,  $P = .046$ ,  $P > .05$ .

<sup>c</sup> Multiple logistic model to adjust for the interaction among the controlled-substance schedules (ie, opioid prescribing rates significantly decreased for schedule II and IV formulations after the inclusion of chiropractic services). Hosmer–Lemeshow test:  $P = .018$ .

## DISCUSSION

The goal of this interprofessional primary care model was to improve the quality of patient care related to pain management while reducing the use of opioid therapy. This observational study of a single clinical setting reveals decreases in opioid-therapy use during a 42-month period from April 2015 to September 2018. After the inclusion of chiropractic services, opioid prescribing rates decreased by 22%. This decrease in opioid-therapy use is the same as was occurring nationally between 2013 and 2017.<sup>31</sup> Although the likelihood of opioid-therapy use after the inclusion of chiropractic services decreased by only 5%, there were changes by controlled-substance schedule and daily dose.

There were decreases in schedule II opioid prescribing rates and daily dosages of opioids in association with changes in opioid medication practices and the inclusion of chiropractic services. The likelihood of writing a schedule II opioid prescription decreased by 27% after the inclusion of chiropractic services. The relationship between controlled-substance schedules and the 4 practice phases shows changes in opioid medication practices to include prescribing a schedule III or IV opioid rather than a schedule II opioid. This relationship between schedule and practice phase described 70% of the variance in prescribing rates. The associations of daily doses of opioids with changes in opioid medication practices and inclusion of chiropractic

services accounted for decreases in likelihood of opioid-therapy use by 30% and 45%, respectively. These decreases in the likelihood of opioid-therapy use are consistent with previous literature on the association between the use of chiropractic services and opioid-therapy use.<sup>18-24,26</sup>

The present study found decreases in opioid-therapy use after the inclusion of chiropractic services within a family medicine practice setting. There are many studies describing integrative health care models, but few of them report clinical outcomes.<sup>32-34</sup> The clinical setting was a practical integrative health care model that simply incorporated chiropractic services into the family medicine practice.<sup>32,33</sup> As such, it is more aligned with a collaborative care model.<sup>35</sup> The practitioners, through communication and care coordination, modeled key characteristics of successful interprofessional collaboration.<sup>36</sup> They had a similar goal: to reduce opioid-therapy use.<sup>35</sup> They had experience working in integrative health care clinics.<sup>36</sup> Sharing knowledge of the benefits and risks of each other's treatment approaches and developing efficient referral patterns lead to interprofessional trust,<sup>36</sup> which is a key factor that sustains referral of patients between chiropractors and family medicine physicians.<sup>34,37-39</sup>

The description of this collaborative care model did not include clinical outcomes. However, there were decreases in opioid-therapy use by this interprofessional primary care team. Reducing the risks of prescription opioid use aligns with a potential societal health benefit.<sup>40</sup> In the current

wave of opioid abuse, 75% of opioid abusers report that their first opioid was a prescription drug.<sup>41</sup> Approximately 21% to 29% of people who are prescribed opioids for chronic pain misuse them, and approximately 80% of people who use heroin first misused prescription opioids.<sup>2</sup> As detailed in January 2018 by the National Institute on Drug Abuse, prescription opioid use is a risk factor for heroin use.<sup>42</sup> Although the present study was an observational one, the description of the primary care clinical setting is aligned with evidence-based characteristics of successful collaborative patient-centered care for pain management.<sup>28,32-36,43-46</sup>

### Limitations and Future Studies

This retrospective analysis describes a reduction of opioid-therapy use in a primary care setting after the inclusion on-site chiropractic services. The observed statistical findings cannot be used to infer a causal relationship. The generalizability of these findings to other clinical settings is unknown. However, the descriptive data are consistent with the previous literature on the association between use of chiropractic services and opioid-therapy use.<sup>18-24,26</sup> The consistency of this association across clinical settings can begin to develop an argument for clinical effectiveness. Prospective clinical trials will be necessary to address clinical effectiveness.

There were limitations of the data source. Age was the only demographic characteristic. There were no data extracted from electronic health records, which would have allowed us to match case presentations, diagnoses, decreased pain intensity, and improvements of physical function to decreased opioid prescription use. Changes in opioid medication practices were a confounding intervening event between baseline opioid-therapy use and the integration of chiropractic services. Qualitative feedback indicated that the patient volume did not change at the family medicine practice, and chiropractic services became fully integrated after 4 months. Qualitative event markers to determine the likelihood of writing an opioid prescription across the 4 practice phases are a potential source of information bias. The Centers for Disease Control and Prevention MME calculator was not designed to determine exact dosing equivalents between opioid analgesics.<sup>30,47</sup> In addition, the daily MME in the present study was only an estimate. Further studies are necessary to investigate the impact of including chiropractic services in medical practices on prescribing rates of opioid medications.

### CONCLUSION

This study describes decreases in opioid-therapy prescribing practices after a family medicine practice included on-site chiropractic services. Additional changes in opioid

prescribing practices by the medical providers included prescribing schedule III or IV opioids rather than schedule II ones and a decrease in daily doses of opioid prescriptions. This suggests that including chiropractic services may have had a positive effect on the prescribing behaviors of medical physicians, as they may have been able to offer their patients additional nonpharmaceutical options for pain management.

### FUNDING SOURCES AND CONFLICTS OF INTEREST

No funding sources or conflicts of interest were reported for this study.

### CONTRIBUTORSHIP INFORMATION

Concept development (provided idea for the research): J.R.  
Design (planned the methods to generate the results): J.R., J.R.B.

Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): J.R., J.R.B.

Data collection/processing (responsible for experiments, patient management, organization, or reporting data): J.R.

Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): J.R.B.

Literature search (performed the literature search): J.R., J.R.B.

Writing (responsible for writing a substantive part of the manuscript): J.R.B.

Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): J.R., J.R.B.

### Practical Applications

- The research describes decreases in opioid prescribing rates by an interprofessional primary care team.
- A family medicine practice included on-site chiropractic services to allow for the referral of a patient from a medical visit to a chiropractic visit at the same appointment time.
- The research describes knowledge translation within routine primary care related to opioid therapy use.

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