

Chiropractic Care for Workers with Low Back Pain

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WC-22-17

May 2022

WORKERS COMPENSATION RESEARCH INSTITUTE
CAMBRIDGE, MASSACHUSETTS

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978-1-61471-478-1

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ACKNOWLEDGMENTS

This study would not be possible without the contributions of many people. Our gratitude goes to William Shaw (associate professor and division chief of the Division of Occupational and Environmental Medicine, Departments of Medicine and Public Health Sciences, University of Connecticut Health Center) and Thomas Wickizer (professor emeritus at the College of Public Health, Ohio State University) who served as technical reviewers of the draft. Their comments and suggestions not only helped us to improve the accuracy and clarity of the final report, but also are valuable for our future research in this area. We are grateful for many other reviewers whose comments and suggestions helped us to improve the clarity and readability of the report.

Our sincere thanks go to our supporters who were so generous with their knowledge and time. Several of our colleagues at WCRI also provided valuable assistance. We thank Evelyn Radeva, Rebecca Yang, William Monnin-Browder, Bogdan Savych, Olesya Fomenko, Te-Chun Liu, Eric Harrison, Melanie Brown-Lyons, and Bryan Giblin for their knowledge of state policies and issues, data and underlying processes, and programming support. We thank Andrew Kenneally, the communications director at WCRI, for disseminating the research findings. Special thanks to John Ruser, president of the Institute, and Sebastian Negrusa, vice president of research, for their valuable input and guidance throughout the process. Sarah Solorzano and Eric LaRocca provided excellent administrative assistance during the production of the report.

Of course, any errors or omissions that remain in the report are the responsibility of the authors.

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May 2022

TABLE OF CONTENTS

| | |
|--|----------------------------|
| List of Tables | 5 |
| List of Figures | 7 |
| Executive Summary | 8 |
| 1. Introduction | 13 |
| Research Questions and Scope of the Study | 13 |
| Background | 14 |
| Organization of This Report | 17 |
| 2. Data and Approach | 18 |
| The Data | 18 |
| Identifying Chiropractic and Non-Chiropractic Physical Medicine Services | 21 |
| Identifying Provider Patterns of PM and E&M Services | 21 |
| Measuring Utilization and Outcomes | 24 |
| Statistical Analysis | 27 |
| Limitations and Caveats | 30 |
| 3. Prevalence of Chiropractic Care | 32 |
| Prevalence of Chiropractic Care | 32 |
| Why Chiropractic Care is More Prevalent in Some States and Not in Others? | 33 |
| 4. How Were Chiropractors Involved in Treating Low Back Pain? | 37 |
| Types of Services Provided by Chiropractors | 37 |
| Provider Patterns of Physical Medicine Care | 41 |
| Provider Patterns of Evaluation and Management Services | 44 |
| Physical Medicine Treatment Groups, Patterns and Outcomes — Descriptive Data | 44 |
| 5. Chiropractic Physical Medicine Care and Workers’ Compensation Outcomes— A Statistical Analysis | 51 |
| 6. Implications | 55 |
| Statistical Appendix | 58 |
| Technical Appendix A: Identifying Low Back Pain and Common Services | 65 |
| Technical Appendix B: Severity, Comorbidities, and Patient Complexity | 77 |
| Technical Appendix C: Statistical Analyses | 81 |
| Glossary | 113 |
| References | 116 |

LIST OF TABLES

| | |
|-----------------------|--|
| 2.1 | Number of Claims / 20 |
| 2.2 | Measuring Utilization, Costs, and Outcomes / 25 |
| 2.3 | Identifying Provider Patterns and Measuring Utilization of Physical Medicine Services / 26 |
| 3.1 | Prevalence of Chiropractic Care, Supply of Chiropractors, and Provider Choice Policies / 35 |
| 4.1 | Common Types of Services Used in Chiropractic Care for Treatment of Low Back Pain / 38 |
| 4.2 | Frequency of Chiropractic Physical Medicine Services, by Type / 39 |
| 4.3 | Utilization Patterns of Physical Medicine Services / 43 |
| 4.4 | Claim Distribution across Treatment Groups / 45 |
| 4.5 | Descriptive Data: Outcomes for Claims Receiving Chiropractic Exclusive PM Care and Non-Chiropractic PM Care / 47 |
| 4.6 | Characteristics of Claims and Environmental Factors: Chiropractic Exclusive PM Care versus Non-Chiropractic-Only PM Care / 48 |
| 4.7 | Descriptive Data: Outcomes for Claims with Combined or Sequential PM Care / 49 |
| 5.1 | Comparative Results of Utilization, Costs, and Temporary Disability Duration between Chiropractic-Only PM/EM and Subset of Non-Chiropractic-Only PM / 52 |
| 5.2 | Comparative Results of Utilization, Costs, and Temporary Disability Duration between Chiropractic-Only PM and Subset of Non-Chiropractic-Only PM / 53 |
| SA.1 | Chiropractic Exclusive PM Care—E&M Patterns and Entry Paths / 59 |
| SA.2 | Worker and Claim Characteristics for LBP Workers Receiving Chiropractic Exclusive PM Care, among 16 States / 60 |
| SA.3 | Costs and Outcomes among Claims with Chiropractic Exclusive PM Care across 16 States / 61 |
| SA.4 | Patterns of Non-Chiropractic-Only PM Care, for Workers with LBP among 16 States / 62 |
| SA.5 | Workers and Claim Characteristics for LBP Workers with Non-Chiropractic-Only PM Care, among 16 States / 63 |
| SA.6 | Costs and Outcomes for Claims with Non-Chiropractic-Only PM Care across 16 Study States / 64 |
| TA.A1 | ICD-10 Codes for Low Back Only Conditions / 66 |
| TA.A2 | ICD-10 Codes for Low Back Conditions That May Have Nerve Involvement / 68 |
| TA.A3 | ICD-10 Codes Indicating Neck Conditions with Neurological Findings / 69 |
| TA.A4 | ICD-10 Codes for Comorbidities with Complications / 70 |
| TA.A5 | Comparing Utilization of Costs between LBP-Only Claims and Neuro Back Claims / 71 |
| TA.A6 | Grouping Procedure Codes of Physical Medicine Services / 72 |
| TA.A7 | Frequency and Payment Distribution by Service Type: Chiropractic versus Non-Chiropractic Physical Medicine Services / 74 |
| TA.A8 | CPT-4 Codes for MRI, Pain Management Injections, and Low Back Surgery / 76 |

- [TA.B1](#) ICD-10 List of Comorbidities for LBP-Only Claims with Physical Medicine Treatment / 78
- [TA.B2](#) Identifying Comorbidities Using ICD-10 Codes, All LBP Claims Included for the Study / 79
- [TA.C1](#) First Step Propensity Score Estimation—Results of Logistic Regressions / 82
- [TA.C2](#) Characteristics of Claims between Chiropractic-Only PM/EM and Matched Non-Chiropractic-Only PM Groups / 87
- [TA.C3](#) Characteristics of Claims between Chiropractic-Only PM and Matched Non-Chiropractic-Only PM Groups / 89
- [TA.C4](#) Estimated Effect of Chiropractic-Only PM/EM versus Matched Non-Chiropractic-Only PM on Medical Utilization and Costs, All LBP Claims / 92
- [TA.C5](#) Estimated Effect of Chiropractic-Only PM/EM versus Matched Non-Chiropractic-Only PM on Indemnity Payments and TD Duration, All LBP Claims / 93
- [TA.C6](#) Estimated Effect of Chiropractic-Only PM versus Matched Non-Chiropractic-Only PM on Medical Utilization and Costs, All LBP Claims / 94
- [TA.C7](#) Estimated Effect of Chiropractic-Only PM versus Matched Non-Chiropractic-Only PM on Indemnity Payments and TD Duration, All LBP Claims / 95
- [TA.C8](#) Comparing Outcomes between Chiropractic-Only PM/EM and Non-Chiropractic-Only PM: Unadjusted and Adjusted Results / 97
- [TA.C9](#) Comparing Outcomes between Chiropractic-Only PM and Non-Chiropractic-Only PM: Unadjusted and Adjusted Results / 98
- [TA.C10](#) Comparing Characteristics of the Non-Chiropractic-Only PM Claims between the Matched and Unmatched to Chiropractic-Only PM/EM Claims / 100
- [TA.C11](#) Testing Sensitivity of Results to State Provider Choice Policies: Comparing Outcomes between Chiropractic-Only PM/EM and Non-Chiropractic-Only PM / 102
- [TA.C12](#) Testing Sensitivity of Results to State Provider Choice Policies: Comparing Outcomes between Chiropractic-Only PM and Non-Chiropractic-Only PM / 103
- [TA.C13](#) Capturing Factors Affecting Treatment Choice and Outcomes / 105

LIST OF FIGURES

- [A](#) Interstate Variation in the Prevalence of Chiropractic Care, Provider Choice Regulations, and Supply of Chiropractors / 10
- [2.1](#) Identifying Common Provider Patterns of Physical Medicine Treatment / 23
- [3.1](#) Prevalence of Chiropractic Care and Availability of Chiropractors among LBP Claims across 28 Study States / 33
- [3.2](#) State Provider Choice Policies and Impact on Use of Chiropractic Care / 34
- [4.1](#) Claim Distribution across Provider Patterns of Physical Medicine Care / 41
- [4.2](#) Claim Distribution of Physical Medicine Provider Patterns by State / 42
- [TA.C1](#) Distribution of Propensity Scores for Chiropractic-Only PM/EM, Matched and Unmatched Non-Chiropractic-Only PM Groups / 85
- [TA.C2](#) Distribution of Propensity Scores for Chiropractic-Only PM, Matched and Unmatched Non-Chiropractic-Only PM Groups / 86

EXECUTIVE SUMMARY

As a non-invasive, non-pharmacological treatment option, physical medicine (PM) treatment¹ is recommended by most treatment guidelines for patients with musculoskeletal conditions, including low back pain (LBP), before considering other invasive procedures.² Opioid prescribing guidelines also recommend PM treatment as the first-line non-pharmacological treatment before prescribing opioids. Chiropractors are licensed professionals with extensive education and training for chiropractic care. Many of them have been participating in the delivery of PM treatments, within and outside workers' compensation. When treating patients, chiropractors establish a diagnosis and formulate a treatment plan that usually focuses on spinal manipulation and other manual therapy services, and may include exercise, patient education, and nutrition. Since an increasing number of workers with injuries receive PM treatment, of which chiropractic care may be a large part, it is important to know how prevalent chiropractic care is in workers' compensation systems, how chiropractors are involved in delivering care, and how chiropractic care is associated with the various outcomes. As part of a series of Workers Compensation Research Institute (WCRI) studies on PM treatment, this study describes the prevalence of chiropractic care and provider patterns of PM treatment for workers with LBP. It also provides some evidence as to how different provider patterns of PM treatment are associated with variations in the utilization of medical services (e.g., magnetic resonance imaging [MRI], opioid prescriptions, and pain management injections), medical and indemnity costs, and the duration of temporary disability (TD).

MAJOR FINDINGS

We found a substantial interstate variation in the prevalence of chiropractic care across the 28 study states.³ A lower use of chiropractic care was observed in states with employer control over the selection of providers. When chiropractors were involved in care for workers with LBP, they almost all performed PM services, either as a sole provider or participating in the delivery of PM care with other non-chiropractic providers. We also found that LBP claims with chiropractic exclusive PM (i.e., all PM services were provided by chiropractors) tended to have lower costs and shorter TD duration, compared with a similar subset of non-chiropractic-only PM claims. The findings are based on our statistical analysis that controls for differences in the mix of cases and a number of important factors that may affect the choice of chiropractic care and the outcomes of interest.⁴

¹ Physical medicine treatment consists of physical modalities (e.g., hot and cold packs, soft-tissue massage, traction, and acupuncture), chiropractic manipulative treatments, manual therapy (e.g., joint or soft-tissue mobilization and manipulation), and active therapies (e.g., therapeutic exercises and related training, active counseling). Evaluation/measurement and functional assessment are also part of physical medicine to evaluate and monitor the progress of treatment. The goal of physical medicine treatment is to mitigate pain and facilitate functional recovery and return to work. Throughout the report, we use *PM* to refer to physical medicine treatment.

² See the American College of Occupational and Environmental Medicine (ACOEM), Official Disability Guidelines (ODG), and Washington State opioid guidelines.

³ The 28 states are Arkansas, California, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nevada, New Jersey, New Mexico, New York, North Carolina, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, and Wisconsin.

⁴ In the analysis, we controlled for the variables we measure that likely affect the likelihood of receiving chiropractic care and outcomes. These variables help capture injury severity and complexity, worker socio-economic characteristics, time to medical care, attorney involvement, and organizational structure of health care delivery, as well as environmental factors, such as rural/urban area, supply of chiropractors, county-level status on health insurance, household income, and education, and unemployment rate. State-specific policies and market environments were included in the adjustment. We also created a variable as a proxy for local perception of and access to chiropractic care.

However, the readers should be cautioned that our findings only provide evidence of an association between chiropractic care and the outcomes we examined, not a causal relationship, as we cannot fully account for unobserved individual and system characteristics⁵ that likely influence the choice of chiropractic care and outcomes.

- We found a substantial variation in the prevalence of chiropractic care across the 28 study states. States with provider choice policies that give employers the control of selecting providers were among the states with the lowest prevalence of chiropractic care.
 - The percentage of LBP claims that received chiropractic care (in the first 18 months of treatment after the injury) was between 5 and 34 percent in 16 of the 28 study states (Figure A). Four states (California, Minnesota, New York, and Wisconsin) had at least 20 percent of LBP claims receiving chiropractic care. In 10 states at the lower end, only 1–2 percent of LBP claims received chiropractic care. Michigan and Nevada were close to these 10 states, with rates of 2.1 and 3.7 percent, respectively.
 - In most states where employers have control over the selection of providers,⁶ we found that the prevalence of chiropractic care was among the lowest of the 28 study states.⁷ States with employee choice and employee limited choice (i.e., workers have the right to choose their treating providers) saw more prevalent chiropractic care. In these states, the use of chiropractic care varied by state, showing a correlation with the supply of chiropractors (Figure A).
 - A major reason why most employer control states have a low use of chiropractic care may be that when the employers and insurers are given control over the selection of providers, they may hesitate to choose chiropractors due to concerns over the cost-effectiveness of chiropractic care. These concerns might stem from historical studies suggesting that chiropractic care contributed to the rapid growth in medical costs in a number of states in the early 1990s.⁸ By contrast, we see more prevalent chiropractic care in the employee choice or employee limited choice states, where patients' perceptions of and preference for chiropractic care may likely be among the key factors influencing the choice of chiropractic care.

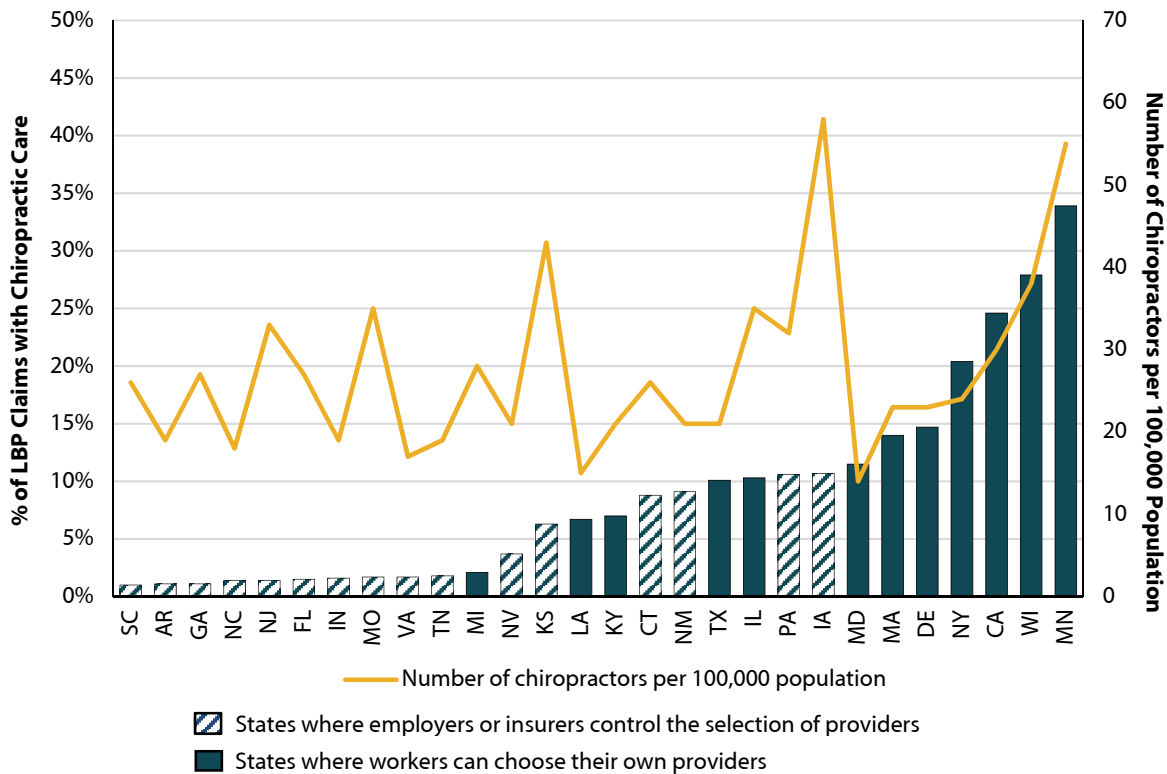
⁵ Although the variables included in our analysis may reflect some differences in the unobserved characteristics of individual workers in terms of their preference and care-seeking behavior toward chiropractic care and outcomes, we cannot fully address the unobserved factors that may affect the results of the analysis. See Chapter 2 for more detail.

⁶ In workers' compensation systems, provider choice policies address whether the employer/payor or the employee has the control to choose treating providers. The policies vary by state. We grouped them into employer control, employee choice, and limited employee choice states. See Chapter 3 for the definition of our categorization of provider choice policies.

⁷ Almost all states with less than 5 percent of claims receiving chiropractic care are employer control states. A few employer control states had relatively more frequent chiropractic care (Connecticut, Iowa, Kansas, New Mexico, and Pennsylvania), but they were on the lower side of the 16 states with more than 5 percent of claims receiving chiropractic care.

⁸ Chapter 1 provides some background information about the rapid growth of medical costs in workers' compensation, and the subsequent reforms that were implemented in the 1990s to curb these cost increases.

Figure A Interstate Variation in the Prevalence of Chiropractic Care, Provider Choice Regulations, and Supply of Chiropractors



Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. The prevalence of chiropractic care is measured as the percentage of nonsurgical LBP claims that received services by chiropractors. There are 28 states included in the analysis.

^aThe data for chiropractor supply per 100,000 population are based on the number of licensed chiropractors and the U.S. Census data that were merged into our study sample.

Key: LBP: low back pain.

- Compared with what has been reported outside workers’ compensation, the prevalence of chiropractic care among workers with occupational LBP appeared to be lower. For example, among studies reviewed by Beliveau et al. (2017), the median use of chiropractic care at 12 months was 31 percent for non-occupational back pain patients. The figure is much higher than that for most of the 28 states we studied. The National Health Interview Survey (NHIS) data showed that the use of chiropractic care in general increased from 7.61 percent in 1997 to 10.11 percent in 2012; for the patients with spine complaints, the likelihood of seeing chiropractors was generally much higher than the likelihood of seeing other providers (Ndetan et al., 2020).
- When chiropractors are involved in care, they may provide exclusive PM care or be involved in the combined PM care model by delivering PM care in conjunction with other non-chiropractic PM providers. Among the 16 states with prevalent chiropractic care, 29 percent of LBP claims involved chiropractors for PM care.
 - For LBP claims with PM, 12 percent received PM care only from chiropractors (referred to as *chiropractic exclusive PM*). Half of these claims received evaluation and management (E&M)

services⁹ by chiropractors only (*chiropractic-only PM/EM*). The other half also had E&M services by non-chiropractic providers (i.e., medical and osteopathic doctors, nurse practitioners, and physician assistants), indicating that these other medical providers were involved in the overall patient management (*chiropractic-only PM*).¹⁰

- Seventeen percent of LBP claims involved both chiropractors and non-chiropractors in PM care, currently or sequentially. We observed that 13 percent of LBP claims received PM care provided concurrently by both chiropractors and non-chiropractors over the period of treatment (referred to as *combined PM*).¹¹ About 4 percent of LBP claims with PM received PM care from chiropractors and non-chiropractors in a sequential manner, which may be reflective of a number of issues: a more severe LBP condition, patients requiring a more complex treatment program, claim management issues, or practice coordination issues. This group is referred to as the *sequential PM* group. Our descriptive analysis shows that claims with combined or sequential care are likely to have more serious LBP and a higher level of complexity than claims with exclusive PM care by chiropractors or non-chiropractors only. More detailed data on the patients' severity and complexity would be needed to determine whether differences in the outcomes are attributable to the way PM services are provided across these groups.¹²
- Focusing on the two subgroups of claims with PM care only by chiropractors, we found that chiropractic care may be associated with lower costs and shorter TD durations, when compared with a subset of non-chiropractic-only PM claims that shared similar characteristics to the claims with chiropractic exclusive PM care.^{13,14}
 - **Chiropractic-only PM/EM vs. non-chiropractic-only PM.** The average medical cost per claim for the chiropractic-only PM/EM group was 47 percent lower than that for the comparable (or "matched") non-chiropractic-only PM claims. The chiropractic-only PM/EM claims also had lower indemnity payments per claim and shorter TD durations. The percentage differentials were 35 percent and 26 percent, respectively.
 - **Chiropractic-only PM vs. non-chiropractic-only PM.** The average medical cost per claim was similar between the chiropractic-only PM group and the matched non-chiropractic-only PM group. However, the average claim that received chiropractic-only PM (likely with a medical

⁹ Evaluation and management services are provided by a physician or other qualified health care professional to diagnose and treat illness and injuries. For this study, E&M services were mostly for new and established patient office visits, billed by a medical provider (i.e., doctors, nurse practitioners, and physician assistants) or by a chiropractor, using the Current Procedure Terminology (CPT[®]) codes. Note that physical therapists do not use the E&M codes to bill for evaluation and measurement services, but a separate set of PM service codes (see Technical Appendix A for more details).

¹⁰ Chiropractors also provide E&M services to evaluate the patient, formulate the treatment plan, and track the patient's functional progress.

¹¹ Among these claims with combined PM care, most received PM services by chiropractors and non-chiropractors who were affiliated with the same billing entity, which may suggest that PM treatment was delivered in a cross-disciplinary setting. Billing entity is a unique tax ID that is used for billing medical services. Providers with the same billing entity are either affiliated with the same health care organization or work with different organizations under the same financial entity billing for services.

¹² The term *patient complexity* has been increasingly used in the literature to address an interaction between the personal, social, and clinical aspects of the patient's experience that complicates patient care, and these factors go beyond medical severity and comorbidities (Tonelli et al., 2018).

¹³ The *non-chiropractic-only PM claims* are those that received PM treatment only from non-chiropractors (mostly physical therapists in our data).

¹⁴ The findings are based on the results from our statistical analysis that controls for factors that may likely influence the choice of chiropractic care and outcomes. The factors we included in the analysis are described in Chapter 2 and Technical Appendix C. More detailed results of the statistical analysis are presented in Chapter 5.

provider co-managing the overall patient care) had a lower average indemnity cost per claim and a shorter TD duration, with a differential of 17 percent on both measures. Also, the frequency of opioid prescriptions, MRI, and pain management injections was lower among the chiropractic-only PM claims, relative to the matched non-chiropractic-only PM claims.

- It is important to note that although we controlled for as many factors as was possible with the available data, we cannot measure factors such as workers' preinjury experiences and their treatment preferences. We did not control for employer/payor practices regarding case management and reimbursement. The results of our analysis provide evidence of an associational, not causal, relationship between chiropractic care and the outcomes of interest. The reader should also be cautioned to not generalize the results to all LBP claims with PM because a large number of non-chiropractic-only PM claims were not similar to chiropractic exclusive PM claims and, therefore, were not matched.

DATA AND APPROACH

Claims included in this study are from the WCRI Detailed Benchmark/Evaluation database and had injuries occurring from October 1, 2015, to September 30, 2017, with detailed medical data and benefit payment data covering the first 18 months after the date of injury. We included LBP claims with or without nerve involvement. These LBP claims may or may not have received indemnity benefits, but all received medical services. Several claims exclusions were applied to increase the homogeneity of the study sample. We excluded LBP claims with underlying red flag conditions (e.g., tumors, infectious diseases, fractures and dislocations) and/or neurological neck conditions.¹⁵ We also excluded a small percentage of claims receiving low back surgery and excluded a small number of LBP claims that had a comorbid condition with severe complications, such as diabetes with hypoglycemia or ketoacidosis, substance abuse with psychotic disorders, and bipolar disorders.¹⁶ We focused on new-onset LBP claims by excluding less than 1 percent of LBP claims with specific procedure codes (MRI, for example) that may indicate a previous low back pain occurrence or a previous low back surgery and by identifying chronic pain mentioned within the initial 3 months of treatment as a comorbidity. As a result, the claims used for this study are most likely new-onset LBP cases that may or may not become chronic low back pain during the 18 months of treatment. There are 28 states included in the study.

We conducted a statistical analysis that compares utilization and costs of medical services, indemnity payments, and TD duration between LBP claims receiving chiropractic exclusive PM care and non-chiropractic-only PM care. A propensity score matching approach was applied in this analysis in order to maximize the comparability, by constructing a subset of non-chiropractic-only PM claims that had similar likelihoods of having chiropractic care to claims that received chiropractic exclusive PM care. More details about the data and approach can be found in Chapter 2 and Technical Appendices A–C. We also discuss several limitations of the study in Chapter 2.

¹⁵ A red flag is a medical condition which, by medical consensus or evidence, requires immediate testing or intervention due to the likelihood of possible permanent, significant impairment or the need for expedited surgery. See Chapter 2 and Technical Appendix A for a more detailed description of the exclusions.

¹⁶ These more serious comorbid conditions were identified using an ICD-10 code list we established for comorbidities (Wang, Mueller, and Lea, 2020). Chapter 2 and Technical Appendix B provide more detailed descriptions.

1

INTRODUCTION

As a non-invasive, non-pharmacological treatment option, physical medicine (PM) treatment¹ is recommended by most treatment guidelines for patients with musculoskeletal conditions, including low back pain (LBP), before considering other invasive procedures.² Opioid prescribing guidelines also recommend PM treatment as the first-line non-pharmacological treatment before prescribing opioids. Chiropractors are licensed professionals with extensive education and training for chiropractic care. Many of them have been participating in the delivery of PM treatments, within and outside workers' compensation. When treating patients, chiropractors establish a diagnosis and formulate a treatment plan that usually focuses on spinal manipulation and other manual therapy services, and may include exercise, patient education, and nutrition. Since an increasing number of workers with injuries receive PM treatment, of which chiropractic care may be a large part, it is important to know how prevalent chiropractic care is in workers' compensation systems, how chiropractors are involved in delivering care, and how chiropractic care is associated with the various outcomes. As part of a series of Workers Compensation Research Institute (WCRI) studies on PM treatment, this study describes the prevalence of chiropractic care and provider patterns of PM treatment for workers with LBP. It also provides some evidence as to how different provider patterns of PM treatment are associated with variations in the utilization of medical services (e.g., magnetic resonance imaging [MRI], opioid prescriptions, and pain management injections), medical and indemnity costs, and the duration of temporary disability (TD).

RESEARCH QUESTIONS AND SCOPE OF THE STUDY

The policy relevant questions of this study are as follows:

- How prevalent is chiropractic care? How does it vary across states? What may help explain the observed interstate variation?
- For states with prevalent chiropractic care, how are chiropractors involved in delivering care for workers with LBP?
- How do the costs and TD duration compare between LBP workers who received PM treatment by

¹ Physical medicine treatment consists of physical modalities (e.g., hot and cold packs, soft-tissue massage, traction, and acupuncture), chiropractic manipulative treatments, manual therapy (e.g., joint or soft-tissue mobilization and manipulation), and active therapies (e.g., therapeutic exercises and related training, active counseling). Evaluation/measurement and functional assessment are also part of physical medicine to evaluate and monitor the progress of treatment. The goal of physical medicine treatment is to mitigate pain and facilitate functional recovery and return to work. Throughout the report, we use *PM* to refer to physical medicine treatment.

² See the American College of Occupational and Environmental Medicine (ACOEM), Official Disability Guidelines (ODG), and Washington State opioid guidelines.

chiropractors only, and those who received PM treatment by non-chiropractors only?

To answer these questions, we focused on all medical claims with LBP that did not have low back surgery. Recognizing that some studies showed that chiropractic care helped patients avoid low back surgery (Keeney et al., 2013), we excluded a small percentage of claims with surgery to focus on PM treatments.

We also focused on LBP claims with PM treatment with or without medication prescriptions. A comparison of costs and outcomes between claims with chiropractic care (or broadly with PM treatment) and those that received medications without PM is outside the scope of this study. This may be addressed in future research.

In this report, we provide evidence on how different provider patterns of PM treatments may be associated with costs and outcomes. Although we applied statistical techniques to control, as much as we could, for factors that may influence choice of chiropractic care and outcomes, our findings on chiropractic care and how it may be associated with lower costs and shorter TD duration for certain types of LBP claims should not be interpreted as a causal relationship.

BACKGROUND

Low back pain was ranked as the leading cause of disability, as measured by years lived with disability in the United States and across the globe (Vos et al., 2010; U.S. Burden of Disease Collaborators, 2013). In 2016, the estimated total costs in health care for low back and neck pain was \$134.5 billion, 57 percent of which were paid by private insurance, 34 percent by public insurance, and 9.2 percent by out-of-pocket payments (Dieleman et al., 2020). The prevalence and cost of low back pain has led to debates regarding how to best manage LBP-related conditions (Hanney et al., 2016). Although physical medicine is recommended by treatment guidelines and has been increasingly used for LBP treatment, most practice guidelines do not have specific recommendations as to which treatment pathways may lead to better outcomes. The most agreed-upon recommendations are to promote the use of active therapies and avoid physical modalities beyond the initial treatment period.³

Physical therapy and chiropractic care both require licensed professionals with extensive education and training. Physical therapists and chiropractors share the same goal of achieving pain relief and function restoration without invasive procedures, but they differ in terms of focus and approach. Chiropractors establish a diagnosis and formulate a treatment plan that usually focuses on spinal manipulation and other manual therapies and may include exercise, patient education, and nutrition.^{4,5} A physical therapist (a.k.a., physiotherapist) focuses on improving a patient's ability to move and function without pain. It is common for physical therapists to work from the diagnosis of the referring medical doctor and formulate a treatment plan that may include physical modalities and therapeutic exercises. Physical therapists are licensed to perform manual therapies. Some physical therapists may also receive training for more complex mobilization

³ See the American College of Occupational and Environmental Medicine (ACOEM), Official Disability Guidelines (ODG), and LBP guidelines in Colorado and Washington.

⁴ Spinal manipulation, also known as chiropractic adjustment, refers to a high-velocity, short lever arm thrust that is applied to abnormal vertebra with the goal of improving functionality.

⁵ Chiropractic mobilization refers to low velocity manipulation, movement, and stretching of the muscles and joints, with the goal of increasing the range of motion within those areas. In addition to chiropractic manipulation and mobilization, there are several other common forms of chiropractic therapy, including heat and ice therapy, exercise focusing on stretching and strengthening the back, massage, and dietary management.

procedures such as grade 4/5 manipulations (at a deeper level with more velocity). The primary difference is that chiropractors tend to focus more on manual treatments and physical therapists tend to focus more on exercise.

PREVALENCE AND USE OF CHIROPRACTIC CARE

Outside workers' compensation, chiropractors see a large percentage of patients with neck and back pain (Chevan and Riddle, 2011; Ndetan et al., 2020). Despite more prevalent and increased use of chiropractic care outside workers' compensation (Whedon et al., 2012; Beliveau et al., 2017; Ndetan et al., 2020), the percentage of workers with similar injuries having chiropractic care is often substantially lower (National Board of Chiropractic Examiners, 2020). In most workers' compensation systems, chiropractors are allowed to provide care as a treating doctor and as a provider of physical medicine services. However, in some states the use of chiropractic care for work-related LBP is low regardless of the availability of chiropractors in the geographic areas.⁶

The infrequent use of chiropractic care in a number of workers' compensation systems may be explained by the historical context of workers' compensation reforms. During the early 1990s, workers' compensation insurance experienced a cost crisis. Employer costs⁷ had risen from \$1.49 per \$100 payroll in 1984 to \$2.18 in 1990, and the rapid cost growth was mainly driven by an increase in payments for medical services (Murphy et al., 2019). Concerned about the impact of the growth of medical costs on the economy, state legislators passed workers' compensation reform bills that put in place many cost containment measures.^{8,9} By 1997, most states had some combination of medical treatment controls (including provider choice, definition of treating doctors, utilization review, and the application of treatment guidelines), which served to decrease utilization of chiropractic and medical services (Eccleston and Yeager, 1997).

Two states that had early reforms are Colorado and Oregon. Colorado passed an extensive reform bill that included requirements for non-chiropractic physicians and chiropractors to become accredited through the Division of Workers' Compensation in order to perform certain services. Specific limitations on the services chiropractors could perform were enacted through the statute and treatment guidelines required by the statute. The first Colorado low back guidelines, in 1993, required demonstrable functional progress after 5 visits with total visits capped at 36 (archived Low Back Pain Treatment Guidelines, State of Colorado, Department of Labor, Division of Workers' Compensation Rule XVII Exhibit A). Oregon passed reform legislation in 1990. Among a number of the enacted changes, chiropractors were only recognized as treating physicians for 12 visits or the first 30 days. A WCRI study evaluating the impact of the Oregon reforms found that the chiropractic share of medical payments reduced from 16 percent pre-reform in 1989 to 3 percent post-reform in 1992. The payment share for chiropractic care after maximum medical improvement (MMI) decreased from 15 percent pre-reform to 10 percent post-reform (Gardner et al., 1996).

⁶ In Chapter 3, we describe the use of chiropractic care across workers' compensation systems and how it is correlated with the supply of chiropractors.

⁷ Employer costs are reported as dollars paid for each \$100 in wages.

⁸ State legislators were extremely concerned that as the costs of their state's workers' compensation insurance increased, fewer businesses would choose to locate in their state and other businesses might move to another location where insurance costs were lower.

⁹ Many cost containment measures were similar to those that had been in place for group health, such as utilization review, managed care organizations, mandatory use of treatment guidelines, and increased restrictions on medical provider choice (Murphy et al., 2019).

CHIROPRACTOR INVOLVEMENT IN DELIVERING CARE

Many guidelines recommend spinal manipulation be included in the treatment plan early in the care of low back pain (Hegmann et al., 2020). In most workers' compensation jurisdictions, chiropractors are authorized to provide care as a primary treating provider (Rothkin and Tanabe, 2018). Primary treating providers can evaluate, diagnose, and manage workers with injuries, as well as provide physical medicine services. Chiropractor involvement in workers' compensation health care and the utilization of chiropractic care may be subject to several relevant policies, including provider choice policies, reimbursement rules, and utilization review in the form of preauthorization, as well as policies regarding authorized treating providers and direct access to physical therapists without physician referrals.

Chiropractors are less likely to serve as initial providers than medical providers (Chevan and Riddle, 2011; Blanchette et al., 2016a).¹⁰ Based on a study using the National Health Interview Survey (NHIS) data, patients were not commonly referred to chiropractors by a medical provider; and many respondents with spine-related conditions receiving chiropractic care had a chiropractor as a personal health provider (Ndetan et al., 2020).¹¹ When chiropractors are involved in managing care, there is a lower likelihood of insurance reimbursement for evaluation and management (E&M) services provided by chiropractors (Whedon, et al., 2017).

Few studies examined integrative chiropractic care, which refers to chiropractic care provided by chiropractors who are affiliated with a hospital or medical provider network as opposed to care provided by an independent chiropractor. Wayne et al. (2019) compared costs and outcomes between integrative and conventional care and found that after adjusting for baseline differences, self-reported costs were higher in the integrative setting, but long-term direct expenditures and medication usage showed a decreasing trend. Comparing costs of chiropractic care between two clinical settings, Whedon et al. (2020) concluded that a clinical model with a patient-centered approach and evidence-based clinical protocols may offer lower costs for chiropractic care.

COSTS AND OUTCOMES OF CHIROPRACTIC CARE

Many studies suggested chiropractic care for spine-related disorders in general is at least as effective as other professional services (Elder et al., 2018; Blanchette et al., 2016b), or more so (McMorland et al., 2010). Patients with work-related low back pain who see a chiropractor as the first point of contact may be less likely to have spine surgery than those who see a surgeon initially (Keeney et al., 2013) and less likely to have early MRI (Graves et al., 2012a). Regarding opioid use, studies have found that patients with LBP seeing chiropractors are less likely to receive opioid prescriptions (Whedon et al., 2018; Whedon et al., 2020) and the supply of chiropractors is inversely correlated with opioid use (Weeks and Goertz, 2016; Kazis et al., 2019). Patients with chiropractic care also reported a reduced use of over-the-counter medications (Ndetan et al., 2020). When chiropractors are seen as an initial provider, chiropractic care may also help reduce the duration of disability (Turner et al., 2008) and the recurrence of disability after low back injuries (Cifuentes et al., 2011).

¹⁰ Chevan and Riddle (2011) reported that for low back and neck pain, 61 percent of the patients received usual care by physicians, 28 percent received chiropractic care, and 11 percent received care by physicians and physical therapists. Based on workers' compensation back pain claims in 2005 in Ontario, Canada, Blanchette et al. (2016) showed that approximately 86 percent of the workers saw a medical doctor initially; only 11 percent saw chiropractors initially and 3 percent received care directly from physiotherapists.

¹¹ The Adult Complementary and Alternative Medicine (ACAM) Survey defines a personal health care provider as "a health professional who knows you well and is familiar with your health history." The survey lists three choices for a personal health provider: (1) medical doctor (MD, DO); (2) nurse, nurse practitioner, or physician assistant; and (3) chiropractor, acupuncturist, or naturopath.

Many studies suggested that chiropractic care might be less costly for low back pain when compared with care provided by other health care providers. However, the evidence was not conclusive, in part due to limitations precluding an effective control of differences in patient characteristics and seriousness of condition between the treatment and comparison groups. Among the studies reviewed by Dagenais et al. (2015), six were focused on workers' compensation claims, providing mixed results. Of these six studies, three reported lower costs for chiropractic care (Phelan et al., 2004; Jarvis et al., 1997; Cifuentus et al., 2011). Two studies reported lower costs for chiropractic care, but after adjusting for worker's health and injury severity, they found no difference in the cost-effectiveness between chiropractic care and care by other medical providers for the treatment of low back pain (Johnson et al., 1999; Butler and Johnson, 2010). One study found that the cost for treatment by chiropractors was greater than that of (non-chiropractic) physicians for similarly classified conditions affecting the low back (Gilkey et al., 2008). It is worth mentioning that some of these studies might not have complete prescription costs included in the analysis, which is important to consider, especially given that there was an increased use of prescription medications in the past years. Mixed results are also found in research outside workers' compensation (Whedon et al., 2013; Weigel et al., 2014; and Weeks et al., 2016).

ORGANIZATION OF THIS REPORT

The report is organized into six chapters. Chapter 2 describes the data used for the analysis; our approach to defining provider patterns of PM and E&M services; and the statistical techniques we applied for comparing the utilization of medical services, costs, and TD duration between chiropractic exclusive PM groups and the non-chiropractic-only PM group. Chapter 3 describes the prevalence of chiropractic care for workers with LBP and explains some of the factors that likely contribute to the substantially large interstate variation in the prevalence of chiropractic care. Chapter 4 describes common provider patterns of PM treatment and other key medical services including evaluation and management services. It also provides descriptive data on outcome variables between chiropractic exclusive PM groups and the non-chiropractic-only PM group. Chapter 5 provides some results from our statistical analysis that compares the outcomes between LBP claims with exclusive chiropractic PM and a subset of claims with non-chiropractic-only PM care, taking into account a number of factors that likely influence choice of chiropractic care and outcomes. We discuss implications of our findings in Chapter 6.

Technical Appendix A highlights additional details regarding the definition of low back pain, based on a previous WCRI study (Wang, Mueller, and Lea, 2019a). Technical Appendix B describes our approach to identify comorbidities in the data. Technical Appendix C discusses our approach to the statistical analysis, the factors we took into consideration to maximize the comparability of the results, and the regression results. The statistical appendix includes tables showing results for individual states included in the analysis.

2

DATA AND APPROACH

This chapter describes the data we used for the study, how we identified provider patterns of PM services for low back pain, and our approach to comparing utilization of medical services, medical and indemnity costs, and duration of TD between chiropractic and non-chiropractic PM care. Technical Appendices A through C provide more detailed discussions on several technical issues related to the data and our statistical analysis.

THE DATA

The data used for this study are from the WCRI Detailed Benchmark/Evaluation (DBE) database, which provides us with more than 2 million open and closed claims from 28 states,¹ with injuries from October 1, 2015, through September 30, 2017, and detailed medical transactions up through March 31, 2019. All except two states have representative data in the DBE database.² These states are geographically diverse and represent a wide spectrum of state policies regarding utilization management and practice patterns of medical services. The claims in the DBE database represent approximately 38–77 percent of all workers' compensation claims, depending on the state, for the individual states we studied. The 28 states combined represent more than two-thirds of the workers' compensation medical benefits in the United States during the study period.

The detailed medical transaction data provide information on the date of service, specific medical procedures or services provided, individual providers and/or provider organizations, the amount charged by and paid to the provider, and diagnostic codes indicating specific injuries and medical conditions that were treated. For service providers, we used the WCRI proprietary mappings of provider type, which are based on data-source specific information on provider specialties and encrypted tax IDs of providers or provider organizations. Although the detailed specialty information in our data was not consistently available across all data sources, the identification of chiropractors and chiropractic care is complete and adequate.

Prior to October 15, 2015, the World Health Organization's 9th revision (ICD-9) was used for recorded diagnoses; after that date, the 10th revision (ICD-10) is required to be used for recorded diagnoses. The 10th revision provides much more detailed coding schemes that help capture specific diagnoses by nature and severity. Specifically for low back related diagnoses, the ICD-10 system provides much more detailed codes for low back conditions involving nerve roots, compared with the ICD-9 system. Because of this, we chose to use the ICD-10 codes for the identification and classification of low back claims to better align our low back

¹ The 28 states are Arkansas, California, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nevada, New Jersey, New Mexico, New York, North Carolina, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, and Wisconsin.

² We do not name the individual states because of a confidentiality concern.

classification with specific low back conditions addressed in medical treatment guidelines. This choice limited us to include claims with injuries occurring on or after October 1, 2015.³ We also restricted the date of injury to be no later than September 30, 2017, in order to observe treatments and benefit payments for 18 months, based on the DBE data as of March 31, 2019.

The LBP claims included in this study are (1) low back pain claims with radiating leg pain and/or neurological findings, and (2) low back pain only claims.⁴ Throughout the reports, we use *LBP claims with nerve involvement* or *neuro back claims* and *LBP-only claims* as shorthand.

To make sure that these LBP claims did not have more serious conditions, we excluded those that had at least one mention in the ICD-10 codes of a red flag condition (e.g., tumors, infectious diseases, fractures and dislocations)⁵ and/or neurological neck conditions.⁶ Note that *red flag* is a term often used for a medical condition that, by medical consensus or evidence, requires immediate testing or intervention due to the likelihood of possible permanent, significant impairment or the need for expedited surgery. We also excluded a small percentage of claims with low back surgery and a few claims that had a comorbid condition with severe complications, such as diabetes with hypoglycemia or ketoacidosis, substance abuse with psychotic disorders, and bipolar disorders.⁷ In order to focus on new-onset LBP claims, we excluded a few claims with specific procedure codes (for example, MRI indicated by the CPT codes 72149 and 72158) that may indicate a previous low back pain occurrence or a previous low back surgery. We also identified claims with chronic pain mentioned in the initial 3 months of treatment and treated this as a comorbidity (see Technical Appendix B). As a result, our study focuses on new-onset LBP claims that may or may not become chronic low back pain during the 18 months of treatment.

The LBP claims included are those LBP claims that received medical care, regardless of whether they were medical-only or indemnity claims. We report results for all medical claims, except for the excluded claims explained in the previous paragraph, to provide a more complete picture of treatment patterns of physical therapy services. Table 2.1 provides the count of initial claims from the DBE database, and the LBP claims we used for the study.

³ We used the date of injury October 1, 2015, as a cut off, instead of October 15, 2015, as a convenient way to construct the data. The 15-day gap is unlikely to make a material difference in the identification of low back claims. Note that the switch from the ICD-9 to ICD-10 system was immediate. The claims with ICD-9 codes were not included in our data.

⁴ The algorithm used the ICD-10 codes that were recorded in the detailed transactions for medical services including evaluation and management services, emergency services, hospital/critical care, consultations, physical medicine, surgery, anesthesia, and psychiatric services. A detailed description of the algorithm can be found in Wang, Mueller, and Lea (2019a). Technical Appendix A provides the ICD-10 codes used in the algorithm.

⁵ We identified a large number of codes in the ICD-10 coding system that are related to signs, symptoms, and conditions indicating potentially serious pathology in patients presenting with back pain. These codes, not included in the report, cover conditions such as tumor, infectious disease, and fracture and dislocation.

⁶ See Technical Appendix A for a description of neurological back and neck conditions and a list of ICD-10 codes indicating these conditions.

⁷ These more serious comorbid conditions were identified using an ICD-10 code list we established for comorbidities. See Wang, Mueller, and Lea (2020).

CHIROPRACTIC CARE FOR WORKERS WITH LOW BACK PAIN

Table 2.1 Number of Claims

| | AR | CA | CT | DE | FL | GA | IA | IL | IN | KS | KY | LA | MA | MD | MI | MN | MO | NC | NJ | NM | NV | NY | PA | SC | TN | TX | VA | WI | 28-State Total | | |
|---|--------|---------|--------|-------|---------|--------|--------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|--------|--------|---------|--------|--------|----------------|--|--|
| Number of all medical claims in DBE round 21 database | 15,013 | 363,151 | 38,466 | 6,807 | 152,285 | 62,635 | 30,453 | 102,454 | 64,773 | 28,785 | 41,289 | 22,007 | 55,377 | 37,935 | 85,751 | 62,483 | 48,062 | 68,741 | 85,858 | 17,869 | 27,588 | 89,373 | 103,152 | 33,027 | 56,929 | 209,217 | 56,304 | 65,881 | 2,031,665 | | |
| LBP claims used for this study^a | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of LBP claims included | 1,576 | 50,429 | 4,805 | 695 | 17,480 | 7,785 | 2,367 | 10,717 | 5,311 | 2,260 | 4,199 | 2,364 | 6,506 | 4,575 | 8,180 | 7,638 | 4,277 | 7,190 | 9,972 | 2,057 | 3,271 | 8,943 | 10,277 | 3,139 | 5,888 | 26,810 | 5,957 | 6,949 | 231,617 | | |
| % LBP-only claims | 84% | 86% | 81% | 76% | 81% | 81% | 81% | 82% | 83% | 82% | 81% | 81% | 80% | 85% | 85% | 79% | 85% | 80% | 78% | 87% | 90% | 72% | 82% | 82% | 81% | 89% | 82% | 79% | | | |
| % LBP claims with nerve involvement | 16% | 14% | 19% | 24% | 19% | 19% | 19% | 18% | 17% | 18% | 19% | 19% | 20% | 15% | 15% | 21% | 15% | 20% | 22% | 13% | 10% | 28% | 18% | 18% | 19% | 11% | 18% | 21% | | | |

Notes: Claims included are those with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. The claims in the DBE database represent approximately 38–77 percent of all workers' compensation claims, depending on the state. See Chapter 2 for more details about the data used for this study.

^a The LBP claims included are those that did not have surgery, but received medical services from chiropractic and non-chiropractic providers. The medical services are predominantly used for treating low back conditions. Claims with ICD-10 codes indicating more serious red flag conditions, neurological neck pain, or more severe comorbidities are excluded. See Chapter 2 for a more detailed description.

Key: DBE: Detailed Benchmark/Evaluation database; ICD: International Classification of Diseases; LBP: low back pain.

IDENTIFYING CHIROPRACTIC AND NON-CHIROPRACTIC PHYSICAL MEDICINE SERVICES

There are several types of physical medicine services, including active therapies (often referred to as exercises), physical modalities (e.g., hot/cold packs, electric stimulation, traction, etc.), chiropractic manipulation or manual therapy (also referred to as “hands-on” treatment), and other PM services not classified above. We identified PM services using CPT-4 codes and grouped these codes into the four types of PM services described above. Table TA.A6 of Technical Appendix A lists all the CPT-4 codes that we used to identify PM services by type. To identify providers of PM services, we used the WCRI proprietary mappings of provider type, which are based on data-source specific information on provider specialties and encrypted tax IDs of providers or provider organizations. Using our data, we are able to differentiate chiropractors from other non-chiropractic physical medicine providers. The detailed review of the data suggests that a vast majority of the non-chiropractic physical medicine providers were physical therapists, while a small percentage of claims received physical medicine services from non-chiropractic physicians, nurse practitioners, and physical assistants. Since the level of detail for provider specialty varies by data source, we cannot identify more detailed provider types for physical medicine services. Table TA.A7 of Technical Appendix A provides the frequency of PM services by type between chiropractic PM and non-chiropractic PM services.

IDENTIFYING PROVIDER PATTERNS OF PM AND E&M SERVICES

In many workers’ compensation systems, chiropractors can provide care as a treating provider. When chiropractors are involved in delivering care, some provide care as a sole provider and others provide PM services in conjunction with other non-chiropractic providers. Since chiropractors can serve as a treating provider as well as a provider of PM treatment, it is helpful to identify common provider patterns of PM treatment and understand how chiropractors may be involved in managing overall patient care as well as PM treatment. To do so, we considered several key elements to establish a framework for the identification of common provider patterns:

- Chiropractor involvement in PM treatment
- Provider patterns of E&M services during the period of treatment
- Common pathways that lead to PM treatment

To identify provider patterns of PM treatment, we focused on chiropractors versus non-chiropractors for two reasons. First, chiropractors treat spinal problems somewhat differently compared with non-chiropractic providers. In our data, physical therapists represent a vast majority of non-chiropractic PM providers, and the other non-chiropractic PM providers include osteopathic doctors, medical doctors, nurse practitioners, and physician assistants providing PM care. Since the non-chiropractic and non-physical therapy PM providers represent a small number of PM providers in our data, it is not necessary to further break down the non-chiropractic PM provider category. Although the detailed specialty information in our data was not consistently available across all data sources, the identification of chiropractors and chiropractic care is complete and adequate.

For provider patterns of PM treatment, we first identified LBP claims that had PM treatments provided exclusively by chiropractors or non-chiropractors—exclusive PM care. For claims receiving PM services by both chiropractors and non-chiropractors, we checked whether there was an overlapping period between chiropractic treatment and non-chiropractic treatment. If a claim had chiropractic treatment overlapping non-

chiropractic treatment, the claim was considered to have combined PM care. If the chiropractic treatment and non-chiropractic treatment were separated in a sequential manner without any overlapping, we considered the claim to have sequential PM care.

To identify claims with different provider patterns of PM treatments, we used a pooled sample of 16 states where chiropractors were involved in care for at least 5 percent of LBP claims. Figure 4.1 shows the claim distribution of provider patterns, using the terms *chiropractic exclusive PM*, *non-chiropractic-only PM*, *combined PM*, or *sequential PM* to refer to each of the high-level groups. Twelve percent of LBP claims received PM treatment by chiropractors only, and 71 percent of claims received PM services by non-chiropractors only. Among the rest of the 17 percent of LBP claims, 13 percent had combined PM care and 4 percent had PM care in a sequential manner.

The 12 percent of claims with chiropractic exclusive PM were further divided into two groups: (1) the chiropractic-only PM/EM group and (2) the chiropractic-only PM group. The chiropractic-only PM/EM group includes LBP claims that received PM treatment by chiropractors only, and all the E&M services were also provided by chiropractors (i.e., chiropractors managing overall care). The second chiropractic exclusive PM group includes claims that also had E&M services by a medical provider (i.e., medical or osteopathic doctor, nurse practitioner, or physician assistant), with or without chiropractors for E&M services. For this group of claims, it is more likely that the medical providers were managing overall patient care and chiropractors provided E&M services to evaluate the patient's need for and management of PM treatment.⁸ We believe that this subdivision is necessary because chiropractors are not fully responsible for the outcomes of overall care when a medical provider is co-managing care and orders medical services, such as opioid prescriptions, MRI, and pain management injections.⁹

While claims with chiropractic exclusive PM care (12 percent of LBP claims) are relatively simple, where chiropractors were the only PM provider, the cases with both chiropractors and non-chiropractors providing PM services (17 percent) could be more complex. As mentioned above, 13 percent of LBP claims received combined PM care and 4 percent had sequential PM care. Of those with combined PM care, 7 percent started PM treatment by both chiropractors and non-chiropractic PM providers on the same date of first PM. For most of these cases, PM treatments were provided by chiropractors and non-chiropractors who were affiliated with the same-billing-entity tax ID. Conceivably, these claims received cross-disciplinary PM care within the same health care organization with chiropractors involved to provide chiropractic manipulation treatment (CMT) services and non-chiropractors performing other PM services, such as exercises and modalities.

The 4 percent of cases involving chiropractors and non-chiropractors in a sequential manner involved provider change for several reasons. First, it could be that the initial PM treatment did not help to achieve functional improvement and the patient was referred to a different provider. Second, the worker or the employer may have requested a change of provider once the initial PM treatment started. Third, the initial treatment may have reached the maximum number of visits allowed and additional PM treatment was authorized and provided by a different provider.

⁸ Chiropractors provide E&M services for new patients to diagnose and formulate a treatment plan. They also provide E&M services periodically over the entire PM treatment to evaluate functional improvement and instruct the patient for home health care/exercises. However, in some workers' compensation systems, not all chiropractic E&M visits are reimbursed.

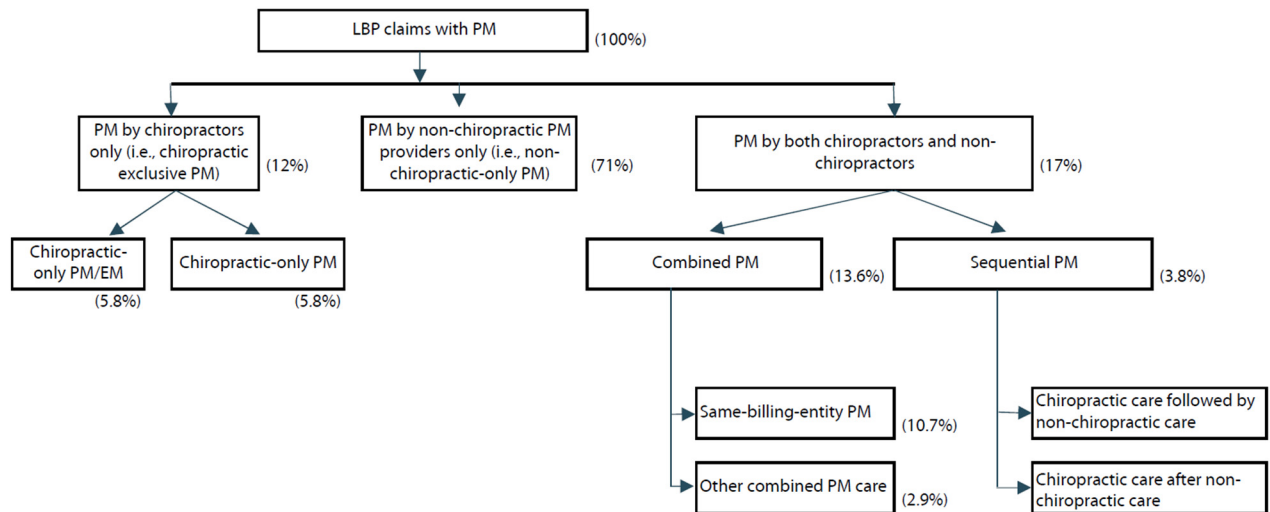
⁹ We explored the identification of ordering providers for MRI and injections since chiropractors can order these services. We were not convinced that the indicator we created would be accurate enough to report, but a detailed review of underlying data suggest that it was much less frequent for a chiropractor to order MRI and injections than for a medical provider to do the same.

Our data analysis indicates that the groups of combined and sequential PM care tended to be associated with substantially higher utilization of medical services, higher costs, and longer TD duration, when compared with claims receiving exclusive PM care by chiropractors only or by non-chiropractors only. The LBP claims in these combined and sequential categories may have more serious injuries and more complex cases, which makes it difficult to understand the extent to which the difference in the outcomes is attributable to provider practices only, while holding constant the patient’s severity and complexity. Because of this, we limited the scope of this study to only comparing outcomes between chiropractic and non-chiropractic care among claims receiving exclusive PM care.

Among the claims with combined PM care, we identified a subgroup of claims with combined PM that received PM services by both chiropractors and non-chiropractors on the same day of first PM. Most claims in this subgroup involved chiropractors and non-chiropractors who were affiliated with the same billing entity, suggesting that these claims likely received PM treatments in a cross-disciplinary setting. However, we could not rule out the possibility that some of these billing entities were formed for financial reasons, and we cannot separate out these financially-linked entities from those health care organizations aiming at improving the delivery of health care.

Figure 2.1 provides a diagram that describes how we identify LBP claims in terms of provider patterns.

Figure 2.1 Identifying Common Provider Patterns of Physical Medicine Treatment



Note: The percentage presented in the parentheses next to each box is the percentage of LBP claims with physical medicine services, based on the pooled data of 16 states where chiropractic care was prevalent (i.e., more than 5 percent of LBP claims received chiropractic care).

Key: EM: evaluation and management; LBP: low back pain; PM: physical medicine.

There have been studies examining the types of medical providers initially seen by patients and the impact on subsequent care.¹⁰ Ideally, we would identify provider specialties for initial medical visits and take the type of initial provider into account for subsequent care and outcomes. Since the level of detail for provider specialty varies across data sources, we grouped the claims in two slightly different ways: (1) grouping of claims based on whether a claim involved a chiropractor, a medical provider, or both a chiropractor and a medical provider for E&M services over the entire treatment period; (2) grouping of claims based on entry path, focusing on E&M services before and on the first date of PM treatment. Since the claim groupings by entry path showed a consistent pattern with the provider patterns of all E&M services, we used provider patterns of E&M services to further define two groups of chiropractic exclusive PM: claims with chiropractic-only PM/EM and claims with chiropractic-only PM (see Table 2.3). Eleven percent of LBP claims had an emergency visit prior to PM treatment. Since provider patterns were fairly similar between claims with and without emergency visits, we grouped claims by provider pattern regardless whether a claim had an emergency visit prior to PM treatment.

MEASURING UTILIZATION AND OUTCOMES

One of the objectives of this study is to compare costs and outcomes between chiropractic and non-chiropractic care. Specifically, the outcome variables used for the study are the percentage of claims with key medical services (MRI, opioid prescriptions, pain management injections),¹¹ the utilization and costs of overall physical medicine services, the average medical and indemnity benefit payments per claim, and the average number of weeks (or days) of TD benefits. The utilization variables were constructed based on detailed medical transactions for medical services, including PM services, rendered during the first 18 months of treatment.

The specific types of medical services and procedures were identified using CPT codes, which are included in Technical Appendix A. Table 2.2 describes the construction of outcomes such as the utilization of medical services, medical and indemnity costs, and TD duration. Table 2.3 lists the variables we constructed to describe the patterns of PM treatment.

¹⁰ There have been a number of studies on this topic, including Chevan and Riddle (2011), Blanchette et al. (2016a), Fritz et al. (2016), Azad et al. (2019), Carey et al. (2019), and Rhon et al. (2019).

¹¹ The rate of surgery is also an important outcome of initial care. However, we do not capture this outcome due to the exclusion of surgical low back pain claims. We made this decision because surgical claims follow different treatment patterns, which requires a different analysis of pre- and post-surgical physical medicine treatment.

Table 2.2 Measuring Utilization, Costs, and Outcomes

| Variables | Description |
|---|--|
| Utilization, costs, and TD duration (observed during 18 months after injury) | |
| % of claims receiving MRI | Percentage or likelihood of receiving lumbar MRI, based on the claim-level variable that has value 1 if the claim received MRI and 0 if not. See the early physical therapy report (Wang, Mueller, and Lea, 2020) for more details. |
| % of claims receiving opioid prescriptions | Percentage or likelihood of receiving opioid prescriptions, based on the claim-level variable that has value 1 if the claim had opioid prescriptions and 0 if not. See the early physical therapy report for more details. Opioid prescriptions are identified based on drug transactions in the DBE database using the therapeutic classification scheme developed by Medi-Span®. ^a These are controlled substances scheduled at the federal level based on their analgesic potency and risk for abuse and dependence. |
| % of claims receiving pain management injections | Percentage or likelihood of receiving spinal pain management injections, based on the claim-level variable that has value 1 if the claim received injections and 0 if not. The CPT codes for spinal injections can be found in Table 2.2 of the early physical therapy report. |
| Medical costs per claim | Mean and median value of medical benefit payments per claim for medical services, based on payors' payment and credit transaction data at 18 months starting from the date of injury. |
| Indemnity payments per claim | Mean and median value of indemnity benefit payments per claim, based on payors' payment and credit transaction data at 18 months starting from the date of injury. |
| TD duration in weeks | Mean and median number of weeks of TD benefit payments, based on payors' payment and credit transaction data at 18 months starting from the date of injury. A small number of claims that had missing or unreasonable TD duration data were excluded from the analysis, including a few claims with negative TD payments after adjusting for credits and claims that had an unusually large number of weeks beyond 18 months. |
| Payments for PM treatment | Mean and median values of payments for PM services, based on detailed medical transactions data in the DBE. |
| Payments for non-PM medical services | Mean and median values of payments for medical services other than PM, based on detailed medical transactions data and payment data in the DBE. |

^a According to Medi-Span®'s Therapeutic Classification System, a hierarchical classification scheme, the first two digits of the 10-digit Generic Product Identifier classifies general drug products. We identified opioid prescriptions based on drug group 65 for opioid analgesics. See Medi-Span® (2005).

Key: CPT: Current Procedural Terminology; DBE: Detailed Benchmark/Evaluation database; MRI: magnetic resonance imaging; PM: physical medicine; TD: temporary disability.

Table 2.3 Identifying Provider Patterns and Measuring Utilization of Physical Medicine Services

| Variables | Description |
|--|---|
| Prevalence | |
| % of claims with PM | Percentage of LBP claims (with or without nerve involvement) that received PM services during 18 months of treatment postinjury. |
| % of claims with chiropractic-only PM/EM | Percentage of LBP claims that received physical medicine treatment by chiropractors only, and chiropractors were the sole provider for E&M services. The group of claims is referred to as having exclusive chiropractic care. |
| % of claims with chiropractic-only PM | Percentage of LBP claims that received physical medicine treatment by chiropractors only, but a medical provider (e.g., non-chiropractic physicians, nurse practitioners, and physician assistants) provided E&M services. |
| % of claims with combined PM care | Percentage of LBP claims that received physical medicine treatment by both chiropractors and non-chiropractors, and the chiropractic and non-chiropractic PM services were provided over an overlapping period of time. The chiropractors and non-chiropractors may or may not be affiliated with the same billing entity health care organization. |
| % of claims with cross-disciplinary PM care | Percentage of LBP claims with PM that received PM treatment in a cross-disciplinary setting. The variable indicating cross-disciplinary PM was assigned value 1 if a claim received PM services by both chiropractors and non-chiropractic PM providers (mostly physical therapists) who were affiliated with the same billing entity. This variable is only used for an analysis examining combined PM care. |
| % of claims with sequential PM care | Percentage of LBP claims with PM that received PM treatment by both chiropractors and non-chiropractors, and the chiropractic and non-chiropractic PM services were provided without an overlapping period of time. The chiropractors and non-chiropractors may or may not be affiliated with the same billing entity health care organization. |
| % of claims with E&M by chiropractors or non-chiropractors | The percentages capture the claim frequency of three provider patterns for E&M services: E&M services provided by chiropractors only, non-chiropractic providers only, or both chiropractic and non-chiropractic providers. |
| Number of PM visits | Number of unique dates of visits for PM services, based on detailed medical transaction data. |
| % of claims receiving active therapy services | Percentage of LBP claims that received active therapies. Active therapy services are those with CPT codes indicating therapeutic exercises and related education and training. By contrast, passive physical therapy services are physical modalities such as hot/cold packs, soft-tissue massage, traction, and acupuncture. |
| % of claims receiving manual therapy | Percentage of LBP claims that received manual therapy services. Manual therapy services are hands-on, including joint or soft-tissue mobilization and manipulation and manual traction as well as chiropractic manipulative treatment (CMT) and osteopathic manipulative treatment (OMT). |

Key: CPT: Current Procedural Terminology; E&M: evaluation and management; LBP: low back pain; MRI: magnetic resonance imaging; PM: physical medicine.

It should be noted that the duration of TD benefits does not exactly reflect the duration of time that workers were away from work. Several possible scenarios include (1) workers received TD benefits until reaching maximum medical improvement and started receiving permanent partial disability benefits; (2) some workers may choose to settle their claims; or (3) in some states, TD benefits may be terminated while workers resolve disputes about their ability to return to work.¹² However, for this study that compares outcomes between chiropractic and non-chiropractic care, the duration of TD should be sufficient to detect differences between the two groups. It is worth noting that across states with different system features, there is large variation in the duration of TD benefits. For example, TD duration is much longer in wage-loss states than in non-wage-loss states, because unlike in a non-wage-loss state, workers in a wage-loss state do not shift to receive permanent partial disability benefits after reaching maximum medical improvement. This can be addressed by controlling for state fixed effects, which we applied in our statistical analysis.

In addition to costs and TD duration, we also compare different treatment patterns and assess how these patterns are associated with the utilization of medical services. Specifically, the outcome variables we use for the study include the percentage of claims with key medical services (MRI, opioid prescriptions, and pain management injections),¹³ the utilization and costs of overall physical medicine services, the average medical and indemnity benefit payments per claim, and the average number of weeks (or days) of TD benefits. These measures were constructed based on the payment transaction data for the low back claims included in this study.

STATISTICAL ANALYSIS

Below we present some results from our statistical analysis that compared utilization of medical services (e.g., opioids, MRI, and pain management injections), medical and indemnity costs, and TD duration for chiropractic-only PM/EM claims or chiropractic-only PM claims with those receiving non-chiropractic-only PM treatment. To maximize the comparability of the results on costs and outcomes between claims with chiropractic and non-chiropractic PM care, we applied a propensity score matching approach to take into account as many variables as we could measure that might affect treatment choice (i.e., having chiropractic care) and outcomes.

Several studies suggest that patients who use chiropractic care are more likely to be middle-aged, white, female, married, and employed (Beliveau et al., 2017; Weeks et al., 2015b and 2016). Concurrent mental health issues and multiple comorbidities were also reported as significant factors (Weeks et al., 2015b; Whedon et al., 2012). Regional/neighborhood socioeconomic factors were also cited as important factors, such as rural- and urban-dwelling, household income, neighborhood education, proportion living under the federal poverty level, and unemployment rate (Weeks et al., 2015b; Shraim et al., 2017). In addition, per-capita supply of chiropractors is strongly correlated with the use of chiropractic care among Medicare beneficiaries with spine problems (Whedon et al., 2012). A few studies have examined factors affecting individual care-seeking behavior with respect to the type of providers initially seen and the relationship between initial provider and subsequent use of medical services. For example, Blanchette et al. (2017) found several key factors that would most likely

¹² See Savych, Neumark, and Lea (2018) for further discussion.

¹³ The rate of surgery is also an important outcome of initial care. However, we do not capture this outcome due to the exclusion of surgical LBP claims. We made this decision because surgical claims follow different treatment patterns, which requires different analysis of pre- and post-surgical physical medicine treatment. Even for nonsurgical claims, various types of providers and services involved add to the complexity of analysis and interpretations of results.

influence the decision on choosing initial providers, including age, gender, job tenure, wage, size of employer, rural and urban area, and the size of community. Chevan and Riddle (2011) found that increased age, female sex, lower self-health rating, and presence of at least one disability day were all significantly associated with physician/physical therapist care over chiropractor care. Efforts were also made to establish a conceptual framework that helps capture confounding factors, observed or unobserved (Chowdhuri and Kundu, 2020; Lalloo et al., 2021).¹⁴

In our analysis, we included most of the variables discussed in the literature and, in addition, we created several variables that help capture certain aspects of patients' preference and care-seeking behavior as well as provider practices. In this section, we discuss our approach at a high level. More detailed discussions can be found in Technical Appendix C, which also provides the results from our statistical analysis.

PROPENSITY SCORE MATCHING AND ADJUSTMENT

The basic idea for propensity score matching is to predict, for individual claims with or without chiropractic care, the likelihood of having chiropractic care based on a set of observed factors that influence the probability of being treated, and for each claim with chiropractic care, find one or multiple claims in the non-chiropractic-only PM group that resembles the chiropractic claim. For each claim with chiropractic care, we matched up to three claims with non-chiropractic-only PM using the nearest neighbor approach, a commonly used matching strategy.¹⁵ We implemented this first step statistical analysis in Stata.

The factors we considered in estimating the likelihood of having chiropractic care include

- variables indicating severity and complexity (i.e., whether the claim had LBP with nerve involvement or more than seven days of lost time; whether there were two or more comorbidities or a mobility diagnosis);¹⁶
- worker demo-socio-economic characteristics (i.e., age, gender, marital status, preinjury average weekly wage, tenure with preinjury employers, and job industry categories);
- access to care (i.e., the number of days from injury to first medical service);
- attorney involvement;
- whether the initial PM treatment was provided by PM providers who are affiliated with the same billing

¹⁴ Chowdhuri and Kundu (2020) proposed a conceptual framework, based on a 30-point questionnaire survey, that identified three groups of contributing factors to an individual's preference and choice behavior toward complimentary alternative medicine (CAM) services, including patient's demo-social-economic characteristics, personal trait and social factors, and cognitive factors. The authors found that cognitive factors (i.e., knowledge, perception, and attitude toward CAM treatment) played an important role of shaping choice of CAM services. Lalloo et al. (2021) proposed a conceptual framework that identified relevant complexity-contributing factors (CCFs) specifically tailored to the occupational health setting. The authors focused on patient complexity (both inherent and perceived by medical providers) and the link between the level of complexity and utilization and costs of medical resources and outcomes. The CCFs were summarized in three domains: health factor, workplace factor, and biopsychosocial factors.

¹⁵ We chose to match the three nearest neighbors, which helps achieve a reasonable balance between the treatment and comparison groups and ensures sufficient sample size.

¹⁶ Workers with LBP receiving care from different providers may be different in terms of medical severity and patient complexity. For example, studies suggest that patients with more serious medical conditions and/or two or more comorbidities were likely to receive care from a medical provider; and patients who had a positive experience with chiropractic care in the past may likely choose chiropractic care when given the choice. Unfortunately, we do not have the data needed to observe these key elements prior to the injury. These key elements may be captured with health services data outside workers' compensation. This is indicated in Table TA.C1 and further discussed in the technical appendices.

entities of the initial office visit providers;¹⁷

- environmental factors including rural/urban area, county-level variables on supply of physical therapists and chiropractors, percentage of population with college or higher degree, median household income, percentage of population with no health insurance coverage, percentage of population below the federal poverty level, unemployment rate, etc.;
- state-specific policies and environment affecting the likelihood of receiving chiropractic care. Note that we adjusted for these state-specific factors with state fixed effects (using state dummy variables). Several state policies are likely to directly or indirectly influence choice of providers and outcomes, including provider choice laws, guidelines and utilization review, reimbursement rules, and workers' compensation benefit structure. Since our analysis focuses on comparing outcomes between chiropractic and non-chiropractic care, we did not isolate specific policies from other state-specific factors, which would need a different study design.¹⁸

Most importantly, we created a variable that helps approximate some of the most important factors determining the choice of chiropractic care—access to chiropractic care, patient preference, and care-seeking behavior. For individual workers with LBP, the variable was created based on how frequent all other workers who lived in the same hospital referral region received chiropractic care.^{19,20}

Using the propensity score matching approach, we constructed a comparison group of non-chiropractic PM claims, separately, for the chiropractic-only PM/EM group and the chiropractic-only PM group. We compared the outcomes before and after further adjusting for several additional factors affecting the outcomes (e.g., whether the claim had any comorbidity, the number of days from initial medical visit to the first date of PM treatment, and whether the claim involved multiple billing entities for PM care).

Since the statistical analysis includes all medical claims with LBP (both medical-only and indemnity claims), we ran a two-part regression in the estimation of indemnity costs and TD duration to address a large number of claims with zero values in these outcome variables. The first part was to estimate the likelihood of receiving indemnity payments or having TD duration based on all medical claims, and the second part was to estimate the effect of treatment on indemnity and TD duration based on claims with positive values in the outcome variable. The estimated indemnity payments and TD duration per claim were computed based on the estimates from the two-part regressions. For medical costs, indemnity payments, and TD duration, the distributions show many of the claims at the lower end of the spectrum. We transformed these variables in the natural log form to meet the normality assumption of the linear regression. For the likelihood of receiving MRI, opioids, and pain management injections, we used logistic regressions.

There was also a small percentage of claims that had unusually high values for a given outcome variable

¹⁷ We use this as a proxy for either “in-house” PM treatment or within organization PM referrals. We include this same-billing-entity PM variable to hold constant organization-level treatment protocols or other incentives that influence treatment choice and outcomes.

¹⁸ One may be concerned that including state fixed effects may not address variable responses of treatment and certain key factors. We conducted a sensitivity test by running the same statistical analysis separately for states with employee choice of provider and employer control of provider selection. The results did not change the comparative findings between the chiropractic exclusive PM groups and the non-chiropractic-only PM group. See Technical Appendix C for more discussion.

¹⁹ The variable is constructed based on the same idea as in Savych, Neumark, and Lea (2018). Instead of constructing an instrumental variable, we use this to approximate the patients' preference of and access to chiropractic care.

²⁰ By definition, the hospital service area (HSA) could help define smaller areas than the hospital referral region (HRR), but this also creates small sample sizes. Because of this, we chose to use HRR for deriving the variable.

such as medical costs and indemnity payments. For the claims with unusually high values in these variables, we capped the value at three times the 99th percentile. For TD duration, we capped a few cases at the extreme values at 82 weeks since the longest amount of time we observed is 18 months.

SENSITIVITY TESTS

We tested several different specifications for the first-stage logistic regression to see whether the estimated propensity distributions for treatment and comparison groups, the weights, and the second-stage results were sensitive to different specifications. In general, the results were not sensitive to several alternative specifications tested.

Several concerns may arise over issues regarding the identification of low back conditions and comorbidities using multiple ICD-10 codes recorded in the detailed medical transactions and issues about the type of defense attorney involvement, which may help indicate pending compensability issues (which may affect choice of providers). These issues are briefly discussed in Technical Appendix C. More discussion can be found in previously published WCRI reports (Wang, Mueller, and Lea, 2020 and 2021).

We also conducted a sensitivity analysis to run the same statistical analysis for several states with prevalent chiropractic care and for states with employee or employee limited choice. The results from these sensitivity analyses did not change the major findings (see Technical Appendix C for the results of the sensitivity test).

LIMITATIONS AND CAVEATS

Several limitations need to be noted to help the reader better interpret the results of our analysis. First, we applied statistical techniques to address the selection of LBP claims into those with chiropractic exclusive PM care versus those that received non-chiropractic-only PM care. Although we identified and controlled for a large number of factors that influence choice of chiropractic care, we were not able to fully address several unobserved factors, such as severity and patient complexity²¹ and patient care-seeking behavior (influenced by bio-psychosocial and cognitive factors).²² Several studies outside workers' compensation explored the measurement of these factors using the patient's experience and utilization of medical resources prior to the episode of illness studied. Unfortunately, we do not have data on workers' preinjury experience. The variable we created, at the hospital referral region level, helps to measure local access to and perception of chiropractic care for workers living in a hospital referral region. However, this high-level characterization may not be enough to address all aspects of individual care-seeking behavior. Therefore, we caution the reader that the findings from our statistical analysis only provide evidence of association between exclusive chiropractic care (i.e., chiropractic-only PM/EM) and lower costs and shorter TD duration when compared with non-chiropractic-only PM care. The same caveat applies to the analysis of chiropractic-only PM.

Second, we applied a propensity score matching approach to construct a subset of non-chiropractic-only PM. As a result of the matching, we have a large percentage of non-chiropractic-only PM claims being excluded from the analysis. We observed some noticeable differences in severity and environmental factors between the

²¹ The term *patient complexity* has been increasingly used in the literature to address an interaction between the personal, social, and clinical aspects of the patient's experience that complicates patient care, and these factors go beyond medical severity and comorbidities (Tonelli et al., 2018).

²² Laloo et al. (2021) and Chowdhuri and Kundu (2020) separately proposed a conceptual framework to account for all factors determining choice of care providers and suggested that bio-psychosocial factors and cognitive factors are important factors shaping the choice.

matched and un-matched non-chiropractic-only PM claims. We do not have data to examine chiropractic costs and outcomes for these unmatched claims.

Third, we identified a small percentage of claims with one or more of the seven comorbidities we defined for low back pain receiving PM treatment. It is reasonable to believe that comorbidities are under-identified in workers' compensation data since those comorbid conditions are normally not covered under workers' compensation; and the understatement of comorbidities might be to a larger extent among claims with exclusive chiropractic care than those with care from medical providers. Although the variable "percentage of claims with comorbidities" helped in our analysis, one needs to better understand the extent of the understatement and investigate whether the understatement affected the observed difference between different PM treatment patterns.

Lastly, patient complexity has been measured and used in an increasing number of studies outside workers' compensation, recognizing that the severity factor in the context of medical treatment extends beyond medical severity. One way to measure patient complexity is to use the patient's pre-condition and medical care experience prior to the current episode of care. Unfortunately, we do not observe workers' experience and health status prior to their injuries.

3

PREVALENCE OF CHIROPRACTIC CARE

Outside workers' compensation, chiropractors see a large percentage of patients with LBP, yet in many workers' compensation systems, the percentage of workers with LBP receiving chiropractic care is substantially lower. In this chapter, we describe the prevalence and interstate variation in the use of chiropractic care among workers with LBP and discuss possible reasons for the substantial interstate variation in the use of chiropractic care.

PREVALENCE OF CHIROPRACTIC CARE

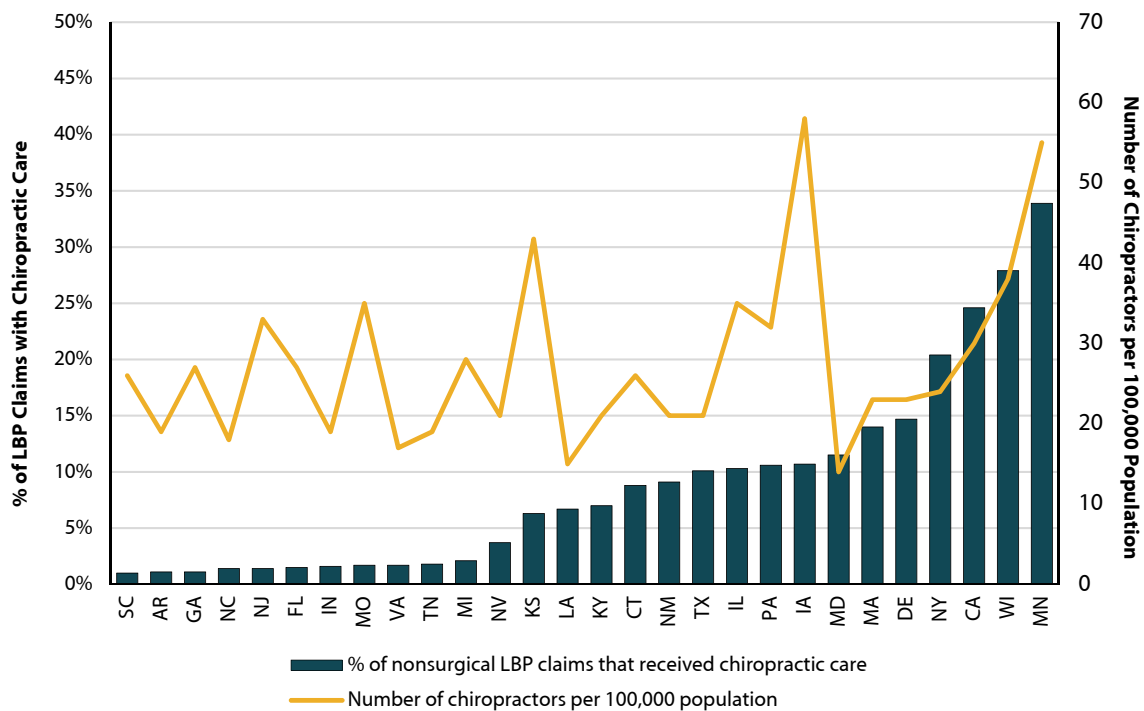
Figure 3.1 shows the prevalence of chiropractic care, measured as the percentage of LBP claims that received chiropractic care in the 18 months after the date of injury, across 28 states. It also shows the availability of chiropractors, measured as the number of chiropractors per 100,000 population based on workers' zip codes.¹

Figure 3.1 shows a substantial variation across states in the percentage of LBP claims that received chiropractic care. In 16 of the 28 states, chiropractic care was prevalent, with the percentage of LBP claims with chiropractic care ranging from 6 percent in Kansas to 34 percent in Minnesota. Chiropractic care was most prevalent in California, Minnesota, New York, and Wisconsin, where at least 20 percent of LBP claims received chiropractic care. In the other 12 states, however, few chiropractors were involved in delivering care—most of these states only had 1–2 percent of LBP claims receiving chiropractic care.

Outside workers' compensation, chiropractors see a large percentage of patients with neck and back pain. For example, Beliveau et al. (2017) reported that the median use of chiropractic care among the studies reviewed was 31 percent for patients with back pain. The use of chiropractic care in general increased over time, and people with spine complaints were more likely to see chiropractors than other PM providers, with the exception of physical therapists (Ndetan et al., 2020). For LBP claims in the 28 workers' compensation systems we studied, only a few states had similar prevalence of chiropractic care in and outside workers' compensation. The prevalence of chiropractic care was considerably lower in many workers' compensation systems than reported outside workers' compensation.

¹ The chiropractor supply data were based on the number of licensed chiropractors from the National Center for the Analysis of Healthcare Data (NCAHD) and population count from the U.S. Census data, which were merged into our study sample by workers' zip codes. See Chapter 2 for more details.

Figure 3.1 Prevalence of Chiropractic Care and Availability of Chiropractors among LBP Claims across 28 Study States



Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. The prevalence of chiropractic care is measured as the percentage of nonsurgical LBP claims that received services by chiropractors. There are 28 states included in the analysis.

The data for chiropractor supply per 100,000 population are based on the number of licensed chiropractors and the U.S. Census data that were merged into our study sample.

Key: LBP: low back pain.

WHY CHIROPRACTIC CARE IS MORE PREVALENT IN SOME STATES AND NOT IN OTHERS?

Why is there such a large interstate variation in the use of chiropractic care? There are several possible reasons, including

- geographic variations in the supply of chiropractors;
- state policies regulating provider choice, as well as other policies (e.g., treatment guidelines, utilization review and preauthorization, fee schedules and reimbursements, and statutory limits on visits to chiropractors and physical therapists);
- organization of health care delivery and market forces;
- patient preference and care-seeking behavior; and
- other environmental and cultural factors.

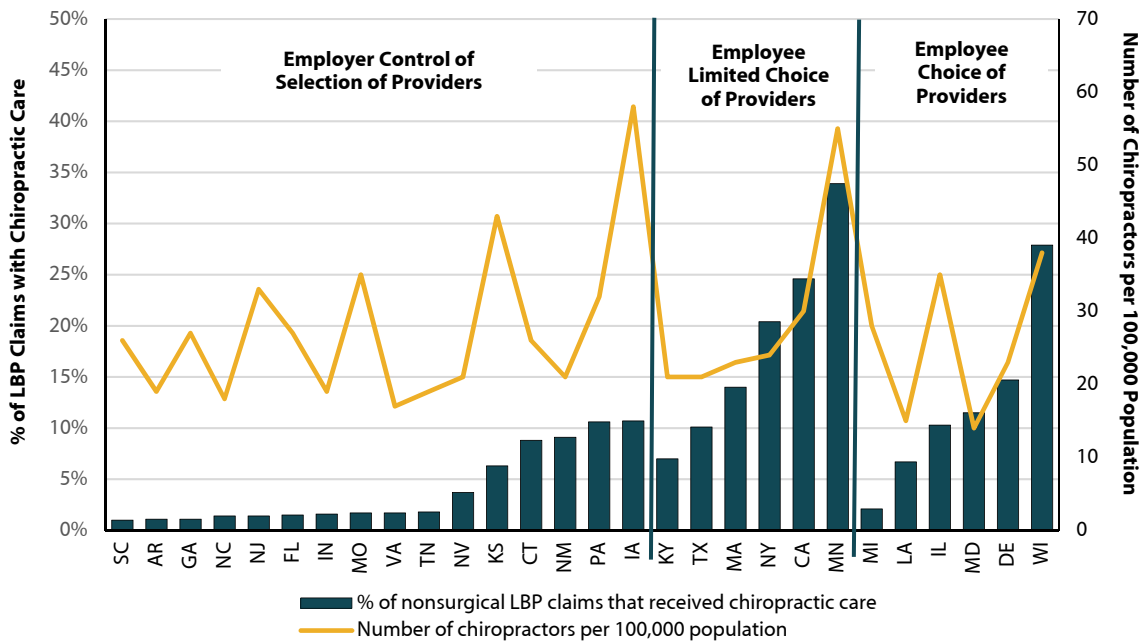
As can be seen in Figure 3.1, the chiropractor supply tends to be correlated with the use of chiropractic care among several states with prevalent chiropractic care, but for most other states, we see little correlation between the two measures. The results are not consistent with what has been reported outside workers' compensation. For example, Whedon and Song (2012) found a large variation in the availability and use of

chiropractic care across states among Medicare beneficiaries with spine-related problems. They also reported a strong correlation between the availability and use (0.86, $p < 0.001$).² We did not find a publication reporting interstate variations in the supply and use of chiropractic care in the general health population.

We also reviewed several workers' compensation policies that may influence the use of chiropractic care, including policies regulating provider choice, reimbursement, and utilization of PM services. Policies, such as stricter utilization review, mandatory preauthorization, limits on the number of visits, and lower amounts of reimbursement, may have a large impact on the utilization of chiropractic and other services in general.³ Based on our analysis, however, we believe that provider choice policies and the general perception of the cost-effectiveness of chiropractic care are the most important factors explaining the large interstate variation in the use of chiropractic care.

Figure 3.2 provides the same data as in Figure 3.1, but it is organized by our grouping of state provider choice policies, which helps explain why we see interstate variation that cannot be explained by the supply of chiropractors. Table 3.1 provides the data underlying Figures 3.2.

Figure 3.2 State Provider Choice Policies and Impact on Use of Chiropractic Care



Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. The prevalence of chiropractic care is measured as the percentage of nonsurgical LBP claims that received services by chiropractors. There are 28 states included in the analysis.

^aThe data for chiropractor supply per 100,000 population are based on the number of licensed chiropractors and the U.S. Census data that were merged into our study sample.

Key: LBP: low back pain.

² In these studies, the chiropractic availability was defined as Medicare servicing chiropractors per 1,000 Medicare Part B beneficiaries. The use of chiropractic care was defined as the number of chiropractic users per 1,000 beneficiaries, where chiropractic users were Medicare beneficiaries with at least one paid service for chiropractic care in 2007.

³ For example, using a single insurer's data in seven states (Florida, Idaho, Illinois, Maryland, New Hampshire, New York, and Pennsylvania), Wasiak and McNeely (2006) found that restrictive payment policies were associated with lower costs of chiropractic care and a lower number of services per visit, but they found no evidence of policy impact on visits and services per person. The study did not address the impact of state policies on the prevalence of chiropractic care.

Table 3.1 Prevalence of Chiropractic Care, Supply of Chiropractors, and Provider Choice Policies

| State | LBP Claims | | Workers' Compensation Policies |
|-------|--|--------------------------------------|---|
| | % of LBP Claims with Chiropractic Care | Number of DCs per 100,000 Population | Characterization of State Provider Choice Policies ^a |
| MN | 34% | 55 | Employee limited choice |
| WI | 28% | 38 | Employee choice |
| CA | 25% | 30 | Employee limited choice |
| NY | 20% | 24 | Employee limited choice |
| DE | 15% | 23 | Employee choice |
| MA | 14% | 23 | Employee limited choice |
| MD | 12% | 14 | Employee choice |
| IA | 11% | 58 | Employer control |
| PA | 11% | 32 | Employer control |
| IL | 10% | 35 | Employee choice |
| TX | 10% | 21 | Employee limited choice |
| NM | 9% | 21 | Employer control |
| CT | 9% | 26 | Employer control |
| KY | 7% | 21 | Employee limited choice |
| LA | 7% | 15 | Employee choice |
| KS | 6% | 43 | Employer control |
| NV | 4% | 21 | Employer control |
| MI | 2% | 28 | Employee limited choice |
| TN | 2% | 19 | Employer control |
| MO | 2% | 35 | Employer control |
| VA | 2% | 17 | Employer control |
| IN | 2% | 19 | Employer control |
| FL | 2% | 27 | Employer control |
| NC | 1% | 18 | Employer control |
| NJ | 1% | 33 | Employer control |
| AR | 1% | 19 | Employer control |
| GA | 1% | 27 | Employer control |
| SC | 1% | 26 | Employer control |

^a See the text below for a description of these categories.

Key: DC: doctor of chiropractic; LBP: low back pain.

Our categorization of provider choice was based on WCRI’s 2018 Medical Cost Containment Inventory (Rothkin and Tanabe, 2018). For the purpose of the analysis, we categorized the states into three groups: employee choice, employee limited choice, and employer control. A state is considered an employee choice state if the injured employees can choose the initial provider without limitation and employers are not allowed to change provider. A state is considered employee limited choice if the employee selects the initial provider without limitation, unless the employer has an approved managed care arrangement (MCA) or managed care organization (MCO), and employer change of provider is not allowed or needs to be approved by the state workers’ compensation agency. The employer control states are those where either the employer controls the

selection of the initial doctor (and the employee can change with the approval of the employer/insurer) or the employee selects a provider from a list or network established by the employer. Note that our categorization of provider choice policies may not be the same as in other WCRI studies, because our analysis is focused on PM treatment, which is typical front-end care.⁴

Figure 3.2 shows that the percentage of LBP claims receiving chiropractic care was only between 1 and 2 percent in 10 of the 16 states with employer control states, and in the other 6 states, the percentage was 4 and 6 percent in Nevada and Kansas, and as high as 9–11 percent in Connecticut, New Mexico, Pennsylvania, and Iowa. By contrast, except for Michigan, all employee choice and employee limited choice states had more than 5 percent of LBP claims receiving chiropractic care. Among the employer control states, we see little correlation between the supply and use of chiropractors. By contrast, in states where workers have the right to choose their own providers, especially those where chiropractic care was prevalent, the availability of chiropractors tends to track the use of chiropractic care closely.⁵ Michigan was an exception; the infrequent involvement of chiropractors in Michigan workers' compensation health care might be related to the scope of practice.

Overall, we found that in most employer control states, few workers with LBP received chiropractic care, even though many chiropractors were available and active in providing care outside workers' compensation. The results may suggest that when employers and insurers were given control of selecting providers, they often did not involve chiropractors in the delivery of care for workers with LBP. The reluctance to using chiropractic care might reflect concerns about the cost-effectiveness of chiropractic care, which may be explained by the historical context discussed in Chapter 1.

Among employee choice or employee limited choice states, chiropractic care was prevalent in general, although there was a large variation in the prevalence of chiropractic care. Among these states, the use of chiropractic care tended to be strongly correlated with the supply of chiropractors. Conceivably, in these states with employee choice and employee limited choice, when workers can choose their own providers, the selection of chiropractic care would be influenced in part by the workers' perception of, preference for, and local access to chiropractic care.⁶

⁴ For example, we grouped Pennsylvania as an employer control state because in Pennsylvania, employers and insurers control the selection of providers for the first 90 days. Pennsylvania was classified as an employee choice state in Neumark and Savych (2017).

⁵ For the states with employee choice or employee limited choice, the correlation between the supply of chiropractors and the use of chiropractic care was 0.8149 ($p=0.0022$).

⁶ Patients' preference and care-seeking behavior reflect their perceptions, knowledge, and experience of chiropractic care, which might be correlated, to some extent, with observed characteristics of the workers and their claims.

4

HOW WERE CHIROPRACTORS INVOLVED IN TREATING LOW BACK PAIN?

Chapter 3 describes the prevalence of chiropractic care for treating work-related LBP across the 28 study states. In 16 of the 28 states, chiropractors were involved in 5–34 percent of medical claims with LBP. In this chapter, we focus on the 16 states with prevalent chiropractic care to describe how chiropractors were involved in delivering care for workers with LBP. We found that chiropractors were involved in providing PM care in many different ways, including three broadly identified categories: chiropractic exclusive PM care, combined PM care, and sequential PM care. Claims with combined and sequential PM care were typically associated with much higher costs and longer TD duration, compared with those with chiropractic exclusive PM care. Note that the results presented in this chapter are aggregate measures across claims based on the medical detailed transaction and payment data we used for the study. These are unadjusted data. Chapter 5 provides the adjusted results from our statistical analysis that controls for various factors that may likely influence the choice of chiropractic care and outcomes.

TYPES OF SERVICES PROVIDED BY CHIROPRACTORS

As expected, when chiropractors were involved in treating workers with LBP, they primarily provided physical medicine services. Chiropractors also provided and billed for E&M services at the beginning of chiropractic treatment and periodically over the duration of chiropractic care.¹ Table 4.1 describes the types of services commonly provided by chiropractors, and Table 4.2 shows the frequency of different types of chiropractic PM services.

¹ Some E&M services provided by chiropractors might not be captured in our data, which is based on the detailed medical transactions for services billed and paid by a workers' compensation payor. Whedon et al. (2017) evaluated the likelihood of insurance reimbursement for complementary health care services in comparison with conventional primary care medical services in New Hampshire. They found that chiropractic services, as part of the complementary health care services, were less likely to be reimbursed. The likelihood of reimbursement for E&M services (e.g., CPT code 99213 for established patient visit) was 77 percent lower than that for primary care physicians (Whedon et al., 2017).

Table 4.1 Common Types of Services Used in Chiropractic Care for Treatment of Low Back Pain

| % of All Chiropractic Services for... | CA | CT | DE | IA | IL | KS | KY | LA | MA | MD | MN | NM | NY | PA | TX | WI | 16-State Median |
|---------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------------|
| Physical medicine | 87.9% | 95.3% | 94.8% | 88.8% | 90.4% | 91.9% | 86.1% | 90.9% | 92.2% | 96.1% | 90.6% | 90.3% | 95.5% | 92.8% | 74.3% | 90.3% | 90.8% |
| Evaluation and management | 7.7% | 3.1% | 2.7% | 7.8% | 5.8% | 5.0% | 10.7% | 5.6% | 6.4% | 2.6% | 3.6% | 6.3% | 2.9% | 4.8% | 5.2% | 6.2% | 5.4% |
| Medical-legal services | 3.0% | 0.1% | 0.3% | – | 0.1% | – | – | 0.0% | 0.0% | – | 0.0% | 0.1% | 0.1% | 0.0% | 17.1% | 0.0% | 0.1% |
| X rays | 0.3% | 0.5% | 0.2% | 2.9% | 1.1% | 2.8% | 1.7% | 2.4% | 0.4% | 0.3% | 0.7% | 0.9% | 0.5% | 0.3% | 0.9% | 1.2% | 0.8% |
| Supplies and equipment | 0.4% | 0.1% | 1.0% | 0.5% | 1.0% | 0.1% | 0.5% | 0.4% | 0.7% | 0.4% | 0.2% | 0.2% | 0.2% | 0.6% | 0.7% | 0.7% | 0.5% |
| Neurological/neuromuscular testing | 0.2% | 0.2% | 0.0% | – | 0.2% | – | 0.1% | – | 0.0% | 0.0% | 0.0% | 0.1% | 0.7% | 0.1% | 0.5% | 0.1% | 0.1% |
| Other services | 0.5% | 0.7% | 1.0% | 0.1% | 1.4% | 0.3% | 0.8% | 0.7% | 0.2% | 0.5% | 0.9% | 0.2% | 0.1% | 1.4% | 1.2% | 1.4% | 0.7% |

Notes: Included are the chiropractic services billed and paid under workers' compensation during the initial 18 months of treatment for nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

Key: –: not seen in the data; LBP: low back pain.

Table 4.2 Frequency of Chiropractic Physical Medicine Services, by Type

| Type of Services ^a | CA | CT | DE | IA | IL | KS | KY | LA | MA | MD | MN | NM | NY | PA | TX | WI | 16-State Median |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----------------|
| Chiropractic manipulation treatment (CMT) | 26% | 33% | 31% | 60% | 25% | 52% | 38% | 26% | 41% | 24% | 41% | 34% | 45% | 28% | 19% | 48% | 34% |
| Manual therapy | 8% | 7% | 5% | 2% | 11% | 2% | 6% | 3% | 5% | 7% | 3% | 9% | 2% | 7% | 12% | 4% | 6% |
| Other physical modalities | 29% | 49% | 49% | 29% | 36% | 42% | 45% | 56% | 40% | 46% | 45% | 47% | 37% | 41% | 18% | 36% | 42% |
| Active therapy services | 37% | 10% | 15% | 9% | 28% | 4% | 11% | 15% | 14% | 22% | 11% | 9% | 11% | 23% | 47% | 11% | 12% |
| Other physical medicine services | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 1% | 4% | 0% | 5% | 0% | 0% |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

^a Listed are the common types of physical medicine services billed by chiropractors and paid under workers' compensation. See Technical Appendix A for definitions.

Key: LBP: low back pain.

Table 4.1 shows that more than 90 percent of all services provided by chiropractors (i.e., all service lines with a specific CPT code that were billed by chiropractors and paid by a workers' compensation payor) were PM services in 12 of the 16 states. The percentage was slightly lower in California (88 percent), Iowa (89 percent), and Kentucky (86 percent) and the lowest in Texas (74 percent). In Texas, 17 percent of the chiropractic services were for medical-legal services, including special reports above and beyond the information documented for E&M services (CPT-4 code 99080) as well as work-related or medical disability evaluation services (CPT-4 code 99455).²

Among the different types of PM services, chiropractors mostly performed chiropractic manipulations (i.e., the CMT codes 98940–98943), manual therapy (97140), and other physical modalities (Table 4.2).³ The frequency of active therapy services⁴ among services provided by chiropractors was low across the states, with California and Texas at the higher end (37 and 47 percent, respectively). We should note that the use of active therapy services might have been understated to the extent that some chiropractors were not reimbursed for services they provided, due to state-specific fee schedule and reimbursement rules for chiropractic services.⁵ Note that 4–5 percent of chiropractic PM services were in the category designated as “other.”⁶

Evaluation and management services accounted for 2.6–10.7 percent of all chiropractic services, depending on the state. Typically, a chiropractor evaluates the patient prior to chiropractic treatment by taking the patient's medical history and examining the patient to evaluate their range of motion, muscle strength, and neurological integrity. The chiropractor will review and/or obtain needed diagnostic studies.⁷ Once chiropractic treatment starts, the chiropractor will periodically perform E&M services to assess functional improvement and adjust the treatment plan based on the patient's progress or lack thereof. When chiropractors perform these services, they typically bill for new patient office visits and established patient office visits using the standard CPT-4 codes for E&M services. However, the frequency of E&M services captured in our data might understate the true frequency of such services for two reasons. Some chiropractors may not bill for E&M services when they provide such services in conjunction with chiropractic manipulation as they may have concerns regarding obtaining reimbursement for the services. Whedon et al. (2017) reported that for any E&M services (e.g., CPT code 99213), the likelihood of reimbursement was 77 percent lower for chiropractors when compared with the same services by primary care physicians. We did not systematically analyze state reimbursement policies, but we expect that state policies may be different and payors may also have different rules for the reimbursement of E&M services provided and billed by chiropractors.

² In Texas, there are a fair number of Directed Doctor Exams (DDEs) performed by chiropractors. Technically, these are forensic examinations assigned by the state, which is outside workers' compensation treatment. In the other states, we saw little or no medical-legal services provided by chiropractors, except in California where 3 percent of all chiropractic services fell into this category, mostly for primary treating physician's progress reports (Form PR-2, California specific code WC002).

³ Manual therapy is a hands-on therapy including joint or soft-tissue mobilization and manipulation, connective tissue massage, and manual tractions. Chiropractic manipulative treatment (CMT) includes manipulation and adjustment exclusively done by chiropractors. Physical modalities, also referred to as passive physical therapies, include hot and cold packs, soft-tissue massage, traction, acupuncture, etc.

⁴ Active therapies require the patient's participation, including therapeutic exercises and related education and training, active counseling, and work hardening. Active therapies aim at facilitating speedy functional recovery.

⁵ It would be difficult to know how many chiropractors provided exercises and activities for their patients, which would be similar to supervised active therapy, because there is no coded marker for such services, and in some state systems, chiropractors may not be reimbursed for active therapy codes.

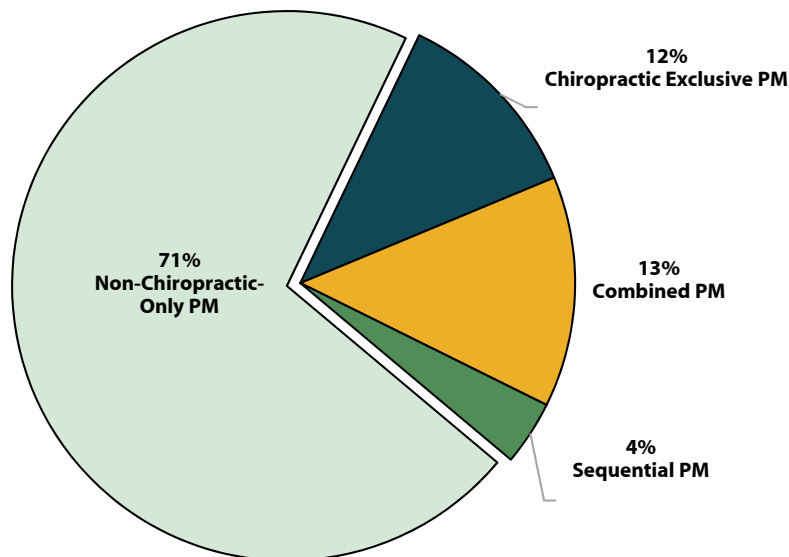
⁶ The underlying data show that in New York, most other services were for physical medicine and rehabilitation procedures (CPT-4 code 97139), and in Texas, the other services were split between physical performance test/measurement (CPT-4 code 97750) and other physical medicine and rehabilitation services (CPT-4 code 97799).

⁷ More detailed information is available at <https://www.spine-health.com>.

PROVIDER PATTERNS OF PHYSICAL MEDICINE CARE

Since chiropractic services are highly concentrated on physical medicine care, we first focused on identifying common provider patterns of PM treatment. Figure 4.1 describes common patterns we observed in our data at a higher level as to how often workers with LBP received PM care by chiropractors only, by non-chiropractors only, and by both chiropractors and non-chiropractors.

Figure 4.1 Claim Distribution across Provider Patterns of Physical Medicine Care



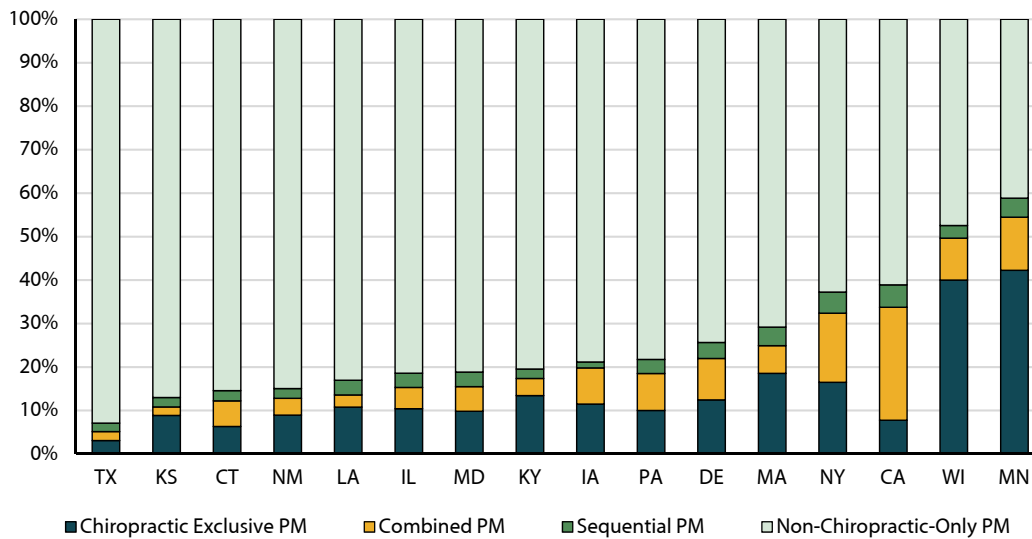
Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

Key: LBP: low back pain; PM: physical medicine.

Overall, using the pooled data of 16 states, chiropractors were involved in 29 percent of LBP claims receiving PM care (referred to as chiropractic PM). The other 71 percent of LBP claims with PM received PM treatment from non-chiropractors only (referred to as non-chiropractic-only PM).⁸ When chiropractors are involved in PM care, they may provide PM treatment as a sole provider (chiropractic exclusive PM), or provide PM services in conjunction with other non-chiropractic PM providers (combined PM), or treat patients as a sole PM provider before or after another PM provider was involved (sequential PM). Figure 4.1 shows that of 29 percent of LBP claims, 12 percent received chiropractic exclusive PM, 13 percent had chiropractors involved in combined care, and 4 percent received PM treatment in a sequential manner by chiropractic and non-chiropractic providers. Figure 4.2 describes how the claim distribution of different provider patterns varied by state.

⁸ The non-chiropractic providers for PM treatment were mostly physical therapists. In a small number of claims, osteopathic doctors and other providers (physician assistants and nurse practitioners) were involved as providers for PM services.

Figure 4.2 Claim Distribution of Physical Medicine Provider Patterns by State



Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

Key: LBP: low back pain; PM: physical medicine.

We see a large interstate variation in the percentage of LBP claims with PM that received chiropractic versus non-chiropractic PM care. The percentage of LBP claims with PM care that received the treatment from chiropractors ranged from 7 percent in Texas to 59 percent in Minnesota (Figure 4.2). Among claims with chiropractic PM care, the proportion of cases with chiropractic-only PM varied substantially across the states. In Minnesota and Wisconsin, when chiropractors were involved in PM care, they mostly provided care as a sole provider. In these two states, two-thirds of the chiropractic PM cases received PM treatment exclusively by chiropractors. In California, by contrast, when chiropractors were involved in PM care, they were more likely to provide care in conjunction with other non-chiropractic PM providers. The results may suggest different levels of integration of chiropractic care into occupational medicine practices (discussed below).

Table 4.3 describes utilization patterns of PM services for each of the four provider patterns of PM care. It also describes provider patterns of E&M services, which indicate what type of providers were likely to manage overall patient care.

Table 4.3 shows that claims with combined and sequential PM care had a much higher number of PM visits. The average number of PM visits was 18.5 for the combined PM group and 20.4 for the sequential group, compared with 11.4 for those with chiropractic exclusive PM and 9.4 for the non-chiropractic-only PM group. Several states had caps for the number of chiropractic visits. For example, California capped chiropractic visits at 24, and in Louisiana, which has the most generous cap among the states with a cap, it is recommended that the number of visits not exceed 28. We set the threshold at 28 visits to indicate claims that might have higher use of PM services than the LBP conditions necessitate. For the combined and sequential PM groups, 1 in 5 workers with LBP had more than 28 PM visits. The patterns of active therapy versus physical modalities also differed—almost all LBP claims involving chiropractors in care had chiropractic manipulation or manual therapy, compared with 66 percent for the non-chiropractic-only PM group. The use of active therapies was similar for the three provider patterns involving non-chiropractic PM providers (i.e., the combined PM,

sequential PM, and non-chiropractic-only PM groups)—91–96 percent of the claims received active therapies. Only 52 percent of the claims with chiropractic exclusive PM had active therapy services. It is difficult to know exactly how often chiropractors provided exercises and activities for their patients based on the transaction data, for reasons stated above.

Table 4.3 Utilization Patterns of Physical Medicine Services

| Measure | Claims with PM Involving Chiropractors | | | Claims with Non-Chiropractic-Only PM ^d |
|--|--|--------------------------|----------------------------|---|
| | Chiropractic Exclusive PM ^a | Combined PM ^b | Sequential PM ^c | |
| Number of LBP claims | 9,152 | 10,702 | 2,986 | 55,946 |
| Patterns of PM care | | | | |
| PM visits per claim, mean | 11.4 | 18.5 | 20.4 | 9.4 |
| PM visits per claim, median | 7 | 13 | 16 | 6 |
| % of claims with > 28 PM visits | 7% | 21% | 21% | 5% |
| % received active therapy services | 52% | 91% | 95% | 96% |
| % received chiropractic manipulation or manual therapy | 98% | 99% | 97% | 66% |
| % direct PM | 15% | 5% | 8% | 5% |
| % SBE for E&M visit(s) and first PM visit | 79% | 70% | 62% | 39% |
| % involving multiple billing entities for PM care | 3% | 38% | 35% | 9% |
| E&M provider patterns | | | | |
| E&M services all by chiropractors | 41% | 3% | 2% | 0% |
| E&M services all by non-chiropractors | 8% | 67% | 25% | 97% |
| E&M services by both chiropractors and non-chiropractors | 42% | 29% | 72% | 1% |
| No E&M services paid | 9% | 1% | 1% | 2% |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Presented are data pooled from 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

^a Claims with PM services provided only by chiropractors.

^b Claims with PM services provided by chiropractors in conjunction with other non-chiropractic PM providers.

^c Claims with PM services provided by chiropractors and non-chiropractors in a sequential manner.

^d Claims with PM services provided only by non-chiropractic PM providers. Most of the non-chiropractic PM providers are physical therapists in our data, but there is a small percentage of non-chiropractors who are medical or osteopathic doctors or nurse practitioners.

Key: E&M: evaluation and management; LBP: low back pain; PM: physical medicine; SBE: same billing entity (i.e., same tax ID for billing the services).

It is not surprising that most claims with chiropractic care had chiropractic manipulation or manual therapy since mobilization and manipulation are the hallmarks of chiropractic care. Although recent clinical practice guidelines recommend the use of multimodel therapy (i.e., a combined approach of patient education, manipulation/mobilization, and supervised exercises),⁹ we saw that nearly half of the claims with chiropractic

⁹ Multimodel chiropractic services include patient education, spinal manipulative therapy and mobilization, soft-tissue therapy, mechanically-assisted manual therapy, nutrition supplements, instructions for home exercises, and physical medicine modalities (e.g., ice, heat, mobilization/manual traction, orthopedic supports, electric simulation, therapeutic ultrasound, and acupuncture). See Beliveau et al. (2017).

care did not have active therapy services. The most common treatments provided by chiropractors were reported to be spinal manipulation, soft-tissue therapy, and patient education (Beliveau et al., 2017).¹⁰ The lack of active therapy services might be due to several factors, including chiropractor practice patterns, coding, and reimbursement policies and practices.

We also observed that the majority of claims with combined PM care received PM services by both chiropractors and non-chiropractors who were affiliated with the same billing entity (i.e., the same health care organization billing for services). This suggests that the PM care was likely delivered in an integrated, cross-disciplinary setting.

PROVIDER PATTERNS OF EVALUATION AND MANAGEMENT SERVICES

Table 4.3 also shows how often chiropractors served as a sole provider for all E&M services when they were involved in care. When LBP workers received PM treatment only by chiropractors, half of them had E&M services provided by non-chiropractors (e.g., medical doctors, nurse practitioners, or physician assistants). In most of these cases, E&M services were also billed for and paid to chiropractors. As Table 4.3 shows, 42 percent had E&M services by both chiropractors and non-chiropractors and 8 percent had E&M services by non-chiropractors only. Forty-one percent of cases had all E&M services only by chiropractors and 9 percent of cases had no E&M services paid. For the 9 percent of cases without E&M services, it is conceivable that for these cases, chiropractors provided E&M services and chiropractic manipulation during a visit but were not paid for the E&M services provided.¹¹ Because of this, it is most likely that the chiropractic exclusive PM claims are split half and half into two subgroups:

- LBP claims that received all PM and E&M services by chiropractors (referred to as *chiropractic-only PM/EM* or *exclusive chiropractic care*)
- LBP claims that received PM treatments by chiropractors only, but medical providers were involved in providing E&M services (referred to as *chiropractic-only PM*). Most of these cases also received E&M services by chiropractors, most likely for evaluation and managing PM treatment.

The statistical appendix provides a set of tables that describe the same variables by state for the readers who are interested in PM patterns in their own state. For example, the use of chiropractic care in Texas was lower than that in most states included in the analysis. In Texas and New York, there were a number of claims within chiropractic PM care that did not have E&M services, which might be due to company policies regarding reimbursement of E&M services billed by chiropractors.

PHYSICAL MEDICINE TREATMENT GROUPS, PATTERNS AND OUTCOMES — DESCRIPTIVE DATA

As mentioned above, we divided the chiropractic exclusive PM cases into two subgroups—those that received all PM and E&M services by chiropractors (i.e., chiropractic-only PM/EM or exclusive chiropractic care) and

¹⁰ Beliveau et al. (2017) reviewed the utilization rate of chiropractic services across 245 studies and found that the median rate of use was 79 percent for spinal manipulation, 35 percent for soft-tissue therapy, and 31 percent for patient education.

¹¹ More discussion can be found in the first section of this chapter.

those that received PM treatment only by chiropractors but also saw medical providers for E&M services (chiropractic-only PM). For the combined PM group, we also identified claims that had most PM services provided by both chiropractors and non-chiropractors who were affiliated with the same-billing-entity health care organization.¹² Table 4.4 shows the PM treatment groups after considering E&M providers and same-billing-entity combined PM care.

Table 4.4 Claim Distribution across Treatment Groups

| Measure | Chiropractic Exclusive PM | | Combined PM | | | Sequential PM | Non-Chiropractic-Only PM ^c |
|---|--------------------------------------|-----------------------------------|----------------------------|--------------------------------|------------------|---------------|---------------------------------------|
| | Chiropractic-Only PM/EM ^a | Chiropractic-Only PM ^b | Combined SBE, Same 1st Day | Combined SBE, Not Same 1st Day | Combined Not SBE | | |
| Number of claims — all 16 states | 4,569 | 4,583 | 4,955 | 3,458 | 2,289 | 2,986 | 55,616 |
| % of claims | 5.8% | 5.8% | 6.3% | 4.4% | 2.9% | 3.8% | 71% |
| Claim distribution across PM/EM groups, by state | | | | | | | |
| CA | 1% | 7% | 15% | 8% | 3% | 5% | 61% |
| CT | 3% | 3% | 2% | 2% | 2% | 2% | 85% |
| DE | 4% | 9% | 1% | 3% | 6% | 4% | 74% |
| IA | 9% | 2% | 6% | 1% | 1% | 1% | 79% |
| IL | 7% | 4% | 1% | 2% | 2% | 3% | 81% |
| KS | 6% | 3% | 1% | 0% | 1% | 2% | 87% |
| KY | 10% | 4% | 1% | 1% | 2% | 2% | 80% |
| LA | 6% | 5% | 0% | 2% | 1% | 3% | 83% |
| MA | 10% | 9% | 1% | 1% | 4% | 4% | 71% |
| MD | 4% | 6% | 1% | 3% | 2% | 3% | 81% |
| MN | 31% | 11% | 4% | 5% | 4% | 4% | 41% |
| NM | 5% | 4% | 1% | 1% | 2% | 2% | 85% |
| NY | 10% | 7% | 3% | 5% | 8% | 5% | 63% |
| PA | 5% | 5% | 2% | 3% | 4% | 3% | 78% |
| TX | 1% | 2% | 0% | 1% | 1% | 2% | 93% |
| WI | 29% | 11% | 3% | 3% | 3% | 3% | 47% |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

^a The chiropractic-only PM/EM group includes LBP claims that received PM treatment only by chiropractors and all the E&M services were also provided by and paid for to chiropractors. In the report, this group is often referred to as exclusive chiropractic care.

^b The chiropractic-only PM group includes LBP claims that received PM treatment only by chiropractors. Workers in this group received E&M services by non-chiropractic providers (e.g., medical and osteopathic doctors, nurse practitioners, and physician assistants) and, in most cases, chiropractors also provided and were paid for E&M services.

^c The non-chiropractic-only PM group includes LBP claims that received PM treatment only by non-chiropractic PM providers, and the patients were also managed by non-chiropractic medical providers. Chiropractors were not involved in the treatments.

Key: E&M: evaluation and management; LBP: low back pain; PM: physical medicine; SBE: same billing entity (for pre-PM office visits and initial PM service).

¹² Ideally, one could identify health care organizations that have physicians, physical therapists, and chiropractors as well as other providers to form multidisciplinary teams to deliver patient-centered care. Unfortunately, we do not have the data needed to identify multidisciplinary PM care centers/clinics consistently across different data sources. We were able to identify billing entities (i.e., encrypted unique tax IDs) where both chiropractors and non-chiropractors provided PM services for the same patient. Specifically, we identified claims in the combined PM group that received most PM services by chiropractors and non-chiropractors who were affiliated with the same billing entity (referred to as same-billing-entity combined PM care).

Table 4.4 shows that among the LBP claims with combined PM care, nearly 4 in 5 received PM services by both chiropractors and non-chiropractors who were affiliated with the same billing entity; and nearly half of them had both chiropractors and non-chiropractors providing PM services on the same day of first PM.

Table 4.4 also shows very different patterns across the 16 states. In Minnesota and Wisconsin, most LBP claims with PM care received PM care by chiropractors, and when chiropractors were involved, they most often provided care as a sole provider managing the treatment of patients—29–31 percent of claims with PM had exclusive care by chiropractors for E&M services and PM treatment.

By contrast, far fewer LBP claims with PM care received exclusive chiropractic care in California. Seven percent of LBP claims in the state received chiropractic-only PM care, with non-chiropractic providers being involved for patient overall management; and only 1 percent of LBP claims with PM received exclusive chiropractic care, where chiropractors were the only providers for PM and E&M services (Table 4.4).

Note that with the data we currently have, we were not able to systematically capture the level of integration in the health care delivery system, but we were able to identify claims with PM services by chiropractors and non-chiropractors who were affiliated with the same billing entity. Table 4.4 shows that in California, 15 percent of LBP claims with PM had combined PM care where the combined PM care was initiated by both chiropractic and non-chiropractic PM providers who were affiliated with the same billing entities. The data suggest that California might be at the forefront of cross-disciplinary PM care.¹³

Table 4.5 provides descriptive data on the utilization of medical services, medical and indemnity costs, and TD duration for LBP claims in the two chiropractic exclusive PM care groups (i.e., chiropractic-only PM/EM and chiropractic-only PM) and in the non-chiropractic-only PM group. Table 4.6 describes worker and injury characteristics as well as several environmental factors for the same groups.

Table 4.5 shows that the overall medical costs per claim were lower for the two chiropractic exclusive PM groups, compared with claims with non-chiropractic-only PM.¹⁴ The average medical cost per claim was \$1,366 per claim for chiropractic-only PM/EM (i.e., chiropractors were the only provider for PM and E&M services), 61 percent lower than for the non-chiropractic-only PM group. The average payment per claim for PM services was also lower for the chiropractic-only PM/EM group than the non-chiropractic-only PM group, but to a lesser extent, because claims with chiropractic-only PM/EM were less likely to have other medical services, such as opioid prescriptions, MRI, and pain management injections.¹⁵ The utilization and medical costs were also lower for the chiropractic-only PM group, for which medical providers were also involved in E&M services, but the differences were smaller.

The chiropractic-only PM/EM group also had the lowest indemnity costs per claim, at \$492 per medical claim, and the shortest TD duration, at 0.7 weeks per claim (Table 4.5), because fewer workers in the chiropractic-only PM/EM group experienced lost time. When we looked at subsets of claims (LBP only versus neuro back, and seven days of lost time), the differences were similar.

¹³ In some cases, the same billing entity may also capture entities that were linked only for financial reasons.

¹⁴ The data presented in this chapter are based on the 16-state pooled sample. One may be concerned that the results of the 16-state pooled sample may predominantly reflect the experience of the large states. We ran the same set of measures weighted by the state-equal weights so that the descriptive results are equally influenced by the experience of each state. The pooled sample and the state-equal weighted data were largely consistent.

¹⁵ Our data show that fewer claims with exclusive chiropractic care (i.e., chiropractic-only PM/EM) received X rays than those in the non-chiropractic-only PM group. However, the use of X rays appeared to be higher for claims with chiropractic exclusive physical medicine care that also involved medical providers for E&M services, compared with the non-chiropractic-only PM group.

Table 4.5 Descriptive Data: Outcomes for Claims Receiving Chiropractic Exclusive PM Care and Non-Chiropractic PM Care

| Measure | Descriptive Data | | | % (point) above/below Non-Chiropractic-Only PM | |
|---------------------------------------|--------------------------------------|-----------------------------------|---------------------------------------|--|----------------------|
| | Chiropractic-Only PM/EM ^a | Chiropractic-Only PM ^b | Non-Chiropractic-Only PM ^c | Chiropractic-Only PM/EM | Chiropractic-Only PM |
| Number of claims | 4,569 | 4,583 | 55,616 | | |
| Costs and outcomes | | | | | |
| Medical costs | \$1,366 | \$3,001 | \$3,522 | -61% | -15% |
| Indemnity payments | \$492 | \$2,502 | \$3,604 | -86% | -31% |
| Weeks of temporary disability | 0.7 | 3.0 | 4.9 | -86% | -38% |
| Payments for PM services | \$1,001 | \$1,126 | \$1,356 | -26% | -17% |
| Payments for non-PM medical services | \$365 | \$1,875 | \$2,166 | -83% | -13% |
| % received opioid prescriptions | 0.8% | 11% | 17% | -16 | -6 |
| % received MRI | 3.0% | 17% | 25% | -22 | -8 |
| % received pain management injections | 0.2% | 6% | 9% | -9 | -4 |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

^a The chiropractic-only PM/EM group includes LBP claims that received PM treatment only by chiropractors and all the E&M services were also provided by and paid for to chiropractors. In the report, this group is often referred to as exclusive chiropractic care.

^b The chiropractic-only PM group includes LBP claims that received PM treatment only by chiropractors. Workers in this group received E&M services by non-chiropractic providers (e.g., medical and osteopathic doctors, nurse practitioners, and physician assistants) and, in most cases, chiropractors also provided and were paid for E&M services.

^c The non-chiropractic-only PM group includes LBP claims that received PM treatment only by non-chiropractic PM providers, and the patients were also managed by non-chiropractic medical providers. Chiropractors were not involved in the treatments.

Key: E&M: evaluation and management; LBP: low back pain; MRI: magnetic resonance imaging; PM: physical medicine.

Table 4.6 suggests that workers who received exclusive chiropractic care (i.e., chiropractic-only PM/EM) tended to be slightly older female workers, with slightly higher wages and longer tenure with their preinjury employers. Proportionally more workers had clerical and professional jobs or worked in a low-risk industry. They were less likely to involve attorneys. Proportionally more workers with exclusive chiropractic care lived in rural areas and in areas where there was a lower unemployment rate, compared with those with chiropractic care and a medical provider providing E&M services (i.e., chiropractic-only PM).¹⁶

¹⁶ This observation is consistent with Chevan and Riddle (2011).

Table 4.6 Characteristics of Claims and Environmental Factors: Chiropractic Exclusive PM Care versus Non-Chiropractic-Only PM Care

| Measure | Descriptive Data | | | % (point) above/below Non-Chiropractic-Only PM | |
|--|--------------------------------------|-----------------------------------|---------------------------------------|--|----------------------|
| | Chiropractic-Only PM/EM ^a | Chiropractic-Only PM ^b | Non-Chiropractic-Only PM ^c | Chiropractic-Only PM/EM | Chiropractic-Only PM |
| Number of claims | 4,569 | 4,583 | 55,616 | | |
| Severity and comorbidity | | | | | |
| % with nerve involvement | 18% | 23% | 25% | -7 | -1 |
| % with more than 7 days of lost time | 14% | 30% | 35% | -21 | -5 |
| % had at least one comorbidity | 0.6% | 3.0% | 4.5% | -4 | -1 |
| % had 2+ comorbidities | 0.3% | 0.9% | 1.2% | -1 | 0 |
| Worker characteristics | | | | | |
| Age | 44 | 41 | 41 | 6% | -1% |
| % female | 46% | 35% | 39% | 7 | -4 |
| % married | 28% | 23% | 27% | 2 | -4 |
| Average weekly wage | \$755 | \$745 | \$739 | 2% | 1% |
| Average tenure in years | 8.2 | 5.7 | 6.1 | 35% | -6% |
| Attorney involvement | | | | | |
| % with attorney involvement | 3% | 9% | 8% | -5 | 1 |
| % with claimant attorney | 4% | 11% | 10% | -7 | 1 |
| % with defense attorney | 3% | 9% | 8% | -5 | 1 |
| Industry grouping | | | | | |
| Manufacturing | 15% | 17% | 14% | 1 | 3 |
| Construction | 6% | 10% | 7% | -1 | 2 |
| Clerical and professional | 13% | 8% | 7% | 7 | 1 |
| High-risk industry | 22% | 25% | 29% | -7 | -5 |
| Trade | 19% | 19% | 21% | -2 | -2 |
| Low-risk industry | 19% | 15% | 14% | 5 | 1 |
| Other | 4% | 6% | 7% | -3 | -1 |
| Missing data | 0% | 0% | 0% | 0 | 0 |
| Environmental factors | | | | | |
| Living in rural area | 18% | 6% | 3% | 14 | 3 |
| Number of physical therapists per 100,000 population | 65 | 57 | 56 | 17% | 2% |
| Number of chiropractors per 100,000 population | 39 | 32 | 28 | 41% | 13% |
| Median household income | \$61,153 | \$63,602 | \$61,330 | 0% | 4% |
| % below federal poverty level | 5% | 6% | 7% | -1 | 0 |
| % without health insurance | 6% | 8% | 10% | -4 | -2 |
| Unemployment rate | 4.5 | 5.0 | 5.0 | -10% | 0% |
| % with physical activity | 78% | 78% | 77% | 0 | 1 |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

^a The chiropractic-only PM/EM group includes LBP claims that received PM treatment only by chiropractors and all the E&M services were also provided by and paid for to chiropractors. In the report, this group is often referred to as exclusive chiropractic care.

^b The chiropractic-only PM group includes LBP claims that received PM treatment only by chiropractors. Workers in this group received E&M services by non-chiropractic providers (e.g., medical and osteopathic doctors, nurse practitioners, and physician assistants) and, in most cases, chiropractors also provided and were paid for E&M services.

^c The non-chiropractic-only PM group includes LBP claims that received PM treatment only by non-chiropractic PM providers, and the patients were also managed by non-chiropractic medical providers. Chiropractors were not involved in the treatments.

Key: EM: evaluation and management; LBP: low back pain; PM: physical medicine.

Claims with combined or sequential PM care involving chiropractors were likely to be more complex and had much higher costs and longer TD duration. Table 4.7 illustrates what we observed for these groups of cases. We also include outcomes for the non-chiropractic-only PM group for reference.

Table 4.7 Descriptive Data: Outcomes for Claims with Combined or Sequential PM Care

| Measure | Descriptive Data | | | | |
|---------------------------------------|--------------------------------|--------------------------------|----------------------------------|----------------------------|---------------------------------------|
| | Combined PM SBE-1 ^a | Combined PM SBE-2 ^a | Combined PM ^b Non-SBE | Sequential PM ^c | Non-Chiropractic-Only PM ^d |
| Number of claims | 4,955 | 3,458 | 2,289 | 2,986 | 55,616 |
| % of claims | 6.3% | 4.4% | 2.9% | 3.8% | 70.9% |
| Costs and outcomes | | | | | |
| Medical costs | \$3,499 | \$7,519 | \$9,877 | \$7,395 | \$3,522 |
| Indemnity payments | \$2,867 | \$9,001 | \$12,434 | \$8,637 | \$3,604 |
| Weeks of temporary disability | 3.9 | 11.6 | 16.0 | 11.2 | 4.9 |
| Payments for PM services | \$1,143 | \$2,683 | \$3,976 | \$2,487 | \$1,356 |
| Payments for non-PM medical services | \$2,356 | \$4,836 | \$5,899 | \$4,909 | \$2,166 |
| % received opioid prescriptions | 10% | 21% | 26% | 26% | 17% |
| % received MRI | 23% | 53% | 60% | 56% | 25% |
| % received pain management injections | 8% | 21% | 31% | 23% | 9% |
| Severity and comorbidity | | | | | |
| % with surgery | 0% | 0% | 0% | 0% | 0% |
| % with nerve involvement | 21% | 40% | 50% | 45% | 25% |
| % with more than 7 days of lost time | 28% | 51% | 61% | 53% | 35% |
| % had at least one comorbidity | 2.6% | 6.4% | 10.1% | 7.4% | 4.5% |
| % had 2+ comorbidities | 0.4% | 1.6% | 1.9% | 2.1% | 1.2% |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

^a Included in this group are the LBP claims that had combined PM care by both chiropractors and non-chiropractors, and most or all PM services were provided by chiropractors and non-chiropractors who were affiliated with the same tax ID (referred to as same-billing-entity PM providers). The subgroup SBE-1 had chiropractors and non-chiropractors providing PM services on day one, and the SBE-2 subgroup had chiropractors and non-chiropractors starting on different dates.

^b Claims in the combined PM non-SBE group are those that received PM services by chiropractors and non-chiropractors who were affiliated with different billing entities or different health care organizations (i.e., different tax ID).

^c Claims in the sequential PM group had PM services by chiropractors and non-chiropractors, but there is no overlapping period between chiropractic care and non-chiropractic PM care.

^d The non-chiropractic-only PM group includes LBP claims that received PM treatment only by non-chiropractic PM providers, and the patients were also managed by non-chiropractic medical providers. Chiropractors were not involved in the treatments.

Key: LBP: low back pain; MRI: magnetic resonance imaging; PM: physical medicine; SBE: same billing entity (for pre-PM office visits and initial PM).

In general, claims with combined and sequential PM care tended to have more diagnoses, more therapeutic interventions, and more health care related costs. They might have had more serious LBP and been more complex than claims that received exclusive PM care by chiropractors or by non-chiropractors. Unfortunately, we do not have data to capture some of these characteristics. However, among LBP claims with combined care,

there is a subgroup of cases that received PM care in a so-called cross-disciplinary setting.¹⁷ Table 4.7 shows that when PM was provided in a cross-disciplinary setting (i.e., combined PM SBE-1 in the table), the average medical cost per claim was \$3,499, similar to that for the non-chiropractic-only PM group. Indemnity payments and TD duration were 20 percent lower than for the non-chiropractic-only PM group. The integrated combined PM group also had fewer cases receiving opioids and pain management injections. Ideally, we would take this group of cases and compare it with the non-chiropractic-only PM group or the other claims with combined PM care but not within the same billing entity. However, more data are needed to better understand how different providers in the same organization were involved in care and how PM services were coordinated among different providers.

¹⁷ We identified a subgroup of claims with combined PM care that received PM treatment from both chiropractors and non-chiropractors who were affiliated with the same billing entity and who provided PM services on the first date of PM care.

5

CHIROPRACTIC PHYSICAL MEDICINE CARE AND WORKERS' COMPENSATION OUTCOMES— A STATISTICAL ANALYSIS

One of the research questions for this study is, How do the costs and TD duration compare between LBP workers who received PM treatment exclusively from chiropractors and those who received non-chiropractic PM treatment? This chapter provides results from our statistical analysis that compared the costs and outcomes between claims with PM treatment by chiropractors only and those with non-chiropractic-only PM.¹

Since chiropractors can provide care as a treating physician and chiropractic manipulation services are less likely to be referred by a medical doctor,² whether a worker with LBP receives chiropractic versus non-chiropractic care is likely to be influenced by several factors. These include, but are not limited to, the severity of LBP conditions, patients' preference and care-seeking behavior,³ state policies that may directly or indirectly impact the utilization of chiropractic care, the availability of chiropractors, payor practices, and the organization of health care providers. This selection of chiropractors likely results in a different composition of cases in the chiropractic-only PM and non-chiropractic-only PM groups.

To maximize the comparability of the results on costs and outcomes between these two groups of claims, we constructed comparison groups of non-chiropractic-only PM claims that have similar characteristics to those with chiropractic PM care, using the propensity score matching approach.⁴ As a result, we have two corresponding subsets of non-chiropractic-only PM claims that, as predicted by the observable characteristics

¹ Although we provided some descriptive data in Chapter 4 for LBP claims with combined PM care, we did not have the necessary data to compare the outcomes between the claims with chiropractic exclusive PM care and claims with combined PM care, controlling for factors that influence the choice of care and outcomes.

² Ndetan et al. (2020): Those who received chiropractic care were less likely to report receiving recommendations from a medical doctor to seek chiropractic manipulation. They were more likely to have a chiropractor as their personal health care provider. They were more likely to report that chiropractic care helped and less likely to report using prescriptions or over-the-counter drugs, surgery, and physical therapy.

³ Patients' preference and care-seeking behavior may be shaped by their preinjury experience and influenced by the general perception among family members and friends or in a local community.

⁴ The variables included in the propensity score estimation include variables indicating severity and complexity (i.e., LBP with nerve involvement, more than seven days of lost time, having two or more comorbidities, and having a mobility diagnosis), worker demo-socio-economic characteristics (i.e., age, gender, marital status, preinjury average weekly wage, tenure with preinjury employers, and job industry categories), time to medical care, attorney involvement, same-billing-entity PM, environmental factors (e.g., rural/urban area, county-level variables on supply of physical therapists and chiropractors, percentage of population with college or higher degree, median household income, percentage of population with no health insurance coverage, percentage of population below the federal poverty level, unemployment rate, etc.), and state-specific policies and environment affecting the likelihood of receiving chiropractic care. See Chapter 2 and Technical Appendix C for more descriptions of our statistical analysis.

in our data, have similar probabilities of receiving chiropractic care to claims in the two chiropractic exclusive PM groups (i.e., chiropractic-only PM/EM and chiropractic-only PM). Using these constructed comparison groups of non-chiropractic-only PM cases and the chiropractic PM claims, we estimated the effect of chiropractic care on outcomes, holding constant all variables used for the propensity score matching and several additional variables affecting outcomes.⁵

Table 5.1 provides the results from our statistical analysis that compared the outcome measures between the treatment group (chiropractic-only PM/EM) and the comparison group (a subset of non-chiropractic-only PM claims matched against chiropractic-only PM/EM claims).⁶ The matched non-chiropractic-only PM claims are those that shared similar observed characteristics to those that received chiropractic-only PM/EM. While these claims may likely be relatively simple cases that resolve quickly, the observed characteristics of the claims between the chiropractic-only PM/EM group and the matched non-chiropractic-only PM group are fairly similar as a result of propensity score matching (see Table TA.C2).

Table 5.1 Comparative Results of Utilization, Costs, and Temporary Disability Duration between Chiropractic-Only PM/EM and Subset of Non-Chiropractic-Only PM

| Measure | Chiropractic-Only PM/EM, Treatment Group ^a | Non-Chiropractic-Only PM, Matched Comparison Group ^b | % (point) Difference |
|---------------------------------------|---|---|----------------------|
| Number of claims | 4,547 | 6,716 | |
| Outcomes | | | |
| Medical costs | \$1,491 | \$2,794 | -47% *** |
| Indemnity payments | \$809 | \$1,250 | -35% *** |
| Weeks of temporary disability | 1.4 | 1.9 | -26% *** |
| Payments for PM services | \$1,145 | \$1,206 | -5% *** |
| Payments for non-PM medical services | \$378 | \$1,827 | -79% *** |
| % received opioid prescriptions | 1.0% | 10.3% | -9.4 *** |
| % received MRI | 4.3% | 18.9% | -14.7 *** |
| % received pain management injections | 0.4% | 6.8% | -6.4 *** |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims in 16 study states where chiropractors were involved in more than 5 percent of LBP claims.

^a The treatment group has LBP claims with chiropractic-only PM/EM. We excluded 22 claims (less than 0.5 percent) with chiropractic-only PM/EM from the analysis because there were missing values in a variable used for propensity score estimation.

^b The comparison group is a subset of LBP claims with non-chiropractic-only PM that had a similar likelihood of receiving chiropractic-only PM/EM to claims with chiropractic-only PM/EM. See Chapter 2 and Technical Appendix C for a description of how we constructed the comparison group.

*** Difference is statistically significant at 1 percent.

Key: EM: evaluation and management; LBP: low back pain; MRI: magnetic resonance imaging; PM: physical medicine.

⁵ In addition to the variables included in the first stage propensity score estimation, in the second stage we also included variables that indicate whether the claim had a comorbidity, whether multiple entities for PM care were involved in care, and the time from initial medical visit to first PM visit.

⁶ Note that the terms *treatment* and *comparison* are typically used in a comparative effectiveness analysis. The treatment group is the group of main interest and the comparison group is the group of cases that provide a reference point. For randomized, controlled trials, these two groups are randomly selected by design so the comparison of outcomes would be free of selection bias. For observational studies, one has to use a statistical technique to mimic the random assignments and, in our study, we applied propensity score matching as mentioned above.

As shown in Table 5.1, we found that chiropractic-only PM/EM claims are associated with lower costs and shorter TD durations than the comparable non-chiropractic-only PM claims. The average medical cost per claim for the chiropractic-only PM/EM group was 47 percent lower than that for the non-chiropractic-only PM comparison group. The difference was reduced considerably from the unadjusted results (see Technical Appendix C for a more detailed discussion). The average indemnity payment per claim was still lower, after the adjustment, for the chiropractic-only PM/EM group than for the matched comparison group of non-chiropractic-only PM claims, by 35 percent. Claims in the chiropractic-only PM/EM group also had a much lower likelihood of having opioid prescriptions, MRI, and pain management injections, compared with those in the matched non-chiropractic-only PM comparison group.

Table 5.2 presents the comparative results of the outcomes between the chiropractic-only PM group (i.e., claims with chiropractic-only PM that received E&M services from a non-chiropractor) and the matched non-chiropractic-only PM group. Similar to Table 5.1, it provides the results after the propensity score matching and further adjustment to hold constant observable factors influencing the choice of chiropractic care and outcomes. Table TA.C3 shows the balance of the observed characteristics of the claims between the chiropractic-only PM group and the matched non-chiropractic-only PM group.

Table 5.2 Comparative Results of Utilization, Costs, and Temporary Disability Duration between Chiropractic-Only PM and Subset of Non-Chiropractic-Only PM

| Measure | Chiropractic-Only PM, Treatment Group ^a | Non-Chiropractic-Only PM, Matched Comparison Group ^b | % (point) Difference |
|---------------------------------------|--|---|----------------------|
| Number of claims | 4,530 | 8,563 | |
| Outcomes | | | |
| Medical costs | \$3,170 | \$3,117 | 2% |
| Indemnity payments | \$2,500 | \$3,019 | -17% *** |
| Weeks of temporary disability | 3.3 | 4.0 | -17% *** |
| Payments for PM services | \$1,149 | \$1,116 | 3% |
| Payments for non-PM medical services | \$1,979 | \$2,048 | -3% ** |
| % received opioid prescriptions | 11.3% | 13.6% | -2.3 *** |
| % received MRI | 17.3% | 22.3% | -5.0 *** |
| % received pain management injections | 6.0% | 9.0% | -3.1 *** |

Note: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims in 16 study states where chiropractors were involved in more than 5 percent of LBP claims.

^a The treatment group has LBP claims with chiropractic-only PM. We excluded 53 claims with chiropractic-only PM (less than 1.2 percent) from the analysis because they were missing values in certain variables used for propensity score estimation or they could not be matched with any claims in the non-chiropractic-only PM group.

^b The comparison group is a subset of LBP claims with non-chiropractic PM that had a similar likelihood of receiving chiropractic-only PM to claims in the chiropractic-only PM group. See Chapter 2 and Technical Appendix C for a description of how we constructed the comparison group.

* Difference is statistically significant at 10 percent; ** difference is statistically significant at 5 percent; *** difference is statistically significant at 1 percent.

Key: LBP: low back pain; MRI: magnetic resonance imaging; PM: physical medicine.

As Table 5.2 shows, the average LBP claim with chiropractic-only PM had similar medical costs to those in the non-chiropractic-only PM comparison group. The average medical cost per claim was \$3,170 per claim with chiropractic-only PM and \$3,117 for claims in the matched non-chiropractic-only PM comparison group,

with a percentage difference of 2 percent (not statistically significant).

However, the chiropractic-only PM claims still had lower indemnity costs per claim and shorter TD duration than claims with non-chiropractic-only PM. As Table 5.2 shows, the average indemnity payment per claim was \$2,500 for claims with chiropractic-only PM, 17 percent lower than that for claims in the matched non-chiropractic-only PM comparison group, after the case-mix adjustments.

Table 5.2 also shows that the use of opioids, MRI, and pain management injections was lower among the chiropractic-only PM claims than the matched non-chiropractic-only PM group. The likelihood of receiving opioid prescriptions was 2.3 percentage points lower for chiropractic-only PM claims than the matched subset of non-chiropractic-only PM claims; the same figure was 5.0 percentage points lower for MRI and 3.1 percentage points lower for injections.

In all, we found that workers with LBP who received chiropractic exclusive PM care tended to have lower indemnity costs and shorter TD duration, compared with workers who received non-chiropractic-only PM care but shared similar characteristics that would make them equally likely to have received chiropractic care as those in the chiropractic group. For claims with exclusive chiropractic care, the average medical cost per claim was also lower. Since the analysis was focused on a subset of non-chiropractic-only PM cases, we caution the reader to not generalize the results to all LBP workers. This is because the observed characteristics of the unmatched non-chiropractic-only PM claims were different from those that were matched and included in the analysis; and we do not know what chiropractic outcomes could be had those unmatched non-chiropractic-only claims received chiropractic care.⁷ We also caution the reader that the results presented in this chapter are limited to address an association, not a causal relationship, between chiropractic care and the outcomes in comparison with non-chiropractic care.⁸

⁷ See Technical Appendix C for a summary of differences between the matched and unmatched non-chiropractic-only PM claims.

⁸ See Chapter 2 for a more detailed discussion.

6

IMPLICATIONS

Physical medicine treatment has been increasingly used for treating workers with LBP as a non-pharmacological alternative to opioids. In many states, chiropractors have been participating in delivering health care for workers with LBP, but in other states, chiropractic care is rarely seen. This study is helpful to inform policymakers and stakeholders on how frequently workers with LBP receive chiropractic care, how chiropractors are involved in care, and the association between chiropractic care and its costs and outcomes.

We found substantial interstate variation in the prevalence of chiropractic care among the 28 states studied. In a vast majority of the states where provider choice policies give employers and insurers the control of selecting providers, the prevalence of chiropractic care was low, mostly in 1–2 percent of LBP claims. There was a lack of correlation between the supply of chiropractors and chiropractor use in the “employer control” states, which is inconsistent with what has been reported outside workers’ compensation (Whedon and Song, 2012; Whedon et al., 2012), and inconsistent with what we saw in the states with “employee choice” or “employee limited choice” systems.

In the states with employer control, it is likely that some employers and insurers hesitated to include chiropractors in the delivery of workers’ compensation health care. The hesitation may be rooted in concerns about the cost-effectiveness of chiropractic care, which may be explained in a historical context. In the 1990s, a number of workers’ compensation systems experienced a rapid cost growth, and studies found that higher costs and utilization of chiropractic care and physical medicine services were part of the cost drivers. These study findings and concerns about the impact of cost growth on the economy were the reasons behind reforms in several states that limited the utilization of certain medical services, including chiropractic care.¹ Without updated information on chiropractic care and the associated costs and outcomes, it is conceivable that some employers and insurers were still concerned about the cost-effectiveness of chiropractic care. The negative perception of chiropractic care on the part of employers and insurers may also be in part because some chiropractors may still provide prolonged maintenance care without measurable benefits regarding function and disability.²

By contrast, in states with employee choice or employee limited choice, workers with LBP may choose their treating providers based on their experience with and perceptions of chiropractic care. According to the National Health Interview Survey (NHIS) data, the survey respondents who had spine complaints reported much higher likelihood of seeing chiropractors than other providers; and those who used chiropractic care reported less use of prescription or over-the-counter medications, surgery, or physical therapy (Ndetan et al., 2020).

¹ See Chapter 1 for a more detailed discussion.

² It could also be for financial reasons.

Our analysis on patterns and outcomes of chiropractic care was based on 16 (of the 28 study) states where more than 5 percent of LBP claims received care from chiropractors. Most states with employer control of provider selection are not included in this analysis due to the infrequent use of chiropractic care. Because of this, the results from our analysis mostly reflect the experience of the states where workers can choose their own providers. For claims with exclusive PM care by chiropractors or non-chiropractors, the results from our analysis suggest that chiropractic care may be associated with lower costs and shorter TD duration, compared with a subset of non-chiropractic-only PM claims that shared similar characteristics to those that received chiropractic care.³ Although it is unclear whether allowing workers to choose chiropractors directly in the employer control states would have an effect of decreasing overall costs and improving outcomes, policymakers and stakeholders in these states may be interested in the experience of other states where many chiropractors participate in the delivery of workers' compensation health care and may contribute to better outcomes. Even in an employer control state, employers and insurers may be interested in re-evaluating the role of chiropractors, especially those who have been adopting evidence-based practices and contributing to cost-effective care. The findings of our study may also encourage some additional analyses, either in a retrospective study or pilot work, to examine the patterns and outcomes of chiropractic care in a state-specific context.

When chiropractors provide care, they can be a sole provider for physical medicine treatment and they can also manage overall patient care. Among the 16 states analyzed, 12 percent of the claims received PM care by chiropractors only, and half of these claims also had chiropractors providing all E&M services, suggesting that chiropractors were managing overall patient care. The other half of chiropractic exclusive PM claims received E&M services by non-chiropractic providers (e.g., medical doctors, nurse practitioners, and physician assistants).⁴ For claims with chiropractic-only PM that were managed by a medical provider, the overall medical costs per claim were similar to those for claims with non-chiropractic-only PM care.

Our data show that 17 percent of the LBP claims received PM care from both chiropractors and non-chiropractors, in a concurrent or sequential manner. These claims had much higher costs and much longer TD duration than those that received non-chiropractic-only PM care. The substantial difference in the outcomes may be due to two intertwined factors: (1) injury severity and complexity of the patients and (2) provider practices. We were not able to address these issues within the scope of this study. More data and a better understanding of how the PM care was organized and delivered are needed to examine the costs and outcomes for this group of LBP claims with combined provider patterns of PM care.

Overall, we believe that this study contributes to a better understanding of chiropractic care in workers' compensation. The results are useful for policymakers and stakeholders who are interested in improving the delivery of workers' compensation health care. While our study answers a number of relevant policy questions, many remain. How might other state policies (e.g., guideline adoption, utilization review, preauthorization, limits on PM visits, and fee schedule reimbursement rules) help explain differences across states in the utilization of chiropractic care? If chiropractic care may help reduce costs and improve the outcomes for certain types of LBP workers, how can one identify who would likely benefit from chiropractic care? What are the reasons for patients to seek chiropractic care as opposed to other forms of care? How much variation in practice

³ A substantially large percentage of non-chiropractic-only PM claims did not appear to have a similar likelihood of having chiropractic care. For these unmatched claims, we do not know how chiropractic care may compare with non-chiropractic care. More data and further investigations are needed to understand who may benefit from receiving chiropractic care.

⁴ It is likely that chiropractors provided E&M services to evaluate the patient's condition, formulate the treatment plan, and track progress, while medical providers managed overall patient care with E&M services.

patterns occurs among chiropractors? Does chiropractic care help patients avoid surgery? Is chiropractic care or general physical medicine treatment a cost-effective alternative to opioid therapy? Can chiropractic care lead to savings on pharmaceutical costs? Future studies may address some of these questions.

STATISTICAL APPENDIX

This statistical appendix provides several tables that show interstate variations in utilization of PM services, separately for claims with chiropractic exclusive PM and non-chiropractic-only PM.

Table SA.1 Chiropractic Exclusive PM Care—E&M Patterns and Entry Paths

| Measure | CA | CT | DE | IA | IL | KS | KY | LA | MA | MD | MN | NM | NY | PA | TX | WI | 16-State Median |
|--|-------|------|------|-----|------|-----|------|------|------|------|-------|-----|------|------|------|-------|-----------------|
| # of LBP claims with chiropractic exclusive PM | 2,215 | 180 | 47 | 126 | 579 | 77 | 198 | 92 | 552 | 244 | 1,720 | 108 | 792 | 439 | 427 | 1,356 | |
| % of LBP claims with chiropractic exclusive PM | 24% | 2% | 1% | 1% | 6% | 1% | 2% | 1% | 6% | 3% | 19% | 1% | 9% | 5% | 5% | 15% | |
| E&M provider patterns | | | | | | | | | | | | | | | | | |
| E&M services all by chiropractors | 7% | 42% | 26% | 49% | 52% | 39% | 60% | 45% | 48% | 36% | 66% | 48% | 31% | 47% | 12% | 65% | 46% |
| E&M services all by non-chiropractors | 6% | 9% | 6% | 6% | 5% | 10% | 4% | 4% | 4% | 25% | 4% | 3% | 17% | 4% | 40% | 5% | 5% |
| E&M services by both chiropractors and non-chiropractors | 85% | 43% | 64% | 15% | 32% | 19% | 25% | 45% | 43% | 35% | 22% | 43% | 22% | 46% | 21% | 23% | 34% |
| No E&M services paid | 1% | 6% | 4% | 29% | 11% | 31% | 11% | 7% | 5% | 5% | 8% | 6% | 30% | 4% | 26% | 7% | 7% |
| Pattern of PM care | | | | | | | | | | | | | | | | | |
| PM visits per claim, mean | 5.6 | 16.2 | 19.3 | 5.1 | 13.2 | 6.2 | 12.0 | 12.1 | 15.1 | 15.8 | 13.4 | 8.4 | 18.1 | 13.8 | 10.4 | 11.1 | 12.7 |
| PM visits per claim, median | 5 | 13 | 13 | 4 | 11 | 5 | 10 | 8 | 13 | 12 | 10 | 6 | 13 | 9 | 7 | 9 | 10 |
| % of claims with > 28 PM visits | 0% | 12% | 23% | 2% | 8% | 0% | 5% | 9% | 10% | 12% | 11% | 3% | 17% | 11% | 7% | 5% | 8% |
| % received active therapy services | 86% | 39% | 60% | 13% | 63% | 16% | 38% | 46% | 44% | 80% | 38% | 22% | 29% | 53% | 63% | 29% | 41% |
| % received manual therapy | 98% | 99% | 98% | 99% | 96% | 92% | 100% | 93% | 99% | 94% | 100% | 98% | 99% | 98% | 85% | 100% | 98% |
| % direct PT | 3% | 14% | 13% | 33% | 18% | 40% | 16% | 10% | 10% | 11% | 13% | 12% | 52% | 9% | 43% | 12% | 13% |
| % SBE for E&M visit(s) and first PM visit | 93% | 77% | 83% | 63% | 77% | 56% | 80% | 87% | 86% | 81% | 86% | 85% | 34% | 88% | 30% | 87% | 82% |
| % involving multiple PM providers | 2% | 1% | 5% | 2% | 2% | 3% | 2% | 0% | 1% | 3% | 2% | 9% | 4% | 3% | 5% | 3% | 2% |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

Key: E&M: evaluation and management; LBP: low back pain; PM: physical medicine; SBE: same billing entity (for pre-PM office visits and initial PM).

Table SA.2 Worker and Claim Characteristics for LBP Workers Receiving Chiropractic Exclusive PM Care, among 16 States

| Measure | CA | CT | DE | IA | IL | KS | KY | LA | MA | MD | MN | NM | NY | PA | TX | WI | 16-State Median |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------------|
| # of LBP claims with chiropractic exclusive PM | 2,215 | 180 | 47 | 126 | 579 | 77 | 198 | 92 | 552 | 244 | 1,720 | 108 | 792 | 439 | 427 | 1,356 | |
| % of LBP claims with chiropractic exclusive PM | 24% | 2% | 1% | 1% | 6% | 1% | 2% | 1% | 6% | 3% | 19% | 1% | 9% | 5% | 5% | 15% | |
| Severity and comorbidity | | | | | | | | | | | | | | | | | |
| % with nerve involvement | 11% | 31% | 53% | 13% | 32% | 16% | 21% | 28% | 25% | 24% | 15% | 29% | 41% | 26% | 29% | 19% | 25% |
| % with more than 7 DLT | 21% | 36% | 40% | 4% | 26% | 9% | 13% | 36% | 38% | 45% | 13% | 11% | 32% | 18% | 44% | 12% | 24% |
| % had at least one comorbidity | 1.4% | 2.2% | 4.3% | 0.0% | 1.4% | 0.0% | 3.5% | 7.6% | 3.6% | 5.7% | 1.0% | 4.6% | 2.3% | 1.8% | 3.7% | 0.9% | 2.2% |
| % had 2+ comorbidities | 0.2% | 1.7% | 0.0% | 0.0% | 0.5% | 0.0% | 1.0% | 5.4% | 1.4% | 1.6% | 0.2% | 1.9% | 0.6% | 0.7% | 2.3% | 0.1% | 0.7% |
| Worker characteristics | | | | | | | | | | | | | | | | | |
| Age | 39 | 43 | 41 | 42 | 44 | 42 | 46 | 43 | 44 | 41 | 43 | 45 | 43 | 43 | 40 | 43 | 43 |
| % female | 29% | 33% | 57% | 43% | 44% | 48% | 58% | 39% | 37% | 41% | 51% | 44% | 41% | 40% | 36% | 45% | 42% |
| % married | 14% | 26% | 43% | 33% | 36% | 23% | 49% | 40% | 34% | 30% | 33% | 46% | 23% | 29% | 27% | 21% | 31% |
| Average weekly wage | \$712 | \$995 | \$642 | \$730 | \$776 | \$792 | \$521 | \$786 | \$833 | \$805 | \$728 | \$747 | \$731 | \$715 | \$860 | \$744 | \$745 |
| Average tenure in years | 4.6 | 7.4 | 6.0 | 6.9 | 7.9 | 9.6 | 8.0 | 4.1 | 6.4 | 4.4 | 7.9 | 5.8 | 9.1 | 8.9 | 4.5 | 9.1 | 7.2 |
| Industry grouping | | | | | | | | | | | | | | | | | |
| Manufacturing | 17% | 10% | 6% | 19% | 13% | 30% | 11% | 5% | 10% | 7% | 16% | 4% | 11% | 22% | 12% | 26% | 11% |
| Construction | 12% | 8% | 4% | 5% | 3% | 12% | 2% | 25% | 9% | 7% | 5% | 11% | 5% | 5% | 13% | 6% | 6% |
| Clerical and professional | 8% | 12% | 13% | 8% | 11% | 8% | 25% | 11% | 13% | 10% | 16% | 12% | 8% | 8% | 11% | 8% | 11% |
| High-risk industry | 21% | 13% | 28% | 22% | 24% | 12% | 13% | 15% | 28% | 27% | 26% | 33% | 30% | 20% | 19% | 24% | 23% |
| Trade | 22% | 21% | 36% | 26% | 25% | 14% | 11% | 15% | 17% | 18% | 17% | 18% | 21% | 21% | 11% | 19% | 19% |
| Low-risk industry | 12% | 21% | 13% | 17% | 18% | 22% | 30% | 23% | 18% | 26% | 18% | 11% | 18% | 18% | 29% | 12% | 18% |
| Other | 7% | 15% | 0% | 2% | 6% | 3% | 9% | 5% | 4% | 6% | 2% | 6% | 5% | 5% | 6% | 5% | 5% |
| Environmental factors | | | | | | | | | | | | | | | | | |
| % living in rural areas | 1% | 1% | 2% | 57% | 8% | 29% | 33% | 5% | 2% | 1% | 21% | 10% | 6% | 8% | 2% | 27% | 7% |
| % with college or above | 32% | 38% | 32% | 23% | 33% | 26% | 22% | 24% | 38% | 37% | 31% | 22% | 33% | 28% | 29% | 26% | 30% |
| Unemployment rate | 5.5 | 5.1 | 4.5 | 3.8 | 5.8 | 4.5 | 5.4 | 5.9 | 4.0 | 4.6 | 4.0 | 7.5 | 4.8 | 5.6 | 4.7 | 4.0 | 4.7 |
| Attorney involvement | | | | | | | | | | | | | | | | | |
| % with attorney involvement | 5% | 12% | 21% | 0% | 11% | 1% | 3% | 17% | 7% | 36% | 2% | 0% | 9% | 6% | 11% | 1% | 7% |
| % with claimant attorney | 7% | 13% | 23% | 0% | 15% | 1% | 6% | 34% | 14% | 35% | 3% | 1% | 7% | 6% | 10% | 1% | 7% |
| % with defense attorney | 5% | 12% | 21% | 0% | 11% | 1% | 3% | 17% | 7% | 36% | 2% | 0% | 9% | 6% | 11% | 1% | 7% |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

Key: DLT: days of lost time; LBP: low back pain; PM: physical medicine.

Table SA.3 Costs and Outcomes among Claims with Chiropractic Exclusive PM Care across 16 States

| Measure | CA | CT | DE | IA | IL | KS | KY | LA | MA | MD | MN | NM | NY | PA | TX | WI | 16-State Median |
|--|---------|---------|---------|-------|---------|-------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----------------|
| # of LBP claims with chiropractic exclusive PM | 2,215 | 180 | 47 | 126 | 579 | 77 | 198 | 92 | 552 | 244 | 1,720 | 108 | 792 | 439 | 427 | 1,356 | |
| % of LBP claims with chiropractic exclusive PM | 24% | 2% | 1% | 1% | 6% | 1% | 2% | 1% | 6% | 3% | 19% | 1% | 9% | 5% | 5% | 15% | |
| Costs and outcomes | | | | | | | | | | | | | | | | | |
| Medical costs | \$2,423 | \$2,542 | \$4,554 | \$529 | \$3,277 | \$628 | \$1,783 | \$5,166 | \$1,458 | \$2,863 | \$1,595 | \$1,649 | \$1,557 | \$2,830 | \$4,050 | \$1,832 | \$2,128 |
| Indemnity payments | \$1,320 | \$2,613 | \$2,256 | \$102 | \$2,187 | \$56 | \$515 | \$6,211 | \$2,399 | \$4,920 | \$393 | \$374 | \$1,636 | \$2,667 | \$5,127 | \$267 | \$1,911 |
| Indemnity-medical ratio | 0.54 | 1.03 | 0.50 | 0.19 | 0.67 | 0.09 | 0.29 | 1.20 | 1.65 | 1.72 | 0.25 | 0.23 | 1.05 | 0.94 | 1.27 | 0.15 | 0.61 |
| % with more than 7 DLT | 21% | 36% | 40% | 4% | 26% | 9% | 13% | 36% | 38% | 45% | 13% | 11% | 32% | 18% | 44% | 12% | 24% |
| Weeks of temporary disability | 1.7 | 2.8 | 2.9 | 0.3 | 2.3 | 0.3 | 1.2 | 7.5 | 3.3 | 3.0 | 0.5 | 0.6 | 3.2 | 1.4 | 7.0 | 0.5 | 2.0 |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

Key: DLT: days of lost time; LBP: low back pain; PM: physical medicine.

Table SA.4 Patterns of Non-Chiropractic-Only PM Care, for Workers with LBP among 16 States

| Measure | CA | CT | DE | IA | IL | KS | KY | LA | MA | MD | MN | NM | NY | PA | TX | WI | 16-State Median |
|--|--------|-------|------|------|-------|------|-------|------|-------|-------|-------|-------|-------|-------|--------|-------|-----------------|
| # of LBP claims with non-chiropractic-only PM | 17,434 | 2,426 | 281 | 864 | 4,521 | 757 | 1,186 | 709 | 2,110 | 2,018 | 1,675 | 1,027 | 3,012 | 3,433 | 12,885 | 1,608 | |
| % of LBP claims with non-chiropractic-only PM | 31% | 4% | 1% | 2% | 8% | 1% | 2% | 1% | 4% | 4% | 3% | 2% | 5% | 6% | 23% | 3% | |
| E&M provider patterns | | | | | | | | | | | | | | | | | |
| E&M services all by chiropractors | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0% |
| E&M services all by non-chiropractors | 98% | 98% | 94% | 97% | 95% | 96% | 97% | 97% | 90% | 97% | 95% | 99% | 95% | 97% | 99% | 98% | 97% |
| E&M services by both chiropractors and non-chiropractors | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| No E&M services paid | 1% | 2% | 6% | 3% | 4% | 4% | 2% | 2% | 9% | 3% | 5% | 1% | 5% | 3% | 1% | 2% | 3% |
| Patterns of PM care | | | | | | | | | | | | | | | | | |
| PM visits per claim, mean | 7.7 | 11.1 | 15.6 | 9.5 | 12.1 | 8.7 | 8.8 | 11.9 | 12.2 | 10.8 | 8.9 | 8.1 | 17.4 | 12.7 | 7.0 | 8.6 | 10.2 |
| PM visits per claim, median | 6 | 7 | 10 | 7 | 8 | 6 | 6 | 9 | 9 | 7 | 6 | 5 | 12 | 8 | 6 | 6 | 7 |
| % of claims with > 28 PM visits | 2% | 8% | 15% | 5% | 9% | 3% | 4% | 8% | 8% | 7% | 6% | 4% | 17% | 10% | 1% | 4% | 6% |
| % received active therapy services | 96% | 99% | 91% | 95% | 98% | 95% | 98% | 95% | 96% | 98% | 96% | 98% | 92% | 97% | 94% | 97% | 96% |
| % received manual therapy | 71% | 74% | 75% | 77% | 68% | 59% | 63% | 63% | 72% | 56% | 68% | 82% | 67% | 67% | 55% | 69% | 68% |
| % SBE for E&M visit(s) and first PM visit | 32% | 36% | 17% | 36% | 31% | 25% | 30% | 32% | 24% | 32% | 51% | 54% | 32% | 21% | 63% | 47% | 32% |
| % involving multiple PM providers | 12% | 10% | 9% | 10% | 12% | 6% | 8% | 6% | 7% | 10% | 8% | 13% | 11% | 13% | 3% | 7% | 9% |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

Key: E&M: evaluation and management; LBP: low back pain; PM: physical medicine; SBE: same billing entity (i.e., same tax ID for billing the services).

Table SA.5 Workers and Claim Characteristics for LBP Workers with Non-Chiropractic-Only PM Care, among 16 States

| Measure | CA | CT | DE | IA | IL | KS | KY | LA | MA | MD | MN | NM | NY | PA | TX | WI | 16-State Median |
|---|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-----------------|
| # of LBP claims with non-chiropractic-only PM | 17,434 | 2,426 | 281 | 864 | 4,521 | 757 | 1,186 | 709 | 2,110 | 2,018 | 1,675 | 1,027 | 3,012 | 3,433 | 12,885 | 1,608 | |
| % of LBP claims with non-chiropractic-only PM | 31% | 4% | 1% | 2% | 8% | 1% | 2% | 1% | 4% | 4% | 3% | 2% | 5% | 6% | 23% | 3% | |
| Severity and comorbidity | | | | | | | | | | | | | | | | | |
| % with nerve involvement | 21% | 27% | 40% | 28% | 29% | 26% | 33% | 36% | 35% | 24% | 34% | 17% | 46% | 26% | 18% | 30% | 29% |
| % with more than 7 DLT | 32% | 39% | 40% | 25% | 42% | 25% | 32% | 48% | 57% | 37% | 34% | 21% | 58% | 32% | 32% | 28% | 33% |
| % had at least one comorbidity | 3.4% | 3.9% | 3.2% | 6.5% | 4.9% | 3.3% | 7.8% | 10.0% | 8.8% | 4.4% | 7.3% | 5.1% | 6.0% | 4.3% | 3.4% | 8.6% | 5.0% |
| % had 2+ comorbidities | 0.7% | 1.0% | 2.1% | 1.4% | 1.2% | 0.9% | 2.4% | 4.8% | 3.0% | 1.5% | 1.7% | 1.1% | 1.3% | 0.8% | 1.1% | 2.6% | 1.3% |
| Worker characteristics | | | | | | | | | | | | | | | | | |
| Age | 40 | 42 | 43 | 42 | 42 | 40 | 41 | 43 | 42 | 41 | 42 | 40 | 43 | 42 | 41 | 41 | 42 |
| % female | 41% | 40% | 49% | 39% | 38% | 39% | 44% | 42% | 37% | 36% | 43% | 46% | 43% | 39% | 36% | 41% | 40% |
| % married | 22% | 23% | 28% | 36% | 36% | 28% | 34% | 31% | 30% | 29% | 31% | 37% | 25% | 28% | 28% | 20% | 29% |
| Average weekly wage | \$752 | \$829 | \$727 | \$676 | \$741 | \$619 | \$593 | \$726 | \$844 | \$816 | \$760 | \$591 | \$805 | \$731 | \$690 | \$714 | \$729 |
| Average tenure in years | 6.1 | 6.9 | 5.9 | 6.5 | 7.2 | 5.2 | 5.6 | 5.9 | 6.4 | 5.9 | 6.9 | 5.0 | 7.6 | 6.9 | 5.0 | 6.3 | 6.2 |
| Industry grouping | | | | | | | | | | | | | | | | | |
| Manufacturing | 12% | 13% | 9% | 29% | 18% | 24% | 23% | 7% | 12% | 11% | 17% | 8% | 10% | 16% | 14% | 30% | 13% |
| Construction | 7% | 5% | 4% | 6% | 3% | 4% | 4% | 13% | 8% | 7% | 7% | 7% | 4% | 5% | 11% | 6% | 6% |
| Clerical and professional | 6% | 6% | 6% | 6% | 6% | 5% | 6% | 6% | 10% | 5% | 8% | 6% | 8% | 6% | 8% | 7% | 6% |
| High-risk industry | 31% | 27% | 31% | 27% | 32% | 27% | 20% | 27% | 30% | 27% | 28% | 36% | 33% | 29% | 27% | 22% | 28% |
| Trade | 24% | 20% | 27% | 16% | 21% | 25% | 19% | 20% | 20% | 20% | 20% | 18% | 21% | 22% | 18% | 19% | 20% |
| Low-risk industry | 11% | 15% | 17% | 12% | 13% | 13% | 15% | 17% | 15% | 19% | 16% | 15% | 19% | 14% | 15% | 13% | 15% |
| Other | 9% | 14% | 4% | 3% | 7% | 2% | 12% | 9% | 3% | 10% | 4% | 6% | 4% | 7% | 7% | 4% | 6% |
| Environmental factors | | | | | | | | | | | | | | | | | |
| % living in rural areas | 1% | 1% | 4% | 19% | 3% | 7% | 17% | 7% | 1% | 2% | 8% | 3% | 4% | 2% | 3% | 12% | 4% |
| % with college or above | 31% | 37% | 31% | 29% | 35% | 33% | 26% | 25% | 39% | 37% | 37% | 31% | 34% | 30% | 29% | 30% | 31% |
| Unemployment rate | 5.6 | 5.2 | 4.6 | 3.8 | 5.9 | 4.4 | 4.8 | 5.9 | 3.9 | 4.5 | 3.8 | 6.2 | 4.8 | 5.4 | 4.5 | 4.3 | 4.7 |
| Attorney involvement | | | | | | | | | | | | | | | | | |
| % with attorney involvement | 8% | 9% | 16% | 9% | 16% | 13% | 6% | 19% | 9% | 15% | 5% | 2% | 20% | 7% | 3% | 3% | 9% |
| % with claimant attorney | 12% | 9% | 17% | 12% | 23% | 11% | 7% | 25% | 13% | 18% | 6% | 4% | 19% | 9% | 2% | 7% | 12% |
| % with defense attorney | 8% | 9% | 16% | 9% | 16% | 13% | 6% | 19% | 9% | 15% | 5% | 2% | 20% | 7% | 3% | 3% | 9% |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

Key: DLT: days of lost time; LBP: low back pain; PM: physical medicine.

Table SA.6 Costs and Outcomes for Claims with Non-Chiropractic-Only PM Care across 16 Study States

| Measure | CA | CT | DE | IA | IL | KS | KY | LA | MA | MD | MN | NM | NY | PA | TX | WI | 16-State Median |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----------------|
| # of LBP claims with non-chiropractic-only PM | 17,434 | 2,426 | 281 | 864 | 4,521 | 757 | 1,186 | 709 | 2,110 | 2,018 | 1,675 | 1,027 | 3,012 | 3,433 | 12,885 | 1,608 | |
| % of LBP claims with non-chiropractic-only PM | 31% | 4% | 1% | 2% | 8% | 1% | 2% | 1% | 4% | 4% | 3% | 2% | 5% | 6% | 23% | 3% | |
| Costs and outcomes | | | | | | | | | | | | | | | | | |
| Medical costs | \$3,326 | \$3,365 | \$4,863 | \$4,391 | \$5,253 | \$3,349 | \$3,299 | \$7,956 | \$2,445 | \$3,192 | \$3,335 | \$3,866 | \$3,265 | \$4,290 | \$2,786 | \$5,927 | \$3,357 |
| Indemnity payments | \$3,525 | \$4,139 | \$3,827 | \$3,008 | \$4,359 | \$2,151 | \$3,042 | \$9,451 | \$6,490 | \$3,582 | \$3,136 | \$2,255 | \$5,799 | \$5,176 | \$2,381 | \$1,443 | \$3,554 |
| Indemnity-medical ratio | 1.06 | 1.23 | 0.79 | 0.69 | 0.83 | 0.64 | 0.92 | 1.19 | 2.65 | 1.12 | 0.94 | 0.58 | 1.78 | 1.21 | 0.85 | 0.24 | 0.93 |
| % with more than 7 DLT | 32% | 39% | 40% | 25% | 42% | 25% | 32% | 48% | 57% | 37% | 34% | 21% | 58% | 32% | 32% | 28% | 33% |
| Weeks of temporary disability | 5.0 | 5.5 | 5.4 | 2.4 | 5.3 | 2.7 | 5.2 | 15.4 | 9.2 | 4.4 | 3.4 | 3.2 | 8.7 | 4.4 | 3.7 | 2.4 | 4.7 |

Note: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

Key: DLT: days of lost time; LBP: low back pain; PM: physical medicine.

TECHNICAL APPENDIX A

IDENTIFYING LOW BACK PAIN AND COMMON SERVICES

In this technical appendix, we describe the algorithm we used for the identification of LBP claims. We also describe our approach to identifying common PM treatment patterns, which led us to develop three research topics, the first of which is the topic for this report.

LOW BACK PAIN CLAIMS

The algorithm we developed in our 2019 study identified two groups of low back claims: (1) low back pain with neurological findings and/or radiating leg pain and (1) low back pain only claims. These are claims that had low back pain diagnoses as primary conditions for medical treatments (i.e., medical services for low back pain accounting for 70 percent of all medical payments) and that did not have any red flag conditions or neurological neck pain. We further excluded a small number of claims that had ICD-10 codes indicating comorbid conditions with complications. Workers with these more serious comorbid conditions are not indicated for PM treatment in general. While a more detailed description of the algorithm can be found in Wang, Mueller, and Lea (2019a), we provide several lists of ICD-10 codes that may help the reader to better understand what these claims are.

Table TA.A1 provides a list of ICD-10 codes indicating various low back diagnoses with no mention of nerve involvement, and Table TA.A2 lists codes that have nerve involvement or codes that may indicate nerve involvement when combined with other codes. For example, spondylolisthesis or spondylolysis with neurological findings are considered low back pain with nerve involvement. Spondylolisthesis without neurological findings is considered instability. Spondylolysis without neurological findings and without spondylolisthesis are considered non-specific low back. In these two tables, the ICD-10 codes are grouped by type, including low back conditions with nerve involvement (e.g., sciatica, radiculopathy, myelopathy, and other neurological conditions), spinal stenosis, spondylolysis and spondylolisthesis, disc disorder with no mention of neurological findings, instability, sacroiliac joint sprains, degenerative conditions without neurological findings, and non-specific low back pain.

Table TA.A1 ICD-10 Codes for Low Back Only Conditions

| ICD-10 Code | Description |
|--|---|
| Disc disorder with no mention of neurological finding | |
| M5125 | Other intervertebral disc displacement, thoracolumbar region |
| M5126 | Other intervertebral disc displacement, lumbar region |
| M5127 | Other intervertebral disc displacement, lumbosacral region |
| M5135 | Other intervertebral disc degeneration, thoracolumbar region |
| M5136 | Other intervertebral disc degeneration, lumbar region |
| M5137 | Other intervertebral disc degeneration, lumbosacral region |
| M5185 | Other intervertebral disc disorders, thoracolumbar region |
| M5186 | Other intervertebral disc disorders, lumbar region |
| M5187 | Other intervertebral disc disorders, lumbosacral region |
| M519 | Unspecified thoracic, thoracolumbar and lumbosacral intervertebral disc disorder |
| Sacroiliac joint sprains | |
| S336XXA | Sprain of sacroiliac joint, initial encounter |
| S336XXD | Sprain of sacroiliac joint, subsequent encounter |
| S336XXS | Sprain of sacroiliac joint, sequela |
| Degenerative conditions without neurological findings | |
| M47815 | Spondylosis without myelopathy or radiculopathy, thoracolumbar region |
| M47816 | Spondylosis without myelopathy or radiculopathy, lumbar region |
| M47817 | Spondylosis without myelopathy or radiculopathy, lumbosacral region |
| M47818 | Spondylosis without myelopathy or radiculopathy, sacral and sacrococcygeal region |
| M47819 | Spondylosis without myelopathy or radiculopathy, site unspecified |
| M47895 | Other spondylosis, thoracolumbar region |
| M47896 | Other spondylosis, lumbar region |
| M47897 | Other spondylosis, lumbosacral region |
| M4826 | Kissing spine, lumbar region |
| M4827 | Kissing spine, lumbosacral region |
| M488X5 | Other specified spondylopathies, thoracolumbar region |
| M488X6 | Other specified spondylopathies, lumbar region |
| M488X7 | Other specified spondylopathies, lumbosacral region |
| M489 | Spondylopathy, unspecified |
| M4986 | Spondylopathy in diseases classified elsewhere, lumbar region |
| M4987 | Spondylopathy in diseases classified elsewhere, lumbosacral region |
| Non-specific back diagnoses | |
| F454 | Pain disorders related to psychological factors |
| F4541 | Pain disorder exclusively related to psychological factors |
| F4542 | Pain disorder with related psychological factors |
| M4040 | Postural lordosis, site unspecified |
| M4045 | Postural lordosis, thoracolumbar region |
| M4046 | Postural lordosis, lumbar region |
| M4047 | Postural lordosis, lumbosacral region |
| M4050 | Lordosis, unspecified, site unspecified |
| M4055 | Lordosis, unspecified, thoracolumbar region |
| M4056 | Lordosis, unspecified, lumbar region |
| M4057 | Lordosis, unspecified, lumbosacral region |
| M438X5 | Other specified deforming dorsopathies, thoracolumbar region |
| M438X6 | Other specified deforming dorsopathies, lumbar region |
| M438X7 | Other specified deforming dorsopathies, lumbosacral region |
| M438X8 | Other specified deforming dorsopathies, sacral and sacrococcygeal region |

continued

Table TA.A1 ICD-10 Codes for Low Back Only Conditions (continued)

| ICD-10 Code | Description |
|-------------|---|
| M438X9 | Other specified deforming dorsopathies, site unspecified |
| S335 | Sprain of ligaments of lumbar spine |
| S335XXA | Sprain of ligaments of lumbar spine, initial encounter |
| S335XXD | Sprain of ligaments of lumbar spine, subsequent encounter |
| S335XXS | Sprain of ligaments of lumbar spine, sequela |
| S338 | Sprain of other parts of lumbar spine and pelvis |
| S338XXA | Sprain of other parts of lumbar spine and pelvis, initial encounter |
| S338XXD | Sprain of other parts of lumbar spine and pelvis, subsequent encounter |
| S338XXS | Sprain of other parts of lumbar spine and pelvis, sequela |
| S339 | Sprain of unspecified parts of lumbar spine and pelvis |
| S339XXA | Sprain of unspecified parts of lumbar spine and pelvis, initial encounter |
| S339XXD | Sprain of unspecified parts of lumbar spine and pelvis, subsequent encounter |
| S339XXS | Sprain of unspecified parts of lumbar spine and pelvis, sequela |
| S3900 | Unspecified injury of muscle, fascia and tendon of abdomen, lower back and pelvis |
| S39002 | Unspecified injury of muscle, fascia and tendon of lower back |
| S39002A | Unspecified injury of muscle, fascia and tendon of lower back, initial encounter |
| S39002D | Unspecified injury of muscle, fascia and tendon of lower back, subsequent encounter |
| S39002S | Unspecified injury of muscle, fascia and tendon of lower back, sequela |
| S3901 | Strain of muscle, fascia and tendon of abdomen, lower back and pelvis |
| S39012 | Strain of muscle, fascia and tendon of lower back |
| S39012A | Strain of muscle, fascia and tendon of lower back, initial encounter |
| S39012D | Strain of muscle, fascia and tendon of lower back, subsequent encounter |
| S39012S | Strain of muscle, fascia and tendon of lower back, sequela |
| S3909 | Other injury of muscle, fascia and tendon of abdomen, lower back and pelvis |
| S39092 | Other injury of muscle, fascia and tendon of lower back |
| S39092A | Other injury of muscle, fascia and tendon of lower back, initial encounter |
| S39092D | Other injury of muscle, fascia and tendon of lower back, subsequent encounter |
| S39092S | Other injury of muscle, fascia and tendon of lower back, sequela |
| M5145 | Schmorl's nodes, thoracolumbar region |
| M5146 | Schmorl's nodes, lumbar region |
| M5147 | Schmorl's nodes, lumbosacral region |
| M5380 | Other specified dorsopathies, site unspecified |
| M5385 | Other specified dorsopathies, thoracolumbar region |
| M5386 | Other specified dorsopathies, lumbar region |
| M5387 | Other specified dorsopathies, lumbosacral region |
| M5388 | Other specified dorsopathies, sacral and sacrococcygeal region |
| M539 | Dorsopathy, unspecified |
| M545 | Low back pain |
| M5489 | Other dorsalgia |
| M549 | Dorsalgia, unspecified |
| M62830 | Muscle spasm of back |
| M791 | Myalgia |
| M9903 | Segmental and somatic dysfunction of lumbar region |
| M9904 | Segmental and somatic dysfunction of sacral region |
| M9983 | Other biomechanical lesions of lumbar region |

Note: See Chapter 2 for a description of how we identified low back claims.

Key: ICD: International Classification of Diseases.

Table TA.A2 ICD-10 Codes for Low Back Conditions That May Have Nerve Involvement

| ICD-10 Code | Description |
|--|---|
| Low back conditions with nerve involvement (e.g., sciatica, radiculopathy, myelopathy, and other neurological conditions) | |
| M5410 | Radiculopathy, site unspecified |
| M5415 | Radiculopathy, thoracolumbar region |
| M5416 | Radiculopathy, lumbar region |
| M5417 | Radiculopathy, lumbosacral region |
| M5418 | Radiculopathy, sacral and sacrococcygeal region |
| M5430 | Sciatica, unspecified side |
| M5431 | Sciatica, right side |
| M5432 | Sciatica, left side |
| M544 | Lumbago with sciatica |
| M5440 | Lumbago with sciatica, unspecified side |
| M5441 | Lumbago with sciatica, right side |
| M5442 | Lumbago with sciatica, left side |
| M4710 | Other spondylosis with myelopathy, site unspecified |
| M4715 | Other spondylosis with myelopathy, thoracolumbar region |
| M4716 | Other spondylosis with myelopathy, lumbar region |
| M4720 | Other spondylosis with radiculopathy, site unspecified |
| M4725 | Other spondylosis with radiculopathy, thoracolumbar region |
| M4726 | Other spondylosis with radiculopathy, lumbar region |
| M4727 | Other spondylosis with radiculopathy, lumbosacral region |
| M4728 | Other spondylosis with radiculopathy, sacral and sacrococcygeal region |
| M5105 | Intervertebral disc disorders with myelopathy, thoracolumbar region |
| M5106 | Intervertebral disc disorders with myelopathy, lumbar region |
| M5115 | Intervertebral disc disorders with radiculopathy, thoracolumbar region |
| M5116 | Intervertebral disc disorders with radiculopathy, lumbar region |
| M5117 | Intervertebral disc disorders with radiculopathy, lumbosacral region |
| M792 | Neuralgia and neuritis, unspecified |
| Spinal stenosis | |
| M4800 | Spinal stenosis, site unspecified |
| M4801 | Spinal stenosis, occipito-atlanto-axial region |
| M4802 | Spinal stenosis, cervical region |
| M4803 | Spinal stenosis, cervicothoracic region |
| M4804 | Spinal stenosis, thoracic region |
| M4805 | Spinal stenosis, thoracolumbar region |
| M4806 | Spinal stenosis, lumbar region |
| M4807 | Spinal stenosis, lumbosacral region |
| M4808 | Spinal stenosis, sacral and sacrococcygeal region |
| M9923 | Subluxation stenosis of neural canal of lumbar region |
| M9933 | Osseous stenosis of neural canal of lumbar region |
| M9943 | Connective tissue stenosis of neural canal of lumbar region |
| M9953 | Intervertebral disc stenosis of neural canal of lumbar region |
| M9963 | Osseous and subluxation stenosis of intervertebral foramina of lumbar region |
| M9973 | Connective tissue and disc stenosis of intervertebral foramina of lumbar region |

continued

Table TA.A2 ICD-10 Codes for Low Back Conditions That May Have Nerve Involvement (continued)

| ICD-10 Code | Description |
|--|--|
| Spondylolysis and spondylolisthesis^a | |
| M4300 | Spondylolysis, site unspecified |
| M4305 | Spondylolysis, thoracolumbar region |
| M4306 | Spondylolysis, lumbar region |
| M4307 | Spondylolysis, lumbosacral region |
| M4309 | Spondylolysis, multiple sites in spine |
| M4310 | Spondylolisthesis, site unspecified |
| M4315 | Spondylolisthesis, thoracolumbar region |
| M4316 | Spondylolisthesis, lumbar region |
| M4317 | Spondylolisthesis, lumbosacral region |
| M4319 | Spondylolisthesis, multiple sites in spine |
| Instability | |
| M532X5 | Spinal instabilities, thoracolumbar region |
| M532X6 | Spinal instabilities, lumbar region |
| M532X7 | Spinal instabilities, lumbosacral region |
| M532X8 | Spinal instabilities, sacral and sacrococcygeal region |

Note: See Chapter 2 for a description of how we identified low back claims.

^a The spondylolisthesis or spondylolysis codes were treated differently. Spondylolisthesis or spondylolysis with neurological findings are considered low back pain with nerve involvement. Spondylolisthesis without neurological findings is considered as instability. Spondylolysis without neurological findings and without spondylolisthesis are considered non-specific low back.

Key: ICD: International Classification of Diseases.

Table TA.A3 provides a short list of ICD-10 codes indicating neurological neck conditions. If any low back pain claims had any of these neurological neck conditions, they were excluded. There are also a large number of ICD-10 codes that are related to signs, symptoms, and conditions indicating potentially serious pathology in patients presenting with back pain. These codes, not included in the report, cover conditions such as tumor, infectious disease, and fracture and dislocation.

Table TA.A3 ICD-10 Codes Indicating Neck Conditions with Neurological Findings

| ICD-10 Code | Description |
|---|---|
| Neck conditions with neurological findings | |
| M4712 | Other spondylosis with myelopathy, cervical region |
| M4713 | Other spondylosis with myelopathy, cervicothoracic region |
| M4722 | Other spondylosis with radiculopathy, cervical region |
| M4723 | Other spondylosis with radiculopathy, cervicothoracic region |
| M500 | Cervical disc disorder with myelopathy |
| M5000 | Cervical disc disorder with myelopathy, unspecified cervical region |
| M5001 | Cervical disc disorder with myelopathy, high cervical region |
| M5002 | Cervical disc disorder with myelopathy, mid-cervical region |
| M5003 | Cervical disc disorder with myelopathy, cervicothoracic region |
| M5012 | Cervical disc disorder with radiculopathy, mid-cervical region |
| M5412 | Radiculopathy, cervical region |

Note: A large number of red flag diagnostic codes were used for identifying claims with more serious conditions. These codes are available but not presented in the report.

Key: ICD: International Classification of Diseases.

In addition to the red flag conditions and neurological neck and back diagnoses, we identified a list of ICD-10 codes for comorbidities with serious complications; we excluded the low back claims that had any of these ICD-10 codes, because workers with these diagnoses are not considered clinically appropriate candidates for PM treatment. Table TA.A4 lists these ICD-10 codes.

Table TA.A4 ICD-10 Codes for Comorbidities with Complications

| Conditions | ICD-10 Codes |
|--|--|
| Diabetes with hyperosmolarity, ketoacidosis, or hypoglycemia with or without coma | E0800, E0801, E081, E0810, E0811, E0864, E08641, E08649, E0900, E0901, E091, E0910, E0911, E0964, E09641, E09649, E101, E1010, E1011, E1064, E10641, E10649, E1101, E1164, E11641, E11649, E1300, E1301, E131, E1310, E1311, E1364, E13641, E13649, E232 |
| Psychotic disorders or severe psychotic symptoms | F060, F062, F23, F24, F28, F3013, F302 |
| Psychotic disorders, with alcohol, drug, and substance abuse and dependence | F1015, F1025, F1095, F1115, F1125, F1195, F1215, F1225, F1295, F1315, F1325, F1395, F1415, F1425, F1495, F1515, F1525, F1595, F1615, F1625, F1695, F1815, F1825, F1895 |
| Intoxication, withdrawal, or psychotic disorders involving other psychoactive substance abuse and dependence | F1912, F19120, F19121, F19122, F19129, F1915, F19150, F19151, F19159, F1922, F19220, F19221, F19222, F19229, F1923, F19230, F19231, F19232, F19239, F1925, F19250, F19251, F19259, F1992, F19920, F19921, F19922, F19929, F1993, F19930, F19931, F19932, F19939, F1995, F19950, F19951, F19959 |
| Bipolar disorders | F3113, F312, F314, F315, F3163, F3164 |
| Major depressive disorders, with psychotic features | F322, F332, F333 |

Note: The ICD-10 codes indicate comorbidities with serious complications. Claims with any of the ICD-10 codes on this list were excluded from this study.

Key: ICD: International Classification of Diseases; PT: physical therapy.

In this study, we included both LBP-only claims and claims with neuro back conditions. These two types of LBP claims can be quite different in terms medical treatment indicated as well as in utilization and costs of medical services. Table TA.A5 provides a comparison of these types of LBP claims.

In the 28-state pooled sample, 83 percent of the LBP claims were identified as LBP-only claims and 17 percent were identified as LBP claims with nerve involvement. The average claim with a neuro back condition used more services with higher medical and indemnity costs (Table TA.A5). TD duration was also longer for neuro back claims. Workers with neuro back conditions were more likely to receive PM treatments (73 percent versus 46 percent for LBP-only claims) and had more visits over a longer duration. Utilization of other medical services was also higher among neuro back claims, compared with LBP-only claims. For example, 26 percent of neuro back claims received opioid prescriptions and the same figure was 9 percent for LBP-only claims. Neuro back claims were more likely to have MRI and spinal injections. It is important to control for the type of LBP condition when we look at the results for all low back claims; we did so when reporting our findings for LBP claims in the main report.

Table TA.A5 Comparing Utilization of Costs between LBP-Only Claims and Neuro Back Claims

| Variables | LBP-Only Claims^a | LBP Claims with Nerve Involvement^a |
|--|------------------------------------|--|
| Number of claims | 168,926 | 34,718 |
| % of claims with specified pattern | 83% | 17% |
| Medical costs and TD duration per claim at 18 months postinjury | | |
| Medical payments, per medical claim | \$1,502 | \$5,296 |
| Indemnity payments, per claim with indemnity benefits | \$863 | \$6,242 |
| TD duration in weeks, per claim with indemnity benefits | 1.2 | 7.5 |
| % of claims with > 7 days of lost time | 16% | 44% |
| Costs and utilization of PM services at 18 months postinjury | | |
| % of claims with PM services | 46% | 73% |
| Number of PM visits, mean | 8 | 14 |
| Number of PM visits, median | 6 | 10 |
| Duration (days) of PM treatment, mean | 39 | 93 |
| Duration (days) of PM treatment, median | 17 | 46 |
| % of medical payments that were made for PM services | 82% | 43% |
| Average paid per visit for PM | \$153 | \$152 |
| Utilization of other services over 18 months of treatment | | |
| Number of office visits, mean | 4 | 8 |
| % of claims with emergency visit | 18% | 25% |
| % of claims received opioid Rx | 9% | 26% |
| Number of opioid Rx, per claim with opioids | 1.7 | 3.1 |
| % of claims received MRI | 8% | 48% |
| % of claims received injections | 1.9% | 23.6% |
| % of claims had surgery | 0.0% | 0.0% |

Notes: Claims included are those with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019.

^a LBP claims were identified based on the algorithm established by Wang, Mueller, and Lea (2019a).

Key: LBP: low back pain; MRI: magnetic resonance imaging; PM: physical medicine; Rx: prescriptions; TD: temporary disability.

PM SERVICES AND COMMON PROVIDER PATTERNS

In our series of PM studies, we identified PM services using CPT-4 codes and grouped these codes into several types of PM services.^{1,2} Table TA.A6 list all the CPT-4 codes that we used to identify PM services by type, including active therapy services (often referred to as exercises), physical modalities, chiropractic manipulation or manual therapy, and other PM services not classified above.

¹ See Wang, Mueller, and Lea (2020 and 2021).

² Several states have state-specific codes, which we cross-walked to standard CPT-4 codes.

Table TA.A6 Grouping Procedure Codes of Physical Medicine Services

| Procedure Code | Description |
|--|--|
| Active therapy services (ATS) | |
| <i>Exercises</i> | |
| 97110 | Therapeutic exercises to develop strength and endurance, range of motion |
| 97112 | Neuromuscular reeducation of movement, balance, coordination |
| 97113 | Aquatic therapy with therapeutic exercises |
| 97116 | Gait training, including stair climbing |
| 97530 | Therapeutic activities to improve functional performance |
| 97531 | Functional activities, one area |
| <i>Work hardening/conditioning</i> | |
| 97545 | Work hardening or conditioning; initial 2 hours |
| 97546 | Work hardening or conditioning; each additional hour |
| <i>Education and training for exercises and self-management</i> | |
| 97535 | Self-care/home management training, direct one-on-one |
| 97537 | Community/work reintegration, direct one on one |
| 97542 | Wheelchair management (e.g., assessment, fitting, training) |
| G8780 | Counseling for diet and physical activity performed |
| 4242F | Counseling for exercise program for back pain lasting longer than 12 weeks |
| 4450F | Self-care education provided to patient |
| 96152–96155 | Health and behavior intervention (respectively for individual patient, group, with or without the patient present) |
| 97532 | Cognitive skills training |
| 97770 | Development of cognitive skills to improve attention, memory, problem solving, direct one on one |
| 98960–98962 | Education and training for patient self-management by a non-physician provider (respectively for single patient, 2–4 patients, and 5–8 patients) |
| 99071 | Patient educational materials (e.g., books, tapes, and pamphlets) |
| 99078 | Educational services rendered to patients in a group setting |
| 97150 | Therapeutic procedure(s), group |
| S9454 | Stress management classes |
| S9445, S9446 | Patient education, not otherwise classified, individual or group |
| V65.4, Z71.8 | Other specified counseling, covered in the ICD-10-CM |
| Physical modalities | |
| 0278T | Transcutaneous electrical modulation pain reprocessing |
| 64550 | Application of surface (transcutaneous) neurostimulator |
| 97010, 97012, 97014, 97016, 97018, 97020, 97022, 97024, 97026, 97028, 97032, 97033, 97034, 97035, 97036, 97039 | Physical modalities (hot or cold packs, mechanical traction, electrical stimulation, vasopneumatic devices, paraffin bath, microwave, whirlpool, diathermy [e.g., microwave], infrared, ultraviolet, electrical stimulation [manual], iontophoresis, contrast baths, ultrasound, hubbard tank, unlisted) |
| 97124 | Massage (e.g., stroking, compression, percussion) |
| 97780, 97781 | Acupuncture with or without electrical stimulation (old codes) |
| 97810–97814 | Acupuncture with or without electrical stimulation, initial or additional 15 minutes of treatment |

continued

Table TA.A6 Grouping Procedure Codes of Physical Medicine Services (continued)

| Procedure Code | Description |
|---|--|
| Physical modalities, continued | |
| S8930 | Electrical stimulation of auricular acupuncture points |
| A4595 | Electrical stimulation supplies |
| E0720, E0730 | Transcutaneous electrical nerve stimulation (TENS) device |
| E0770 | Functional electrical stimulator, transcutaneous stimulation of nerve and/or muscle groups, any type, complete system, not otherwise specified |
| E0941 | Gravity assisted traction device |
| G0281–G0283 | Electrical stimulation, unattended |
| S8948 | Application of a modality (requiring constant provider attendance) |
| S9090 | Vertebral axial decompression, per session (2020 code) |
| Manual therapy services (MT) | |
| 97140 | Manual therapy techniques (e.g., mobilization, manipulation, manual lymphatic drainage, manual traction) |
| 98925–98929 | Osteopathic manipulative treatment (OMT), depending on the number of body regions involved |
| 98940–98943 | Chiropractic manipulative treatment (CMT), depending on the number of body regions |
| S8990 | Physical or manipulative therapy performed for maintenance rather than restoration |
| Other physical medicine services, not classified above (OTH) | |
| 97000–97004 | Old evaluation-measurement code |
| 97161–97163 | Physical therapy evaluation, by level of complexity (i.e., low, moderate, and high) |
| 97164–97165 | Re-evaluation of physical therapy established plan of care; occupational therapy evaluation |
| G8509, G8730, G8731, G8939 | Pain assessment documented |
| 95833, 95834 | Muscle testing, total evaluation of body, excluding or including hands |
| 95851 | Range of motion measurements and report |
| 97750, 97751 | Physical performance test or measurement |
| 97752 | Muscle testing with torque curves during isometric and isokinetic exercise: mechanized or computerized evaluations with print out |
| 97755 | Assistive technology assessment (e.g., to restore, augment, or compensate for existing function), direct one on one contact |
| S9451 | Exercise class by a non-physician provider |
| 97720, 97721 | Extremity for strength, dexterity, or stamina, initial or additional visit |

Note: Four broad categories of physical medicine services are active therapy services (ATS), passive physical modalities (PPT), manual therapy (MT), and other services (OTH), which were identified based on the CPT-4 codes and Healthcare Common Procedure Coding System (HCPCS) codes. Since hospital revenue codes (i.e., R codes) do not provide specific information of service type, we excluded services that were provided in and billed for by hospitals from the analysis.

For our studies on physical medicine treatment, we included some services that are not typically considered PM services, such as work hardening and conditioning (part of occupational therapy). We included these services because we focus on services that are used in practice to help workers recover from their LBP injuries and return to work. Table TA.A6 also lists chiropractic manipulative treatment (CMT) services, which are used by chiropractors for billing chiropractic manipulations. This study describes provider patterns of these PM services.

PT services include evaluation/measurement, functional assessment, physical modalities (e.g., hot/cold packs, electric stimulation, massage, traction, and acupuncture), “hands-on” treatment (e.g., chiropractic manipulative treatment, manipulation and mobilization, soft-tissue massage, manual traction, and trigger

point therapy), and active therapies (e.g., therapeutic exercises, physical therapy related education and training, active counseling, and work hardening).³ We also separated out physical medicine services into those provided by chiropractors (i.e., chiropractic physical medicine services) and those provided by non-chiropractic physical medicine providers (i.e., non-chiropractic physical medicine services). We did so by using the WCRI provider type as described in Chapter 2. Table TA.A7 shows the frequency and payment distribution of physical medicine services by type, between chiropractic physical medicine and non-chiropractic physical medicine services.

Table TA.A7 Frequency and Payment Distribution by Service Type: Chiropractic versus Non-Chiropractic Physical Medicine Services

| | Percentage of PM Services | | Percentage of PM Payments | |
|---|------------------------------|--------------------------|------------------------------|--------------------------|
| | Non-Chiropractic PM Services | Chiropractic PM Services | Non-Chiropractic PM Services | Chiropractic PM Services |
| Hands-on treatment (e.g., spinal adjustment, manipulation and mobilization) | 14% | 43% | 13% | 50% |
| Physical modalities (e.g., hot/cold packs, electric stimulation, traction) | 18% | 33% | 10% | 20% |
| Active therapies (e.g., exercises) | 63% | 23% | 66% | 26% |
| Assessment and measurement | 4% | 0% | 10% | 2% |
| Other PM services, not otherwise classified | 0% | 1% | 2% | 2% |

Notes: The underlying data are detailed transactions of physical medicine services provided by chiropractors or non-chiropractic physical medicine providers, among medical claims receiving physical medicine services. Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. Pooled data of 28 states.

Key: LBP: low back pain; PM: physical medicine.

For this study, we focused on provider patterns of PM treatment.⁴ PM services can be performed by different providers, including physical therapists, chiropractors, osteopathic physicians, and other providers. This study focuses on comparing provider patterns of PM treatments between chiropractic and non-chiropractic care for two reasons. First, our data provide a clear distinction between chiropractors and non-chiropractic providers, but data on provider specialties have a different level of detail, depending on the data source, that does not support a consistent distinction between physical therapists and osteopathic physicians and other providers. Second, PM services by osteopathic physicians and other providers are infrequent, as we observe in our data, and a vast majority of the non-chiropractic PM services are provided by physical therapists. For simplicity and clarity, we use the terms *chiropractors* and *non-chiropractic providers* to describe the types of PM providers and use *physical therapists* interchangeably with *non-chiropractic PM providers*.

Physical therapy and chiropractic care both involve licensed professions with extensive education and training. Physical therapists and chiropractors share the same goal of achieving pain relief and function

³ Conventionally, work hardening is part of occupational therapy instead of physical therapy. We include work hardening as part of PM and related services for our studies because these services are an intrinsic part of the services used for treating workers and facilitating return to work.

⁴ There are several key aspects of physical medicine treatments, including timing of initiation, type of provider and services, frequency, duration, and intensity of PT services. Some of these physical medicine service patterns were reported in Wang, Mueller, and Lea (2020 and 2021). In this study, we focus on provider patterns of PM services.

restoration without invasive procedures, but differ in terms of focus and approach. Chiropractors establish a diagnosis and formulate a treatment plan that usually focuses primarily on spinal manipulation, and also may include other manual therapies, exercise, patient education, and nutrition.^{5, 6} A physical therapist (a.k.a., physiotherapist) focuses on improving a patient's ability to move and function without pain and therefore improve the quality of life. To achieve this goal, a physical therapist evaluates the patient then formulates a treatment plan that may include patient education on ways to stay active and healthy. They also provide instructions for stretches and exercises, as well as physical modalities to help address pain and facilitate return of joint motion and muscle strength. Many physical therapists receive additional training and are licensed to perform manual therapies; they are often referred to as manual physical therapists.

We have four broadly-defined types of PM services: active therapy services, physical modalities, manual therapy (including chiropractic manipulation treatments), and other services (Table TA.A6). Most treatment guidelines provide strong evidence that supports the use of active therapies and limits the use of physical modalities to initial care when necessary. We see that active therapy services were billed for and paid by workers' compensation payors when non-chiropractic providers provided such services. However, the frequency in the use of these services was considerably low among chiropractors, compared with non-chiropractic providers. It could be that some chiropractors focused more on manipulations and mobilization services and less on active therapy exercises, and it could also be that some chiropractors provided instructions on exercise and home health care during the treatment but did not bill for this component of the services.

OTHER COMMON SERVICES FOR TREATING LOW BACK PAIN

Other common services for treating LBP include medication therapy (i.e., opioid prescriptions and paid medications), MRI, pain management injections, and lumbar surgery. In this study, we focused on nonsurgical LBP claims because there were a small percentage of LBP claims that had lumbar surgery (see CPT-4 codes listed in Table TA.A8) and those surgical claims are more complex and need a different design to study provider and treatment patterns.

Like non-chiropractic physicians, nurse practitioners, and physician assistants, chiropractors provide and bill for evaluation and management services (CPT codes 99201–99205 and 99211–99215).⁷ We expect to see chiropractic services with these E&M codes for new patients and periodically over the duration of chiropractic treatment. However, there was a percentage of claims with chiropractic-only PM that did not have E&M services by chiropractors, and the percentage was noticeable for some states. The reason that we do not see chiropractors getting paid for E&M services among workers with chiropractic PM care is likely either because they provided an E&M service but did not bill for it, especially when the service was performed during chiropractic manipulation treatment, or because they were not reimbursed for the E&M services they billed for.

In this study, we also evaluated the likelihood of use of opioids, MRI, and pain management injections, as

⁵ Spinal manipulation, also known as chiropractic adjustment, refers to a high-velocity, short lever arm thrust that is applied to abnormal vertebra with the goal of improving functionality.

⁶ Chiropractic mobilization refers to low velocity manipulation, movement, and stretching of the muscles and joints, with the goal of increasing the range of motion within those areas. In addition to chiropractic manipulation and mobilization, there are several other common forms of chiropractic therapy, including heat and ice therapy, exercise focusing on stretching and strengthening the back, massage, and dietary management.

⁷ Physical therapists are not allowed to bill for E&M codes. There are a set of PM codes that are to be used by physical therapists for evaluation, assessment, and measurement services they provide (see Table TA.A6).

part of the outcomes. Chiropractors cannot prescribe opioids, but they can order MRI and pain management injections. We explored the identification of ordering providers for these services at an early stage of our analysis but were not convinced that we could use the indicator reliably for the study. Based on our review and the detailed data, we believe that ordering MRI and injections was less common among chiropractors than non-chiropractic medical providers. This observation prompted us to divide the LBP claims with chiropractic exclusive PM into two groups: chiropractic-only PM/EM and chiropractic-only PM. The chiropractic-only PM/EM group includes LBP claims for which chiropractors provided all PM and E&M services (referred to as exclusive chiropractic care). The chiropractic-only PM group has LBP claims with PM services provided by chiropractors only, but E&M services were provided by non-chiropractic physicians and other non-chiropractic providers (with or without chiropractors providing E&M services). In the latter group, it is more likely that non-chiropractic physicians were managing overall care and responsible for prescribing opioids and ordering MRI and injections.

Table TA.A8 provides CPT codes we used to identify MRI, pain management injections, and low back surgery.

Table TA.A8 CPT-4 Codes for MRI, Pain Management Injections, and Low Back Surgery

| Medical Procedures | CPT-4 Codes |
|----------------------------|--|
| MRI for low back | 72148 ^a |
| Pain management injections | Epidural steroidal injections: 62322, 62323, 62326, 62327, 64484 Facet injections: 64493, 64494, 64495, 64635, 0216T, 0217T, 0218T Trigger point: 20552, 20553 Other injections: 62282, 62292, 62303, 62304 |
| Low back surgery | 63005, 63011, 63012, 63017, 63030, 63035, 63042, 63044, 63047, 63048, 63056, 63057, 63077, 63081, 63272, 63277; 20931, 20936-7, 22551, 22558, 22585, 22612, 22614, 22630, 22632-4, 22830, 22840, 22842, 22845, 22846, 2285x. |

^a CPT code 72148 is the common code billed for MRI, spinal canal and contents, lumbar, without contrast material. Note that code 72149 (MRI, spinal canal and contents, lumbar, with contrast material) and 72158 (MRI, spinal canal and contents, without contrast material, followed by contrast material and further sequences; lumbar) were less frequent but could indicate a case with existing low back pain and prior lumbar surgery. Less than 1 percent of the LBP-only claims had either of the two codes; these claims were excluded from our analysis.

Key: CPT: Current Procedural Terminology; LBP: low back pain; MRI: magnetic resonance imaging.

TECHNICAL APPENDIX B

SEVERITY, COMORBIDITIES, AND PATIENT COMPLEXITY

One of the challenges for an observational study that examines the effect of certain interventions on outcomes is the lack of information on severity and comorbidities. This compromises the comparability of the outcomes between the treatment and comparison groups. Treating providers make medical decisions regarding what treatment would be beneficial for the patient, taking into account the medical condition being treated, comorbidities, and other characteristics of the patient that may affect the treatment and outcomes. There is an increasing number of studies exploring the concept and measurement of patient complexity as a way to address the severity issue beyond clinical or medical severity.

We measured severity and comorbidities to the extent we could. We identified comorbidities based on a set of pre-designated ICD-10 codes and checked across multiple ICD-10 fields in the data.¹ For comorbidities, we developed an ICD-10 comorbidity list specific to studies on physical medicine treatment after reviewing the comorbidity instruments in the literature.² This list was used to identify LBP claims with comorbidities in our study on early timing of physical therapy (Wang, Mueller, and Lea, 2020). Table TA.B1 provides the ICD-10 codes we used to create a comorbidity indicator for workers who received PM treatments.

¹ Although some may reflect a practice pattern that may not be in concordance with evidence-based medicine, it is conceivable that a number of such claims may represent more serious low back pain that was not properly coded in the administrative data.

² Among several comorbidity indexes we reviewed, the Charlson Comorbidity Index (CCI) (Charlson et al., 1987) and the Elixhauser Comorbidity Index (ECI) (Elixhauser et al., 1998) were based on the International Classification of Diseases diagnosis codes recorded in the administrative data. The CCI has 17 categories, including heart disease, pulmonary disease, diabetes with or without chronic complications, tumor and malignancy, AIDS/HIV, etc. The ECI originally had 30 categories, used primarily for predicting hospital resource use and mortality. Quan et al. (2005) established ICD-9 and ICD-10 lists for 31 categories of the ECI. In addition to several more serious diseases and conditions found in the CCI, it also includes several conditions relevant to our study, including obesity, alcohol and drug abuse, psychoses, and depression. The ICD-10 comorbidity list we established partially reflects these categories.

Table TA.B1 ICD-10 List of Comorbidities for LBP-Only Claims with Physical Medicine Treatment

| Comorbidity Type | ICD-10 Coding Description |
|------------------------|--|
| Alcohol or drug abuse* | Alcohol abuse: F10.x, E52, G62.1, I42.6, K29.2x, K70.x, T51.x, Z50.2, Z71.4x; Drug abuse: F11.x–F16.x, F18.x, F19.x, F55.x, Z71.5x, Z72.2 |
| Chronic pain | G4422, G4432, G892, G8921, G8922, G8928, G8929, G894, and R5382 (ICD-10 codes indicating chronic pain or symptom within 3 months of injury) |
| Diabetes* | Diabetes due to underlying condition: E08.x; Drug or chemical induced diabetes: E09.x; Type 1 diabetes: E10.x; Type 2 diabetes: E11.x |
| Obesity | Obesity: E66, E66.0, E66.01, E66.09, E66.1, E66.2; Overweight: E66.3, E66.8, E66.9 |
| Psychosocial issues* | Anxiety and depression: F31.3x, F32.x - F34.x, F41.x, F43.x, F48.1, F48.8, and F48.9; Psychoses: F20.x, F22–F25, F28.x, F29.x, F30.1x, F30.2, F31.1x; Pain or problem related with psychosocial factors: F454, F4541, F4542, Z658, Z659; Adult psychological abuse: T74.3x, T76.3x; Anti-social: Z72.81x |
| Smoking | Tobacco use: Z72.0 |
| Lifestyle issue | (Other than smoking): Z72.x Lack of physical exercise: Z72.3 |

Notes: The ICD-10 comorbidity list we developed was partially based on the ICD-10 codes selected for the CCI (Charlson et al., 1987) and ECI (Elixhauser, 1998; Quan et al., 2005).

* In these comorbidity categories (alcohol or drug abuse, diabetes, and psychosocial issues), we identified more than 100 ICD-10 codes that indicate serious conditions or complications (e.g., diabetes with hypoglycemia or ketoacidosis, substance abuse with psychotic disorders, and bipolar disorders). These conditions, if present in the patient's record, are not suitable for physical medicine treatment. We further excluded a small number of claims with these conditions from the study.

Family history and hypertension are not considered comorbidities in our study.

Key: CCI: Charlson Comorbidity Index; ECI: Elixhauser Comorbidity Index; ICD: International Classification of Diseases; LBP: low back pain.

The major categories of comorbidity we identified include alcohol or drug abuse, diabetes, obesity, psychosocial factors, and smoking. We also identified chronic pain conditions and symptoms if any of the chronic conditions were mentioned in the medical services data for the initial three months of treatment after the onset of low back pain. We use the three-month time window to make sure that the chronic pain mentioned was likely due to a pre-existing condition, rather than chronic pain arising late in the treatment. Table TA.B2 shows the frequency of claims that had at least one of these comorbid conditions, separately for LBP-only claims and neuro back claims.

Table TA.B2 Identifying Comorbidities Using ICD-10 Codes, All LBP Claims Included for the Study

| Type of Comorbidity | LBP Claims with Nerve Involvement with > 7 DLT | LBP Claims with Nerve Involvement with ≤ 7 DLT | LBP-Only Claims with > 7 DLT | LBP-Only Claims with ≤ 7 DLT |
|---|--|--|------------------------------|------------------------------|
| % of claims with ICD-10 codes indicating the following comorbid conditions | | | | |
| Alcohol or drug abuse* | 1.0% | 0.3% | 0.2% | 0.1% |
| Chronic pain within first 3 months | 3.5% | 2.0% | 1.1% | 0.6% |
| Diabetes* | 2.4% | 1.1% | 1.1% | 0.6% |
| Lifestyle issues (e.g., lack of physical exercise) | 0.0% | 0.0% | 0.0% | 0.0% |
| Obesity | 2.6% | 1.1% | 1.0% | 0.3% |
| Psychosocial issues* | 3.1% | 1.1% | 1.1% | 0.5% |
| Smoking | 1.0% | 0.5% | 0.5% | 0.3% |
| At least one of the above | 11.6% | 5.6% | 4.6% | 2.2% |

Notes: We do not consider hypertension and family history to be comorbidities since these are less likely to make a difference for PM treatment. The percentages of claims with each type of identified comorbidity does not add up to the percentage of claims with comorbidities because the claims with types of comorbidities are not mutually exclusive.

* In these comorbidity categories (alcohol or drug abuse, diabetes, and psychosocial issues), we identified more than 100 ICD-10 codes that indicate serious conditions or complications (e.g., diabetes with hypoglycemia or ketoacidosis, substance abuse with psychotic disorders, and bipolar disorders). These conditions, if present in the patient's record, are not suitable for physical medicine treatment. We further excluded a small number of claims with these conditions from the study.

Key: DLT: days of lost time; ICD: International Classification of Diseases; LBP: low back pain; PM: physical medicine.

Based on these identified comorbidity categories, we created two indicators. One indicates whether a claim had at least one comorbidity and the other indicates whether the claim had two or more comorbid conditions. We used these comorbidity indicators to adjust for different comorbidity mix of claims across different treatment patterns.

One may be concerned about how well we capture comorbidities in workers' compensation data since treatments of comorbidities are not covered under workers' compensation.³ Based on our review of detailed medical data, we believe that some providers do code comorbidities and the comorbidity diagnoses are kept in the detailed medical transaction data, especially when the ICD-10 codes are kept for multiple diagnoses on the bill. However, the lack of consistent recording of comorbidities and certain data system issues may result in the understatement of the prevalence of comorbidities. Nonetheless, even if we cannot fully capture comorbidities using the administrative data, we can use the relative level in the indicator between the treatment and comparison groups to adjust for the observed differences.⁴ The reader who is interested in more discussion is referred to the early timing of physical therapy report (Wang, Mueller, and Lea, 2020, Technical Appendices B and C), where we provide a more detailed description of what we see in our data and the results of our sensitivity analysis.

In Chapter 2, we discuss the factors we controlled for in our statistical analysis in the framework of

³ This concern is shared by a number of system practitioners who believe that there is just not enough in the workers' compensation data to reasonably measure comorbidities. Since the treatments of comorbidities are normally not covered by workers' compensation, one does not expect to see the workers' compensation data maintain ICD-10 codes indicating comorbidities for workers.

⁴ The relative differences in the comorbidity indicators can be seen in Chapters 4 and 5. Technical Appendix B of the early physical therapy study by Wang, Mueller, and Lea (2020) has a more detailed discussion about capturing comorbidities in our data.

Andersen's behavioral model. The framework groups all the covariates and confounding factors into three categories: predisposing factors, need factors, and enabling factors (see Chapter 2). The need factors in Andersen's model are broadly defined to include patient's perceived need for medical care, evaluated need by medical providers, and the need that could be determined by how complex the patient's situation is. The concept of patient complexity, established in recent years, refines the need factors that indicate how complex the patient situation is. Several studies measured patient complexity based on the patient's past experience, including pre-conditions and utilization patterns of medical services prior to the current episode of care. We were able to construct several variables to control for the type of LBP pain, lost time, pre-physical therapy injections (a proxy for medical severity), comorbidities, and workers' demo-socio-economic characteristics. These, to some extent, may represent the level of patient complexity. However, we do not directly observe pre-conditions and prior medical utilization in the workers' compensation medical data.

TECHNICAL APPENDIX C

STATISTICAL ANALYSES

In Chapter 5, we presented some results from our statistical analysis that compares utilization of medical services, costs, and outcomes between chiropractic and non-chiropractic care. Instead of reporting coefficient estimates of the treatment variables and other variables included in the regressions, we interpret the results by computing the average predicted values for individual claims across all claims included in the analysis, holding constant the factors we controlled for in the regression, and only allow the treatment variable to vary. This technical appendix describes what we did in our statistical analysis, including the statistical techniques we applied to construct the comparison group, statistical adjustments applied to produce comparative results, as well as key considerations as to what factors we include in modeling the choice of chiropractic care and adjustments for the results on outcomes. We also discuss several technical issues and our sensitivity analyses that aimed at addressing these issues.

PROPENSITY SCORE MATCHING TO CONSTRUCT A COMPARISON GROUP

Propensity score matching and propensity score weighting are two common approaches used to balance different characteristics of the cases between treatment and comparison groups. The propensity score matching approach allows for the construction of comparison groups, by identifying non-treated observations with a similar likelihood of being treated. However, this approach also reduces sample size, limiting the average treatment effect to those who are equally likely to be treated. On the other hand, the propensity score weighting approach helps achieve balance in the factors controlled between the two treatment and comparison groups, producing the average treatment effect for the entire sample. The critical assumption for this approach to be successful is that there exists a sufficient overlap in the distribution of propensity scores between the treatment and comparison groups. This is not the case in our study on chiropractic care. We saw quite a number of claims in the non-chiropractic-only PM group that had very low propensity scores that did not overlap the propensity scores for individual claims in the chiropractic-only PM/EM or chiropractic-only PM groups, which is consistent with Weeks et al. (2015b).¹ Because of this, we used the propensity score matching approach to construct a comparison group, separately for claims with chiropractic-only PM/EM and for claims with chiropractic-only PM. The comparison group is a small subset of non-chiropractic-only PM claims that may have similar characteristics that make them have similar probabilities of receiving chiropractic care to individual claims in the chiropractic exclusive PM groups.

The first stage propensity score modeling was to determine the key factors that likely influence the likelihood of receiving chiropractic care (versus non-chiropractic care), using a set of variables that affect choice

¹ Weeks et al. (2015b) applied both approaches to balance demographics of patients between patients who received only chiropractic manipulative treatment (CMT) services and those who received no CMT care, and found that patients who used only CMT had different characteristics from those who did not.

of chiropractic care and outcomes. Table TA.C1 presents the estimates of the logistic models, with dependent variables, separately, on whether a claim received chiropractic-only PM/EM or whether a claim received chiropractic-only PM.

Table TA.C1 First Step Propensity Score Estimation—Results of Logistic Regressions

| | Likelihood of Having Chiropractic-Only PM/EM | Likelihood of Having Chiropractic-Only PM |
|---|---|--|
| Intercept | -4.7173 *** | -2.2563 *** |
| Likelihood of having chiropractic care in the local area ^a | 3.2691 *** | 4.0109 *** |
| Severity and comorbidity | | |
| 1 if neuro back; 0 if LBP only | -0.4146 *** | 0.0326 |
| 1 if incurred > 7 days of lost time; 0 if ≤ 7 days of lost time | -1.0127 *** | -0.1285 *** |
| 1 if claim has 2 or more comorbidities | -1.3494 *** | -0.1887 |
| 1 if claim has mobility diagnosis | -3.0765 *** | -2.8660 *** |
| Worker characteristics | | |
| Age (reference = 35–44) | | |
| ≤ 24 years old | 0.0317 | -0.0581 |
| 25–34 | 0.0374 | 0.0221 |
| 45–54 | 0.1223 ** | -0.0519 |
| ≥ 55 years old | 0.2782 *** | -0.0486 |
| Missing information on age | 0.6379 ** | -0.1291 |
| 1 if male worker (0 = female) | -0.1348 *** | 0.1325 *** |
| 1 if married (0 = single) | 0.0661 | 0.1009 ** |
| Other | 0.0125 | -0.2479 *** |
| Missing information on marital status | 0.1754 *** | 0.5335 *** |
| Average weekly wage in log form | -0.0191 *** | 0.0152 ** |
| Tenure with preinjury employer (reference = 2–5 years) | | |
| ≤ 2 years | -0.1605 *** | 0.0709 |
| 5–10 years | -0.0154 | -0.0023 |
| 10–20 years | 0.1358 * | -0.1351 ** |
| > 20 years | 0.1698 ** | -0.0054 |
| Missing information on tenure | 0.0316 | 0.2089 *** |
| Industry group (reference = clerical and professional) | | |
| Manufacturing | -0.9477 *** | -0.1879 ** |
| Construction | -0.4001 *** | 0.0651 |
| High-risk industry | -0.7273 *** | -0.2634 *** |
| Trade | -0.4400 *** | -0.2455 *** |
| Low-risk industry | -0.2141 *** | -0.0677 |
| Other industries | -0.5487 *** | -0.1218 |
| Missing information on industry | -0.3488 | 0.0293 |
| Claim and case management | | |
| 1 if claim involved attorney | -0.3637 *** | 0.2512 *** |
| 1 if claim received PT from SBE provider as office visit | 1.4945 *** | 2.2769 *** |
| Time from injury to initial medical visit | 0.0053 *** | -0.0024 ** |

continued

Table TA.C1 First Step Propensity Score Estimation—Results of Logistic Regressions (continued)

| | Likelihood of Having Chiropractic-Only PM/EM | Likelihood of Having Chiropractic-Only PM |
|--|---|--|
| Local environmental factors | | |
| 1 if worker resides in a rural area | 0.7380 *** | 0.0550 |
| Number of physical therapists per 100,000 population | -0.0010 | 0.0002 |
| Number of chiropractors per 100,000 population | 0.0121 *** | 0.0108 *** |
| % of population in worker's county who have college or higher degree | -3.4582 *** | -3.6414 *** |
| Median household income in \$1,000 | 0.0000 *** | 0.0000 |
| % of population under the federal poverty line | -0.4097 | -1.5403 |
| % of population without health insurance | -4.7799 *** | -6.0507 *** |
| Local unemployment rate | 0.0983 *** | 0.0048 |
| % of population who engaged in physical activities | 1.7362 * | -1.6779 |
| State-specific effect (reference = MD) | | |
| CA | -2.5909 *** | -0.5798 *** |
| CT | -0.4359 *** | -0.7977 *** |
| DE | 0.0753 | 0.5483 ** |
| IA | -0.3925 ** | -2.0978 *** |
| IL | 0.2422 * | -0.5753 *** |
| KS | 0.4365 ** | -0.7428 *** |
| KY | 0.4975 *** | -0.7602 *** |
| LA | 0.3819 * | -0.1544 |
| MA | 0.9042 *** | 0.1496 |
| MN | 0.3886 ** | -1.1542 *** |
| NM | -0.1346 | -0.3919 ** |
| NY | 0.7706 *** | -0.4594 *** |
| PA | -0.0223 | -0.3357 ** |
| TX | -1.2819 *** | -1.1857 *** |
| WI | 0.6884 *** | -0.9898 *** |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. Pooled data of 16 states.

^a This variable is used to control for the likelihood of receiving chiropractic care at the hospital referral region level. See Technical Appendix C for more details.

*** statistically significant at the 1 percent level, ** statistically significant at the 5 percent level, * statistically significant at the 10 percent level.

Key: EM: evaluation and management; LBP: low back pain; PM: physical medicine; SBE: same billing entity (for pre-PM office visits and initial PM).

The claims included are LBP-only and neuro back claims that received medical treatment regardless of whether the workers had lost time. We controlled for neuro back and seven-day lost time status as well as other variables (Table TA.C1). The key variable in the estimation is the variable called “likelihood of having chiropractic care in the local area” (Table TA.C1). We constructed this variable to capture an individual worker’s likelihood of having chiropractic care, based on the experience of all other workers in the same hospital referral region (HRR) but independent of the worker’s own experience. Although imperfect, we believe that this variable helps control for differences in the attitude and perception of chiropractic care across geographic areas as well as local access to chiropractic care. A more detailed description of the variables we used in the analysis can be found later in this technical appendix.

The estimated results from Table TA.C1 suggest that several factors had large and significant effects on the likelihood of having chiropractic care for individual workers with LBP:

- Local access to and perception of chiropractic care had a large and significant effect on the propensity of having chiropractic care, either exclusive chiropractic care (estimated coefficient 3.2691, $p < 0.0001$) or chiropractic-only PM care (4.0109, $p < 0.0001$). The effect of chiropractor supply was small, but significant.
- The impacts of severity and comorbidity were large and significant, especially for exclusive chiropractic care (i.e., chiropractic-only PM/EM). The estimated coefficients suggest that LBP workers with neuro findings were less likely to have chiropractic-only PM/EM (-0.4146, $p < 0.0001$), but this was not a significant factor for those who had chiropractic-only PM care. Whether there was more than seven days of lost time significantly reduced the likelihood of having chiropractic care in both cases, which may in part reflect the severity of LBP as well as the desire to avoid lost time. Having multiple comorbidities reduced the likelihood of having exclusive chiropractic care—the impact was large and significant for the chiropractic-only PM/EM versus non-chiropractic-only PM claims, but not significant for the chiropractic-only PM versus non-chiropractic-only PM claims. It appears that workers who had compromised mobility issues were less likely to have chiropractic care (a large and significant impact), but this may reflect differences in diagnosis or coding.
- The effect of demo-socio-economic characteristics on the likelihood of chiropractic care appeared to be small and less significant. In general, older women were more likely to have exclusive chiropractic care. Workers with jobs in the clerical and professional industry (which is the reference) tended to be more likely to have chiropractic-only PM/EM.
- Chiropractic care is associated with same-billing-entity PM treatment, which is conceivable because most chiropractors treat patients at initial visits.
- It is interesting to note that there are opposite effects of attorney involvement on the likelihood of having exclusive chiropractic care (i.e., chiropractic-only PM/EM) and chiropractic-only PM with non-chiropractic physicians managing care (chiropractic-only PM). Conceivably, workers who did not have compensability issues and who preferred to receive chiropractic care and were permitted to do so might well choose exclusive chiropractic care, while those who also preferred chiropractic care but had a compensability issue might have chosen to see non-chiropractic physicians for evaluation and management and receive chiropractic manipulation treatment. Attorneys may also be involved in issues related to care. Unfortunately, we could not identify specific reasons for attorney involvement and we did not have data consistent across the data sources that indicates the timing of attorney involvement.
- Several states have distinctive provider patterns of PM care. For example, workers in California had a much lower likelihood of having exclusive chiropractic care. In California, most LBP workers with chiropractic PM care also had E&M services by non-chiropractic providers and most were likely to have PM care in conjunction with non-chiropractic providers in a cross-disciplinary setting. By contrast, workers in Minnesota and Wisconsin were more likely to have exclusive chiropractic care and less likely to have chiropractors provide PM care with non-chiropractic physicians managing care.

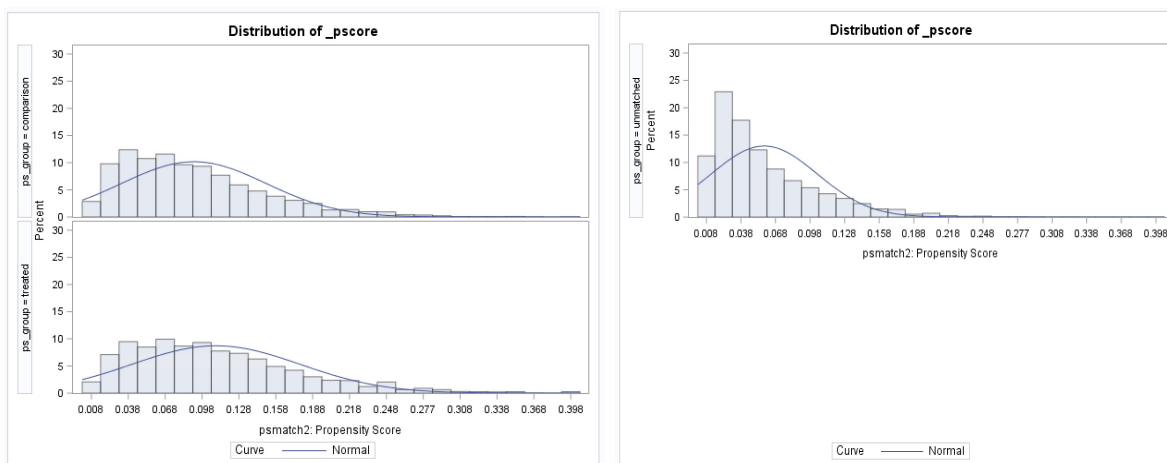
Note that we included 16 of the 28 states in the analysis of patterns and outcomes of chiropractic care. These 16 states had more than 5 percent of LBP claims that received chiropractic care. Most of these states are employee choice or employee limited choice states where workers may choose their treating doctors. In this case, the patient's preference and care-seeking behavior may be largely reflective of their perceptions of chiropractic care based on their knowledge and past experiences. Among the 16 states, 5 states were characterized as employer control states where employers and insurers are given control of provider selection.

The prevalence of chiropractic care in these 5 states was among the lowest and the impact of employer control on the choice of chiropractic care was captured by the state fixed effect (i.e., state dummies in Table TA.C1).

Once we had the propensity models, we computed, for individual claims, the propensity score or the likelihood of individual claims having received chiropractic care, which is a composite score computed based on the variables included in the logistic model and estimated coefficients of each variable included. The propensity score matching algorithm is to find for each claim in the chiropractic-only PM/EM group, for example, one or more claims in the non-chiropractic-only PM group that have propensity scores closely resembling that of the matching case. We applied the nearest neighbor approach to construct the comparison group and searched for the number of neighbors that help produce a reasonable balance in the factors between the treatment and comparison with an adequate sample size. We chose to use the three nearest neighbors based on the test results. In the process of propensity score matching, a set of frequency weights were created for individual claims in the treatment and the matched comparison group that reflect the frequency of matched and matching cases. The propensity score estimation and matching were done in Stata using the psmatch2 command; and the second stage estimations were in SAS.²

Figure TA.C1 shows the propensity score distribution for the treated (chiropractic-only PM/EM), the comparison (non-chiropractic-only claims that closely matched cases in the chiropractic-only PM/EM group), and the unmatched non-chiropractic-only PM claims. Figure TA.C2 shows the propensity score distribution for the treated (chiropractic-only PM), the comparison (non-chiropractic-only PM claims that closely matched cases in the chiropractic-only PM group), and the unmatched non-chiropractic-only claims.

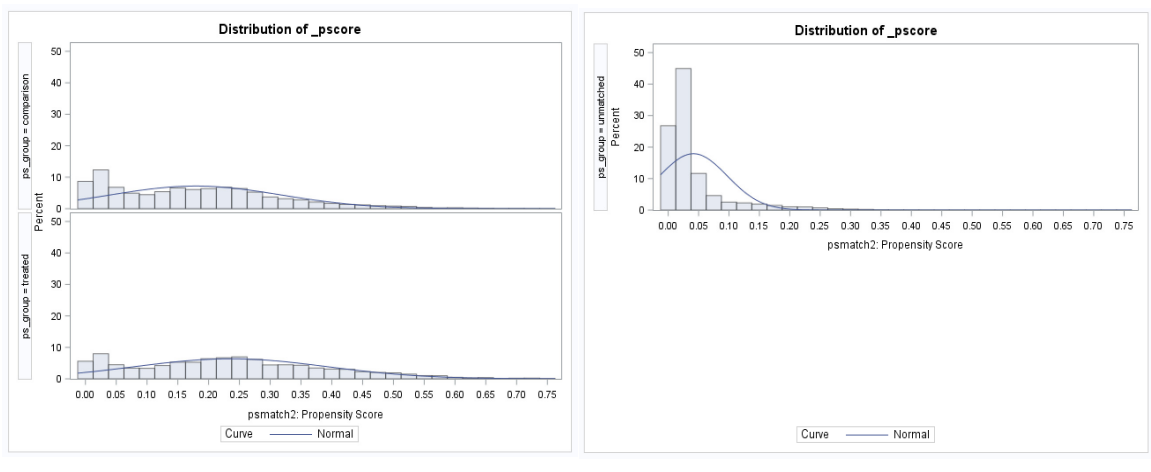
Figure TA.C1 Distribution of Propensity Scores for Chiropractic-Only PM/EM, Matched and Unmatched Non-Chiropractic-Only PM Groups



Key: EM: evaluation and management; PM: physical medicine.

² Note that Stata also has a command teffects that can be used in conjunction with psmatch2 to produce more accurate estimates. We tested this using the outcome variable on medical costs and found that the results of the teffects analysis were similar to the results we obtained from the SAS program that streamlines the estimation and computation of the adjusted outcome variables.

Figure TA.C2 Distribution of Propensity Scores for Chiropractic-Only PM, Matched and Unmatched Non-Chiropractic-Only PM Groups



Key: PM: physical medicine.

As can be seen in these two figures of propensity score distribution, the unmatched group of claims with non-chiropractic-only care had very different propensity scores. The matched comparison group is the set of claims we use to compare utilization of medical services, costs, and TD duration between chiropractic and non-chiropractic PM treatment.

Tables TA.C2 and TA.C3 provide descriptive statistics of the variables included in the propensity score estimation, weighted by the frequency weights. These tables show that the average characteristics of claims between the treatment group (chiropractic-only PM/EM or chiropractic-only PM) and the comparison group (the matched non-chiropractic-only PM claims) are similar, suggesting balance was achieved.

Table TA.C2 Characteristics of Claims between Chiropractic-Only PM/EM and Matched Non-Chiropractic-Only PM Groups^a

| Measure | Chiropractic-Only PM/EM (treatment) | Non-Chiropractic-Only PM (matched for comparison) |
|--|-------------------------------------|---|
| Number of claims | 4,547 | 6,716 |
| Severity and comorbidity | | |
| % with nerve involvement | 18% | 21% |
| % with more than 7 DLT | 14% | 15% |
| % had 2+ comorbidities | 0.3% | 0.4% |
| % had mobility diagnosis | 0.0% | 0.1% |
| Worker characteristics | | |
| Age | 44 | 43 |
| 24 or younger | 9% | 9% |
| 25–34 | 21% | 21% |
| 35–44 | 20% | 21% |
| 45–54 | 25% | 26% |
| 55 or older | 24% | 23% |
| Age missing | 1% | 0% |
| % female | 46% | 47% |
| % married | 29% | 28% |
| % single | 29% | 28% |
| % other | 10% | 10% |
| Missing marital status | 33% | 34% |
| Average weekly wage | \$756 | \$744 |
| Average tenure in years | 8.2 | 8.4 |
| % tenure missing | 0.2 | 0.2 |
| Attorney involvement | | |
| % with attorney involvement | 3% | 3% |
| % SBE for E&M visit(s) and first PM visit | 75% | 74% |
| Industry grouping | | |
| Manufacturing | 15% | 14% |
| Construction | 6% | 6% |
| Clerical and professional | 13% | 13% |
| High-risk industry | 22% | 22% |
| Trade | 19% | 19% |
| Low-risk industry | 19% | 21% |
| Other | 4% | 5% |
| Missing data | 0% | 0% |
| Environmental factors | | |
| Living in rural area | 18% | 18% |
| Number of physical therapists per 100,000 population | 65 | 65 |
| Number of chiropractors per 100,000 population | 39 | 40 |
| Median household income | \$61,154 | \$61,810 |
| % below federal poverty level | 5.5% | 5.4% |
| % without health insurance | 6.5% | 6.5% |
| Unemployment rate | 4.5 | 4.5 |
| % with physical activity | 78% | 78% |

continued

Table TA.C2 Characteristics of Claims between Chiropractic-Only PM/EM and Matched Non-Chiropractic-Only PM Groups^a (continued)

| Measure | Chiropractic-Only PM/EM (treatment) | Non-Chiropractic-Only PM (matched for comparison) |
|------------------------------|-------------------------------------|---|
| Composition of states | | |
| California | 4% | 5% |
| Connecticut | 2% | 2% |
| Delaware | 0% | 0% |
| Iowa | 2% | 2% |
| Illinois | 8% | 8% |
| Kansas | 1% | 1% |
| Kentucky | 3% | 2% |
| Louisiana | 1% | 1% |
| Massachusetts | 6% | 6% |
| Maryland | 2% | 2% |
| Minnesota | 28% | 27% |
| New Mexico | 1% | 1% |
| New York | 11% | 12% |
| Pennsylvania | 5% | 4% |
| Texas | 4% | 4% |
| Wisconsin | 21% | 22% |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. Pooled data of 16 states.

^a Claims with chiropractic-only PM/EM are those in the treatment group that received E&M and PM services by chiropractors only. The matched non-chiropractic-only PM is a comparison group which is a subset of all LBP claims with PM care by non-chiropractors only that matched individual claims in the chiropractic-only PM/EM group with a similar likelihood of having chiropractic-only PM/EM care. The propensity score matching was done in Stata. See Chapter 2 and Technical Appendix C for a description of the propensity score matching approach and construction of the comparison group.

Key: DLT: days of lost time; E&M: evaluation and management; LBP: low back pain; PM: physical medicine; SBE: same billing entity (for pre-PM office visits and initial PM).

Table TA.C3 Characteristics of Claims between Chiropractic-Only PM and Matched Non-Chiropractic-Only PM Groups^a

| Measure | Chiropractic-Only PM (treatment) | Non-Chiropractic-Only PM (matched for comparison) |
|--|----------------------------------|---|
| Number of claims | 4,530 | 8,563 |
| Severity and comorbidity | | |
| % with nerve involvement | 23% | 25% |
| % with more than 7 DLT | 30% | 33% |
| % had 2+ comorbidities | 0.9% | 1.1% |
| % had mobility diagnosis | 0.0% | 0.1% |
| Worker characteristics | | |
| Age | 41 | 41 |
| 24 or younger | 10% | 10% |
| 25–34 | 26% | 25% |
| 35–44 | 24% | 25% |
| 45–54 | 22% | 23% |
| 55 or older | 17% | 17% |
| Age missing | 0% | 0% |
| % female | 35% | 36% |
| % married | 24% | 24% |
| % single | 27% | 27% |
| % other | 8% | 8% |
| Missing marital status | 41% | 41% |
| Average weekly wage | \$746 | \$752 |
| Average tenure in years | 5.7 | 5.9 |
| % tenure missing | 0.2 | 0.2 |
| Attorney involvement | | |
| % with attorney involvement | 9% | 10% |
| % SBE for E&M visit(s) and first PM visit | 84% | 84% |
| Industry grouping | | |
| Manufacturing | 17% | 17% |
| Construction | 10% | 10% |
| Clerical and professional | 8% | 8% |
| High-risk industry | 25% | 25% |
| Trade | 19% | 19% |
| Low-risk industry | 15% | 15% |
| Other | 6% | 7% |
| Missing data | 0% | 0% |
| Environmental factors | | |
| Living in rural area | 6% | 6% |
| Number of physical therapists per 100,000 population | 57 | 58 |
| Number of chiropractors per 100,000 population | 32 | 32 |
| Median household income | \$63,619 | \$63,546 |
| % below federal poverty level | 6.2% | 6.2% |
| % without health insurance | 7.7% | 7.7% |
| Unemployment rate | 5.0 | 5.0 |
| % with physical activity | 78% | 78% |

continued

Table TA.C3 Characteristics of Claims between Chiropractic-Only PM and Matched Non-Chiropractic-Only PM Groups^a (continued)

| Measure | Chiropractic-Only PM (treatment) | Non-Chiropractic-Only PM (matched for comparison) |
|------------------------------|----------------------------------|---|
| Composition of states | | |
| California | 44% | 41% |
| Connecticut | 2% | 2% |
| Delaware | 1% | 1% |
| Iowa | 1% | 1% |
| Illinois | 5% | 5% |
| Kansas | 1% | 1% |
| Kentucky | 1% | 1% |
| Louisiana | 1% | 1% |
| Massachusetts | 6% | 6% |
| Maryland | 3% | 3% |
| Minnesota | 10% | 10% |
| New Mexico | 1% | 1% |
| New York | 7% | 8% |
| Pennsylvania | 5% | 4% |
| Texas | 6% | 7% |
| Wisconsin | 8% | 10% |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. Pooled data of 16 states.

^a Claims with chiropractic-only PM are those in the treatment group that received PM services by chiropractors only and received E&M services by non-chiropractic physicians (most of the cases also had E&M services by chiropractors). The matched non-chiropractic-only PM is a comparison group which is a subset of all LBP claims with PM care by non-chiropractors only that matched individual claims in the chiropractic-only PM group with a similar likelihood of having chiropractic-only PM care. The propensity score matching was done in Stata. See Chapter 2 and Technical Appendix C for a description of the propensity score matching approach and construction of the comparison group.

Key: DLT: days of lost time; E&M: evaluation and management; LBP: low back pain; PM: physical medicine; SBE: same billing entity (for pre-PM office visits and initial PM).

Two related issues are worth noting. First, the propensity score matching approach facilitates valid comparisons between the treatment and comparison groups only if the variables included in the propensity score estimation cover all the confounding factors or reasonably represent certain factors that are unobserved and unmeasured. There is a concern about our ability to measure all the confounding factors. For example, studies suggest that patients’ perception of and preference for chiropractic care strongly predict the likelihood of choosing chiropractic care. While some of these unobserved factors may be reflected in the demo-social characteristics of workers and other variables we controlled, we were not convinced that we fully controlled for medical severity and patient complexity (e.g., cognitive and psychosocial factors). Several studies outside workers’ compensation explored the measurement of patient complexity based on the utilization patterns of similar services prior to the illness episode of interest. Unfortunately, we do not have data to capture preinjury experience. Patient preference and care-seeking behavior is another factor. Although we controlled for workers’ demo-socio-economic characteristics and created a variable to indicate access and preference at the hospital referral region level, we cannot assert that we fully control for these factors. Because of this, we caution the reader that the comparative findings are evidence of association between chiropractic care and outcomes, not causation.

The second issue is related to the much larger set of unmatched claims with non-chiropractic-only PM

back cases, one would like to know what types of workers with LBP would most likely benefit from chiropractic care. In Chapter 5, we attempted to compare the characteristics of the claims with non-chiropractic-only care between the matched and unmatched groups. We discussed some key difference at an aggregate level, but more investigation is needed to make it useful for policymakers and stakeholders.

COMPARING OUTCOMES BETWEEN CHIROPRACTIC EXCLUSIVE PM CARE AND MATCHED NON-CHIROPRACTIC-ONLY PM CLAIMS

For the treatment group (chiropractic-only PM/EM or chiropractic-only PM) and the comparison group (the matched non-chiropractic-only PM claims), we adjusted for the mix of cases, policy factors, and environmental factors to compare the outcomes, holding all other variables constant. The additional variables we included in the second stage adjustment that were not in the propensity score estimation include whether a claim had a comorbidity diagnosis, the time from initial medical visit to the date of first PM, and whether multiple billing entities for PM care were involved in care.

Table TA.C4 provides adjusted results for medical utilization and costs (i.e., medical costs; use of MRI, opioids, and pain management injections; PM and non-PM costs) between the chiropractic-only PM/EM and matched non-chiropractic-only groups. The adjusted results for the likelihood of receiving indemnity payments and TD duration are in Table TA.C5. Tables TA.C6 and TA.C7 provide similar results for comparisons between the chiropractic-only PM and matched non-chiropractic-only groups.

Table TA.C4 Estimated Effect of Chiropractic-Only PM/EM versus Matched Non-Chiropractic-Only PM^a on Medical Utilization and Costs, All LBP Claims

| | Log (medical cost) | Likelihood of Having MRI | Likelihood of Having Opioids | Likelihood of Having Injections | Log (cost for PM services) | Log (cost for non-PM services) |
|--|-----------------------|--------------------------|------------------------------|---------------------------------|----------------------------|--------------------------------|
| | Estimated Coefficient | Estimated Coefficient | Estimated Coefficient | Estimated Coefficient | Estimated Coefficient | Estimated Coefficient |
| Intercept | 6.728 *** | -3.734 ** | -6.735 *** | -7.229 ** | 6.395 *** | 6.312 *** |
| Chiropractic-only PM/EM (reference = matched non-chiropractic-only PM) | -0.628 *** | -2.088 *** | -2.642 *** | -3.305 *** | -0.053 ** | -1.576 *** |
| Severity and comorbidity | | | | | | |
| 1 if neuro back; 0 if LBP only | 0.398 *** | 1.549 *** | 0.497 *** | 1.678 *** | 0.301 *** | 0.465 *** |
| 1 if incurred > 7 days of lost time; 0 if ≤ 7 days | 0.438 *** | 0.897 *** | 0.755 *** | 0.617 *** | 0.367 *** | 0.509 *** |
| 1 if claim has at least one comorbidity | 0.248 *** | 0.408 ** | 0.405 * | 0.970 *** | 0.088 | 0.399 *** |
| 1 if claim has multiple comorbidities | 0.396 ** | -0.664 | 0.679 | -0.726 | 0.107 | 0.677 *** |
| Worker characteristics | | | | | | |
| Age (reference = 35–44) | | | | | | |
| ≤ 24 years old | -0.048 | 0.002 | -0.507 ** | -0.751 ** | -0.035 | -0.054 |
| 25–34 | 0.000 | 0.090 | -0.345 ** | -0.352 | -0.007 | 0.005 |
| 45–54 | 0.042 | 0.170 | 0.226 | 0.211 | 0.073 ** | 0.057 * |
| ≥ 55 years old | 0.087 *** | 0.277 ** | 0.012 | 0.253 | 0.103 *** | 0.089 *** |
| 1 if male worker (0 = female) | -0.019 | 0.061 | -0.457 *** | 0.010 | -0.110 *** | 0.044 * |
| 1 if married (0 = single) | 0.015 | 0.131 | -0.048 | 0.105 | 0.027 | 0.020 |
| Average weekly wage in log form | 0.026 *** | 0.072 *** | 0.032 * | 0.116 *** | 0.022 *** | 0.023 *** |
| Tenure with preinjury employer (reference = 2–5 years) | | | | | | |
| ≤ 2 years | -0.073 *** | -0.171 | 0.144 | -0.296 | -0.069 ** | 0.008 |
| 5–10 years | 0.050 | -0.038 | 0.042 | -0.124 | 0.093 ** | -0.016 |
| 10–20 years | -0.053 | -0.140 | -0.266 | -0.061 | -0.002 | -0.135 *** |
| > 20 years | -0.082 ** | -0.157 | -0.114 | -0.300 | -0.069 | -0.137 *** |
| Industry group (reference = clerical and professional) | | | | | | |
| Manufacturing | 0.052 | 0.111 | 0.123 | 0.106 | 0.050 | 0.126 *** |
| Construction | 0.035 | 0.416 ** | 0.292 | 0.502 | -0.028 | 0.158 *** |
| High-risk industry | 0.083 *** | 0.217 | -0.039 | 0.192 | 0.027 | 0.154 *** |
| Trade | 0.016 | 0.288 * | 0.235 | 0.129 | 0.017 | 0.050 |
| Low-risk industry | 0.066 ** | -0.092 | 0.298 | -0.173 | 0.128 *** | 0.024 |
| Other industries | 0.039 | 0.292 | -0.252 | -0.037 | 0.010 | 0.181 *** |
| Claim and case management | | | | | | |
| 1 if claims involved attorney | 0.747 *** | 1.416 *** | 1.083 *** | 0.961 *** | 0.374 *** | 1.036 *** |
| Time from injury to initial medical visit | 0.001 | 0.009 *** | -0.011 *** | 0.006 *** | 0.000 | 0.000 |
| Time from initial medical care to first PM | 0.003 *** | 0.007 *** | 0.005 *** | 0.006 *** | -0.001 | 0.005 *** |
| 1 if claim had no office visits before PM | -0.510 *** | -0.139 | 0.045 | -0.290 | -0.297 *** | -0.687 *** |
| 1 if claim received PT from SBE provider as office visit | -0.107 *** | -0.083 | -0.112 | -0.027 | -0.344 *** | 0.051 |
| 1 if PT services were provided by more than one provider | 0.425 *** | 0.333 ** | 0.191 | 0.405 * | 0.588 *** | 0.338 *** |
| Local environmental factors | | | | | | |
| 1 if worker resides in a rural area | -0.102 *** | 0.239 * | 0.054 | 0.108 | -0.119 *** | -0.084 ** |
| Number of physical therapists per 100,000 population | | | | | | |
| | -0.001 | -0.001 | -0.007 ** | 0.005 | -0.001 * | 0.000 |
| Number of chiropractors per 100,000 population | | | | | | |
| | 0.000 | 0.007 ** | 0.009 *** | -0.005 | 0.000 | 0.000 |
| % of population in worker's county who has college or higher degree | | | | | | |
| | 0.579 *** | -1.185 | -3.522 *** | -2.700 * | 0.875 *** | 0.392 |
| Median household income in \$1,000 | | | | | | |
| | 0.000 *** | 0.000 ** | 0.000 | 0.000 | 0.000 *** | 0.000 *** |
| % of population under the federal poverty line | | | | | | |
| | 1.527 * | -1.408 | 1.343 | 4.078 | 0.226 | 1.583 |
| % of population without health insurance | | | | | | |
| | 2.841 *** | 1.523 | 1.435 | 0.971 | 2.488 *** | 2.493 *** |
| Local unemployment rate | | | | | | |
| | 0.033 *** | 0.076 * | 0.083 * | -0.010 | 0.016 | 0.032 ** |
| % of population who engaged in physical activities | | | | | | |
| | -1.292 *** | -0.618 | 5.649 ** | 2.953 | -1.193 ** | -1.707 *** |
| State-specific effect (reference = MD) | | | | | | |
| CA | 0.090 | 0.160 | -0.277 | -0.191 | -0.397 *** | 0.611 *** |
| CT | 0.350 *** | 0.397 | 0.323 | 0.433 | 0.351 *** | 0.336 *** |
| DE | 0.500 *** | 1.057 | -0.056 | 0.803 | 0.203 | 0.606 *** |
| IA | -0.003 | -0.327 | 0.160 | 0.689 | 0.000 | 0.230 * |
| IL | 0.310 *** | 0.224 | -0.055 | 0.496 | 0.265 *** | 0.369 *** |
| KS | -0.228 ** | 0.453 | 0.195 | 1.044 | -0.289 ** | -0.097 |
| KY | 0.523 *** | 0.245 | -0.227 | 0.062 | 0.503 *** | 0.442 *** |
| LA | 0.390 *** | 0.007 | 1.076 ** | 0.731 | 0.058 | 0.562 *** |
| MA | -0.105 | -0.313 | -0.774 | -0.384 | -0.126 | -0.101 |
| MN | 0.369 *** | -0.098 | -0.570 | 0.368 | 0.279 *** | 0.362 *** |
| NM | 0.226 ** | 0.197 | 0.305 | 0.930 | 0.207 * | 0.214 |
| NY | -0.234 *** | 0.545 | -0.751 * | 0.383 | -0.339 *** | -0.290 *** |
| PA | 0.333 *** | 0.347 | -0.207 | 0.684 | 0.183 ** | 0.334 *** |
| TX | 0.109 | 0.379 | 0.753 | 0.544 | -0.002 | 0.192 |
| WI | 0.614 *** | -0.148 | -0.126 | 0.642 | 0.539 *** | 0.626 *** |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. Pooled data of 16 states.

^a Claims with chiropractic-only PM/EM are those in the treatment group that received E&M and PM services by chiropractors only. The matched non-chiropractic-only PM is a comparison group which is a subset of all LBP claims with PM care by non-chiropractors only that matched individual claims in the chiropractic-only PM/EM group with a similar likelihood of having chiropractic-only PM/EM care. The propensity score matching was done in Stata. See Chapter 2 and Technical Appendix C for a description of the propensity score matching approach and construction of the comparison group.

*** statistically significant at the 1 percent level, ** statistically significant at the 5 percent level, * statistically significant at the 10 percent level.

Key: E&M: evaluation and management; LBP: low back pain; MRI: magnetic resonance imaging; PM: physical medicine; SBE: same billing entity (for pre-PM office visits and initial PM).

Table TA.C5 Estimated Effect of Chiropractic-Only PM/EM versus Matched Non-Chiropractic-Only PM^a on Indemnity Payments and TD Duration, All LBP Claims

| | Likelihood of Receiving Indemnity Payments | Log (indemnity payments) Claims with Ind. Payments | Likelihood of Having Lost Time | Log (TD weeks) Claims with Lost Time |
|--|--|--|--------------------------------|--------------------------------------|
| | Estimated Coefficient | Estimated Coefficient | Estimated Coefficient | Estimated Coefficient |
| Intercept | -7.809 *** | 7.426 *** | -10.457 *** | 2.694 *** |
| Chiropractic-only PM/EM (reference = matched non-chiropractic-only PM) | -0.259 * | -0.430 *** | -0.455 *** | -0.272 *** |
| Severity and comorbidity | | | | |
| 1 if neuro back; 0 if LBP only | 0.129 | 0.509 *** | 0.116 | 0.277 *** |
| 1 if incurred > 7 days of lost time; 0 if ≤ 7 days | 8.092 *** | 1.703 *** | 6.782 *** | 0.751 *** |
| 1 if claim has at least one comorbidity | -0.224 | 0.340 ** | -0.273 | 0.254 *** |
| 1 if claim has multiple comorbidities | 1.171 | -0.125 | 1.523 ** | -0.231 |
| Worker characteristics | | | | |
| Age (reference = 35–44) | | | | |
| ≤ 24 years old | -0.364 | -0.191 * | -0.260 | -0.044 |
| 25–34 | -0.001 | -0.068 | 0.058 | -0.011 |
| 45–54 | -0.032 | 0.093 | 0.068 | 0.067 |
| ≥ 55 years old | -0.156 | -0.014 | -0.291 | 0.061 |
| 1 if male worker (0 = female) | 0.052 | 0.358 *** | -0.064 | 0.086 ** |
| 1 if married (0 = single) | 0.039 | 0.056 | 0.069 | -0.027 |
| Average weekly wage in log form | 0.550 *** | 0.144 *** | 0.601 *** | -0.025 * |
| Tenure with preinjury employer (reference = 2–5 years) | | | | |
| ≤ 2 years | 0.371 ** | 0.050 | 0.325 * | 0.115 *** |
| 5–10 years | 0.346 | 0.111 | 0.243 | -0.016 |
| 10–20 years | -0.057 | 0.270 *** | -0.158 | 0.049 |
| > 20 years | 0.217 | 0.107 | 0.156 | -0.042 |
| Industry group (reference = clerical and professional) | | | | |
| Manufacturing | 0.442 * | -0.315 ** | 0.461 * | -0.131 * |
| Construction | 0.054 | 0.196 | 0.126 | 0.053 |
| High-risk industry | 1.162 *** | -0.203 * | 1.206 *** | -0.061 |
| Trade | 0.219 | -0.332 *** | 0.403 | -0.061 |
| Low-risk industry | 0.699 *** | -0.298 ** | 0.720 *** | -0.081 |
| Other industries | 0.752 ** | -0.193 | 0.884 ** | 0.014 |
| Claim and case management | | | | |
| 1 if claims involved attorney | 2.334 *** | 1.398 *** | -1.265 *** | 0.594 *** |
| Time from injury to initial medical visit | -0.007 * | 0.004 *** | -0.022 *** | 0.005 *** |
| Time from initial medical care to first PM | 0.000 | 0.006 *** | -0.001 | 0.005 *** |
| 1 if claim had no office visits before PM | 0.018 | -0.155 | 0.128 | -0.025 |
| 1 if claim received PT from SBE provider as office visit | -0.138 | 0.014 | -0.129 | -0.001 |
| 1 if PT services were provided by more than one provider | -0.048 | 0.349 *** | -0.100 | 0.207 *** |
| Local environmental factors | | | | |
| 1 if worker resides in a rural area | -0.063 | -0.070 | -0.015 | -0.006 |
| Number of physical therapists per 100,000 population | -0.005 | -0.001 | -0.005 | -0.001 * |
| Number of chiropractors per 100,000 population | 0.003 | 0.002 | 0.003 | 0.002 |
| % of population in worker's county who has college or higher degree | -1.472 | 0.673 | -1.828 | 0.454 |
| Median household income in \$1,000 | 0.000 | 0.000 | 0.000 | 0.000 |
| % of population under the federal poverty line | 2.496 | -0.236 | 4.426 | 0.210 |
| % of population without health insurance | 6.122 | -0.317 | 2.524 | -1.192 |
| Local unemployment rate | -0.155 ** | -0.023 | -0.030 | 0.014 |
| % of population who engaged in physical activities | 2.928 | -3.490 ** | 3.989 | -2.324 *** |
| State-specific effect (reference = MD) | | | | |
| CA | -0.030 | 0.300 | -0.307 | 0.071 |
| CT | 0.698 | 0.121 | 1.592 *** | -0.145 |
| DE | -0.201 | 0.337 | 0.150 | -0.229 |
| IA | -0.597 | -0.489 | 0.420 | -0.070 |
| IL | -0.752 * | -0.248 | 0.100 | -0.093 |
| KS | -2.152 ** | -0.860 ** | -1.550 | -0.161 |
| KY | -1.050 | -0.030 | -0.611 | 0.048 |
| LA | -2.379 ** | 0.064 | -0.915 | -0.124 |
| MA | -0.037 | -0.574 *** | 0.897 * | 0.052 |
| MN | -0.509 | -0.543 *** | 0.409 | -0.197 * |
| NM | -1.885 ** | 0.212 | -1.530 * | 0.284 |
| NY | -2.507 *** | -0.307 | -0.709 | 0.026 |
| PA | -1.856 *** | 0.112 | -0.895 | 0.105 |
| TX | -2.641 *** | -0.047 | -1.719 ** | 0.160 |
| WI | 0.426 | -0.421 ** | 1.552 *** | -0.145 |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. Pooled data of 16 states.

^a Claims with chiropractic-only PM/EM are those in the treatment group that received E&M and PM services by chiropractors only. The matched non-chiropractic-only PM is a comparison group which is a subset of all LBP claims with PM care by non-chiropractors only that matched individual claims in the chiropractic-only PM/EM group with a similar likelihood of having chiropractic-only PM/EM care. The propensity score matching was done in Stata. See Chapter 2 and Technical Appendix C for a description of the propensity score matching approach and construction of the comparison group.

*** statistically significant at the 1 percent level, ** statistically significant at the 5 percent level, * statistically significant at the 10 percent level.

Key: EM: evaluation and management; LBP: low back pain; PM: physical medicine; SBE: same billing entity (for pre-PM office visits and initial PM); TD: temporary disability.

Table TA.C6 Estimated Effect of Chiropractic-Only PM versus Matched Non-Chiropractic-Only PM^a on Medical Utilization and Costs, All LBP Claims

| | Log (medical cost) | Likelihood of Having MRI | Likelihood of Having Opioids | Likelihood of Having Injections | Log (cost of PM services) | Log (cost of non-PM services) |
|---|-----------------------|--------------------------|------------------------------|---------------------------------|---------------------------|-------------------------------|
| | Estimated Coefficient | Estimated Coefficient | Estimated Coefficient | Estimated Coefficient | Estimated Coefficient | Estimated Coefficient |
| Intercept | 7.025 *** | -2.845 ** | -1.883 | -6.595 *** | 6.896 *** | 6.078 *** |
| Chiropractic-only PM (reference = matched non-chiropractic-only PM) | 0.017 | -0.437 *** | -0.237 *** | -0.558 *** | 0.030 | -0.034 ** |
| Severity and comorbidity | | | | | | |
| 1 if neuro back; 0 if LBP only | 0.457 *** | 1.652 *** | 0.693 *** | 1.768 *** | 0.271 *** | 0.561 *** |
| 1 if incurred > 7 days of lost time; 0 if ≤ 7 days | 0.453 *** | 1.007 *** | 0.681 *** | 0.777 *** | 0.365 *** | 0.517 *** |
| 1 if claim has at least one comorbidity | 0.283 *** | 0.283 * | 0.478 *** | 0.978 *** | -0.024 | 0.443 *** |
| 1 if claim had multiple comorbidities | 0.202 *** | 0.192 | 0.135 | 0.013 | 0.202 * | 0.233 *** |
| Worker characteristics | | | | | | |
| Age (reference = 35–44) | | | | | | |
| ≤ 24 years old | -0.089 *** | -0.231 * | -0.241 * | -0.554 ** | -0.098 *** | -0.099 *** |
| 25–34 | -0.092 *** | -0.238 *** | -0.410 *** | -0.242 * | -0.098 *** | -0.098 *** |
| 45–54 | 0.020 | 0.004 | -0.132 | -0.060 | 0.000 | 0.000 |
| ≥ 55 years old | 0.043 ** | -0.081 | -0.123 | -0.054 | 0.044 | 0.015 |
| 1 if male worker (0 = female) | 0.010 | 0.052 | -0.003 | -0.022 | -0.023 | 0.039 * |
| 1 if married (0 = single) | 0.009 | -0.083 | 0.000 | 0.076 | 0.035 | 0.000 |
| Average weekly wage in log form | 0.023 *** | 0.068 *** | 0.025 * | 0.080 *** | 0.019 *** | 0.022 *** |
| Tenure with preinjury employer (reference = 2–5 years) | | | | | | |
| ≤ 2 years | -0.013 | -0.122 | 0.262 ** | -0.263 * | -0.052 * | 0.020 |
| 5–10 years | -0.008 | -0.072 | -0.025 | 0.042 | 0.032 | -0.030 |
| 10–20 years | -0.018 | 0.047 | -0.090 | 0.097 | 0.028 | -0.038 |
| > 20 years | -0.030 | 0.040 | -0.027 | -0.118 | 0.023 | -0.080 ** |
| Industry group (reference = clerical and professional) | | | | | | |
| Manufacturing | 0.040 | 0.303 ** | 0.080 | -0.035 | -0.007 | 0.097 *** |
| Construction | 0.045 | 0.436 *** | 0.063 | 0.352 | -0.102 ** | 0.133 *** |
| High-risk industry | 0.022 | 0.214 | 0.133 | -0.104 | -0.069 * | 0.103 *** |
| Trade | -0.002 | 0.384 *** | 0.020 | 0.006 | -0.056 | 0.057 * |
| Low-risk industry | 0.029 | 0.201 | -0.032 | -0.068 | 0.012 | 0.036 |
| Other industries | 0.014 | 0.232 | 0.192 | -0.088 | -0.176 *** | 0.091 ** |
| Claim and case management | | | | | | |
| 1 if claims involved attorney | 0.712 *** | 1.095 *** | 0.812 *** | 0.714 *** | 0.420 *** | 0.788 *** |
| Time from injury to initial medical visit | 0.001 *** | 0.011 *** | -0.004 | 0.009 *** | 0.001 ** | 0.001 ** |
| Time from initial medical care to first PM | 0.002 *** | 0.006 *** | 0.002 *** | 0.004 *** | -0.001 *** | 0.003 *** |
| 1 if claim had no office visits before PM | -0.058 | 0.392 ** | -0.324 | 0.531 ** | 0.014 | -0.134 *** |
| 1 if claim received PT from SBE provider as office visit | -0.010 | -0.059 | -0.213 ** | -0.044 | -0.116 *** | 0.087 *** |
| 1 if PT services were provided by more than one provider | 0.362 *** | 0.428 *** | 0.547 *** | 0.393 ** | 0.593 *** | 0.233 *** |
| Local environmental factors | | | | | | |
| 1 if worker resides in a rural area | -0.144 *** | -0.022 | 0.003 | -0.231 | -0.089 ** | -0.175 *** |
| Number of physical therapists per 100,000 population | 0.000 | 0.000 | -0.004 | 0.003 | 0.000 | -0.001 * |
| Number of chiropractors per 100,000 population | -0.001 | 0.007 ** | 0.008 *** | 0.001 | -0.002 * | 0.000 |
| % of population in worker's county who has college or higher degree | 0.449 ** | -0.323 | -0.794 | -1.515 | 0.395 | 0.586 *** |
| Median household income in \$1,000 | 0.000 *** | 0.000 * | 0.000 | 0.000 ** | 0.000 *** | 0.000 *** |
| % of population under the federal poverty line | 0.483 | -1.007 | 0.083 | 2.848 | 1.963 ** | 0.027 |
| % of population without health insurance | 3.645 *** | 3.593 ** | -2.524 | 7.271 *** | 3.490 *** | 3.410 *** |
| Local unemployment rate | 0.011 | 0.092 *** | 0.029 | 0.062 | -0.013 | 0.015 * |
| % of population who engaged in physical activities | -1.318 *** | -2.084 | 0.357 | 1.248 | -1.713 *** | -1.323 *** |
| State-specific effect (reference = MD) | | | | | | |
| CA | 0.266 *** | -0.104 | -0.286 | -0.826 *** | -0.345 *** | 0.731 *** |
| CT | 0.300 *** | 0.322 | -0.715 ** | 0.181 | 0.050 | 0.447 *** |
| DE | 0.319 *** | 0.921 *** | -0.639 | 0.164 | 0.010 | 0.298 *** |
| IA | 0.221 ** | -0.072 | -0.409 | 0.207 | -0.209 | 0.459 *** |
| IL | 0.471 *** | 0.135 | -0.437 * | 0.154 | 0.317 *** | 0.492 *** |
| KS | -0.103 | 0.315 | 0.099 | -0.083 | -0.547 *** | 0.158 |
| KY | 0.412 *** | 0.234 | -0.788 ** | -0.548 | 0.327 *** | 0.466 *** |
| LA | 0.383 *** | 0.248 | 0.479 | 0.545 | -0.025 | 0.604 *** |
| MA | -0.145 *** | -0.432 * | -1.443 *** | -0.363 | -0.311 *** | -0.108 * |
| MN | 0.429 *** | 0.026 | -0.705 *** | 0.060 | 0.248 *** | 0.503 *** |
| NM | 0.152 * | -0.586 | -0.447 | -0.425 | -0.002 | 0.295 *** |
| NY | -0.208 *** | 0.352 * | -1.233 *** | -0.001 | -0.546 *** | -0.011 |
| PA | 0.430 *** | 0.396 * | -0.614 ** | -0.038 | 0.186 *** | 0.532 *** |
| TX | -0.002 | 0.221 | 0.909 *** | -0.555 | -0.283 *** | 0.259 *** |
| WI | 0.779 *** | 0.192 | -0.557 ** | 0.467 | 0.476 *** | 0.924 *** |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. Pooled data of 16 states.

^a Claims with chiropractic-only PM are those in the treatment group that received PM services by chiropractors only and received E&M services by physicians (most of the cases also had E&M services by chiropractors). The matched non-chiropractic-only PM is a comparison group which is a subset of all LBP claims with PM care by non-chiropractors only that matched individual claims in the chiropractic-only PM group with a similar likelihood of having chiropractic-only PM care. The propensity score matching was done in Stata. See Chapter 2 and Technical Appendix C for a description of the propensity score matching approach and construction of the comparison group.

*** Statistically significant at the 1 percent level, ** statistically significant at the 5 percent level, * statistically significant at the 10 percent level.

Key: E&M: evaluation and management; MRI: magnetic resonance imaging; LBP: low back pain; PM: physical medicine; SBE: same billing entity (for pre-PM office visits and initial PM).

Table TA.C7 Estimated Effect of Chiropractic-Only PM versus Matched Non-Chiropractic-Only PM^a on Indemnity Payments and TD Duration, All LBP Claims

| | Likelihood of Receiving Indemnity Payments | Log (indemnity payments) claims with Indemnity Payments | Likelihood of Having Lost Time | Log (TD weeks) Claims with Lost Time |
|---|--|---|--------------------------------|--------------------------------------|
| | Estimated Coefficient | Estimated Coefficient | Estimated Coefficient | Estimated Coefficient |
| Intercept | -7.662 *** | 7.285 *** | -8.706 *** | 0.730 |
| Chiropractic-only PM (reference = matched non-chiropractic-only PM) | 0.223 ** | -0.192 *** | -0.125 | -0.173 *** |
| Severity and comorbidity | | | | |
| 1 if neuro back; 0 if LBP only | 0.264 ** | 0.608 *** | 0.079 | 0.387 *** |
| 1 if incurred > 7 days of lost time; 0 if ≤ 7 days | 7.339 *** | 1.693 *** | 5.801 *** | 0.836 *** |
| 1 if claim has at least one comorbidity | 0.338 | 0.185 ** | -0.163 | 0.290 *** |
| 1 if claim had multiple comorbidities | 0.200 | 0.135 | 0.069 | 0.072 |
| Worker characteristics | | | | |
| Age (reference = 35–44) | | | | |
| ≤ 24 years old | -0.057 | -0.348 *** | 0.071 | -0.127 ** |
| 25–34 | 0.163 | -0.214 *** | 0.125 | -0.090 *** |
| 45–54 | 0.030 | -0.099 * | -0.077 | -0.071 ** |
| ≥ 55 years old | 0.154 | -0.154 ** | -0.051 | -0.063 |
| 1 if male worker (0 = female) | 0.134 | 0.319 *** | -0.027 | 0.064 * |
| 1 if married (0 = single) | 0.192 | 0.023 | 0.233 * | -0.002 |
| Average weekly wage in log form | 0.442 *** | 0.179 *** | 0.458 *** | 0.003 |
| Tenure with preinjury employer (reference = 2–5 years) | | | | |
| ≤ 2 years | 0.227 | -0.035 | 0.081 | 0.044 |
| 5–10 years | -0.056 | 0.031 | -0.328 * | -0.008 |
| 10–20 years | 0.044 | 0.078 | -0.176 | -0.016 |
| > 20 years | 0.190 | 0.160 | -0.004 | -0.010 |
| Industry group (reference = clerical and professional) | | | | |
| Manufacturing | -0.007 | -0.139 | 0.333 | -0.014 |
| Construction | -0.387 | 0.434 *** | 0.208 | 0.246 *** |
| High-risk industry | 0.429 ** | -0.081 | 0.659 *** | 0.035 |
| Trade | 0.044 | -0.171 * | 0.631 *** | 0.011 |
| Low-risk industry | 0.168 | 0.009 | 0.445 ** | 0.040 |
| Other industries | 0.117 | 0.091 | 0.614 ** | 0.082 |
| Claim and case management | | | | |
| 1 if claims involved attorney | 1.848 *** | 1.308 *** | -1.243 *** | 0.639 *** |
| Time from injury to initial medical visit | 0.001 | 0.007 *** | -0.011 *** | 0.005 *** |
| Time from initial medical care to first PM | 0.003 ** | 0.005 *** | 0.001 | 0.004 *** |
| 1 if claim had no office visits before PM | 0.139 | 0.206 * | 0.156 | 0.084 |
| 1 if claim received PT from SBE provider as office visit | -0.094 | -0.182 *** | -0.068 | -0.136 *** |
| 1 if PT services were provided by more than one provider | 0.125 | 0.278 *** | -0.098 | 0.141 *** |
| Local environmental factors | | | | |
| 1 if worker resides in a rural area | 0.124 | -0.157 * | 0.108 | -0.085 |
| Number of physical therapists per 100,000 population | -0.005 | -0.001 | -0.003 | -0.002 *** |
| Number of chiropractors per 100,000 population | -0.001 | -0.003 * | 0.001 | 0.000 |
| higher degree | -0.066 | 1.517 *** | -0.582 | 0.222 |
| Median household income in \$1,000 | 0.000 | 0.000 | 0.000 | 0.000 |
| % of population under the federal poverty line | 10.918 ** | -0.379 | 3.065 | 0.436 |
| % of population without health insurance | 4.064 | 1.540 | -0.459 | 0.201 |
| Local unemployment rate | 0.024 | 0.034 | 0.044 | 0.033 *** |
| % of population who engaged in physical activities | 1.546 | -3.485 *** | 2.404 | -0.308 |
| State-specific effect (reference = MD) | | | | |
| CA | -0.675 * | -0.396 *** | 0.570 * | 0.113 |
| CT | 0.826 * | -0.309 ** | 1.834 *** | 0.091 |
| DE | -1.312 * | -0.271 | 1.268 ** | 0.135 |
| IA | 0.106 | -0.236 | 1.493 ** | 0.045 |
| IL | -0.789 ** | -0.336 ** | 0.690 * | 0.169 * |
| KS | -3.651 *** | -1.056 *** | -0.559 | -0.025 |
| KY | -2.076 ** | -0.503 ** | 0.138 | 0.372 ** |
| LA | -0.591 | 0.022 | 0.648 | 0.701 *** |
| MA | 0.012 | -0.698 *** | 1.572 *** | 0.238 *** |
| MN | -0.326 | -0.436 *** | 1.065 *** | 0.039 |
| NM | -3.049 *** | -1.018 *** | -1.198 * | 0.021 |
| NY | -2.200 *** | -0.708 *** | 0.500 | 0.216 *** |
| PA | -1.555 *** | -0.111 | -0.326 | 0.258 *** |
| TX | -1.949 *** | -0.372 ** | 0.177 | 0.332 *** |
| WI | 0.773 ** | -0.517 *** | 2.222 *** | 0.066 |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. Pooled data of 16 states.

^a Claims with chiropractic-only PM are those in the treatment group that received PM services by chiropractors only and received E&M services by physicians (most of the cases also had E&M services by chiropractors). The matched non-chiropractic-only PM is a comparison group which is a subset of all LBP claims with PM care by non-chiropractors only that matched individual claims in the chiropractic-only PM group with a similar likelihood of having chiropractic-only PM care. The propensity score matching was done in Stata. See Chapter 2 and Technical Appendix C for a description of the propensity score matching approach and construction of the comparison group.

*** Statistically significant at the 1 percent level, ** statistically significant at the 5 percent level, * statistically significant at the 10 percent level.

Key: E&M: evaluation and management; LBP: low back pain; PM: physical medicine; SBE: same billing entity (for pre-PM office visits and initial PM); TD: temporary disability.

For the binary dependent variables on the likelihood of receiving MRI, opioids, and pain management injections, we used logistic regressions, and for continuous variables, we used the log form of medical costs in linear regressions. For all LBP claims regardless of whether a claim has lost time, we ran (1) two-part regressions to estimate the likelihood of receiving indemnity payments based on all LBP claims and (2) linear regressions with the log form of the dependent variable for LBP claims with indemnity payments. The estimated average indemnity payments and TD duration per claim reported in the main report were computed using the predicted likelihood of receiving payment and estimated the amount received holding other variables constant throughout the whole sample, separately for the binary values of the treatment variable.

Table TA.C8 provides the unadjusted and adjusted results to show how much difference our statistical analysis made to the comparison of outcomes between claims with chiropractic-only PM/EM and non-chiropractic-only PM. There are three blocks of data in Table TA.C8. The first block has unadjusted results from the 16-state pooled data including all LBP claims that either received chiropractic-only PM/EM or non-chiropractic only PM. The second block shows the average values of the outcome variables per claim for claims with chiropractic-only PM/EM (i.e., the treatment group—exclusive chiropractic care) and for a small subset of claims with non-chiropractic-only PM claims (i.e., the comparison group). The comparison group was constructed using the propensity score matching approach (as discussed above) so that the treatment and comparison groups are *balanced* to have similar characteristics (see Table TA.C2). The third block provides the final adjusted results, the same as those presented in Chapter 5. This is after further controlling for some additional factors that affect outcomes but were not included in the propensity score estimation. Table TA.C9 also provides three blocks of data, similar to those in Table TA.C8, for the comparison between claims with chiropractic-only PM (i.e., chiropractic-only PM with non-chiropractors providing E&M services) and non-chiropractic-only PM.

Table TA.C8 Comparing Outcomes between Chiropractic-Only PM/EM and Non-Chiropractic-Only PM: Unadjusted and Adjusted Results

| Measure | Unadjusted Results ^a | | | Results after Step 1 Propensity Score Matching ^b | | | Results after Step 2 Adjustment ^c | | |
|---------------------------------------|---|--|----------------------|---|--|----------------------|--|--|----------------------|
| | LBP Claims with Chiropractic-Only PM/EM | LBP Claims with Non-Chiropractic-Only PM | % (point) Difference | Chiropractic-Only PM/EM, Treatment | Non-Chiropractic-Only PM, Matched for Comparison | % (point) Difference | Chiropractic-Only PM/EM, Treatment | Non-Chiropractic-Only PM, Matched for Comparison | % (point) Difference |
| Number of claims | 4,569 | 55,616 | | 4,547 | 6,716 | | | | |
| Outcomes | | | | | | | | | |
| Medical costs | \$1,366 | \$3,522 | -61% | \$1,367 | \$2,889 | -53% | \$1,491 | \$2,794 | -47% *** |
| Indemnity payments | \$492 | \$3,604 | -86% | \$492 | \$1,222 | -60% | \$809 | \$1,250 | -35% *** |
| Weeks of temporary disability | 0.7 | 4.9 | -86% | 0.7 | 1.7 | -61% | 1.4 | 1.9 | -26% *** |
| Payments for PM services | \$1,001 | \$1,356 | -26% | \$1,002 | \$1,216 | -18% | \$1,145 | \$1,206 | -5% *** |
| Payments for non-PM medical services | \$365 | \$2,166 | -83% | \$365 | \$1,673 | -78% | \$378 | \$1,827 | -79% *** |
| % received opioid prescriptions | 0.8% | 17.0% | -16.2 | 0.8% | 10.2% | -9.4 | 1.0% | 10.3% | -9.4 *** |
| % received MRI | 3.0% | 24.7% | -21.8 | 2.9% | 18.7% | -15.8 | 4.3% | 18.9% | -14.7 *** |
| % received pain management injections | 0.2% | 9.5% | -9.3 | 0.2% | 7.1% | -6.9 | 0.4% | 6.8% | -6.4 *** |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

^a Data presented are the average values for a given outcome variable aggregated across claims for claims with chiropractic-only PM/EM and for claims with non-chiropractic-only PM, based on the 16-state pooled data.

^b Data presented are the average values for a given outcome variable aggregated across claims for claims with chiropractic-only PM/EM and for a subset of claims with non-chiropractic-only PM that had a similar likelihood of receiving chiropractic care as those chiropractic-only EM/PM claims. The former is labeled as the treatment group and the latter is labeled as the comparison group. The results are for a balanced sample of claims between the treatment and comparison groups that had similar characteristics controlled in the propensity score estimation. See Table TA.C2 for sample balance. We excluded 22 claims (less than 0.5 percent) with chiropractic-only PM/EM from the analysis because there were missing values in a variable used for propensity score estimation.

^c Data presented are the final adjusted results reported in Chapter 5. The results are from the step 2 analysis that compared the treatment and comparison groups, adjusting for additional factors affecting outcomes as well as those included in the step 1 propensity score estimation.

*** Difference is statistically significant at 1 percent.

Key: EM: evaluation and management; LBP: low back pain; MRI: magnetic resonance imaging; PM: physical medicine.

Table TA.C9 Comparing Outcomes between Chiropractic-Only PM and Non-Chiropractic-Only PM: Unadjusted and Adjusted Results

| Measure | Unadjusted Results ^a | | | Results after Step 1 Propensity Score Matching ^b | | | Results after Step 2 Adjustment ^c | | |
|---------------------------------------|--------------------------------------|--|----------------------|---|--|----------------------|--|--|----------------------|
| | LBP Claims with Chiropractic-Only PM | LBP Claims with Non-Chiropractic-Only PM | % (point) Difference | Chiropractic-Only PM, Treatment | Non-Chiropractic-Only PM, Matched for Comparison | % (point) Difference | Chiropractic-Only PM, Treatment | Non-Chiropractic-Only PM, Matched for Comparison | % (point) Difference |
| Number of claims | 4,583 | 55,616 | | 4,530 | 8,563 | | | | |
| Outcomes | | | | | | | | | |
| Medical costs | \$3,001 | \$3,522 | -15% | \$2,982 | \$3,357 | -11% | \$3,170 | \$3,117 | 2% |
| Indemnity payments | \$2,502 | \$3,604 | -31% | \$2,506 | \$3,338 | -25% | \$2,500 | \$3,019 | -17% *** |
| Weeks of temporary disability | 3.0 | 4.9 | -38% | 3.0 | 4.4 | -32% | 3.3 | 4.0 | -17% *** |
| Payments for PM services | \$1,126 | \$1,356 | -17% | \$1,126 | \$1,156 | -3% | \$1,149 | \$1,116 | 3% |
| Payments for non-PM medical services | \$1,875 | \$2,166 | -13% | \$1,856 | \$2,201 | -16% | \$1,979 | \$2,048 | -3% ** |
| % received opioid prescriptions | 10.8% | 17.0% | -6.2 | 10.9% | 14.2% | -3.4 | 11.3% | 13.6% | -2.3 *** |
| % received MRI | 16.7% | 24.7% | -8.0 | 16.7% | 23.2% | -6.5 | 17.3% | 22.3% | -5.0 *** |
| % received pain management injections | 5.8% | 9.5% | -3.7 | 5.8% | 9.5% | -3.7 | 6.0% | 9.0% | -3.1 *** |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

^a Data presented are the average values for a given outcome variable aggregated across claims for claims with chiropractic-only PM and for claims with non-chiropractic-only PM, based on the 16-state pooled data.

^b Data presented are the average values for a given outcome variable aggregated across claims for claims with chiropractic-only PM and for a subset of claims with non-chiropractic-only PM that had a similar likelihood of receiving chiropractic care as those chiropractic-only PM claims. The former is labeled as the treatment group and the latter is labeled as the comparison group. The results are for a balanced sample of claims between the treatment and comparison groups that had similar characteristics controlled in the propensity score estimation. See Table TA.C3 for the sample balance. We excluded 53 claims with chiropractic-only PM (less than 1.2 percent) from the analysis because there were missing values in certain variables used for propensity score estimation or they could not be matched with any claims in the non-chiropractic PM group.

^c Data presented are the final adjusted results reported in Chapter 5. The results are from the step 2 analysis that compared the treatment and comparison groups, adjusting for additional factors affecting outcomes as well as those included in the step 1 propensity score estimation.

* Difference is statistically significant at 10 percent; ** difference is statistically significant at 5 percent; *** difference is statistically significant at 1 percent.

Key: LBP: low back pain; MRI: magnetic resonance imaging; PM: physical medicine.

Overall, the propensity score matching and subsequent adjustment helped narrow down the differences in the outcomes between the chiropractic and non-chiropractic PM groups. However, the directions of the differences did not change for any outcome variables except for medical costs between chiropractic-only PM and non-chiropractic-only PM (the difference was 2 percent, not statistically significant—see Table TA.C9). Across the three blocks, the reduction in the size of the differences between chiropractic and non-chiropractic groups indicates how much the differences in the outcomes are attributable to the observable characteristics that we controlled for in the analysis.

It is worth noting that the results in Chapter 5 are based on our statistical analysis between chiropractic exclusive PM claims and matched non-chiropractic-only PM claims. There was a large percentage of the non-chiropractic-only PM claims that were not matched, and we did not examine the outcomes of these unmatched claims. Table TA.C10 provides descriptive data for the non-chiropractic-only PM claims that were matched or not matched to individual claims in the chiropractic-only PM/EM group.³

The unmatched non-chiropractic-only claims tended to be more likely to have LBP with nerve involvement and more likely to experience at least seven days of lost time. Although the percentages of claims having two or more comorbidities and having a mobility diagnosis⁴ were low, there was a significant difference—the unmatched cases were more likely to have two or more comorbidities or have a mobility diagnosis (Table TA.C10). While the matched and unmatched cases were fairly similar on average in demographic-economic characteristics, those unmatched non-chiropractic-only PM claims were more likely to involve an attorney. It appears that the matched non-chiropractic-only PM cases were more likely to be residents in a rural area and more likely to live in a neighborhood with a lower percentage of the population below the federal poverty line. Proportionally more claims from Minnesota, New York, and Wisconsin were represented in the matched comparison group. For California, by contrast, most LBP claims with chiropractic care received combined PM care or had medical providers involved in care. Texas has a small number of claims with chiropractic PM.

³ Claims in the unmatched group are those that either had extremely low propensity scores or did not meet the criteria for the nearest neighbor matching. Note that with one-to-three nearest neighbor matching, many non-chiropractic-only PM claims were not matched, but increasing the number of matched cases for each chiropractic-only PM/EM claim would reduce the level of comparability between the treatment and comparison groups.

⁴ Mobility diagnoses were identified using the ICD-10 codes indicating reduced mobility, abnormalities of gait and mobility, specified or unspecified (see Chapter 2 for more detail). It is possible that non-chiropractic PM providers, as compared with chiropractors, more commonly report this diagnosis.

Table TA.C10 Comparing Characteristics of the Non-Chiropractic-Only PM Claims between the Matched and Unmatched to Chiropractic-Only PM/EM Claims^a

| Measure | Non-Chiropractic-Only PM, Matched for Comparison | Non-Chiropractic-Only PM, Not Matched |
|--|--|---------------------------------------|
| Number of claims | 6,716 | 48,477 |
| Severity and comorbidity | | |
| % with nerve involvement | 22% | 25% |
| % with more than 7 days of lost time | 22% | 37% |
| % had 2+ comorbidities | 0.6% | 1.3% |
| % had mobility diagnosis | 0.2% | 1.0% |
| Worker characteristics | | |
| Age | 42 | 41 |
| 24 or younger | 9% | 10% |
| 25–34 | 23% | 25% |
| 35–44 | 22% | 24% |
| 45–54 | 24% | 24% |
| 55 or older | 21% | 17% |
| % female | 42% | 39% |
| % married | 28% | 27% |
| Average weekly wage | \$732 | \$740 |
| Average tenure in years | 7.4 | 5.9 |
| Attorney involvement | | |
| % with attorney involvement | 5% | 9% |
| % SBE for initial office visit and 1st PM | 61% | 36% |
| Industry grouping | | |
| Manufacturing | 15% | 14% |
| Construction | 6% | 7% |
| Clerical and professional | 11% | 6% |
| High-risk industry | 23% | 30% |
| Trade | 21% | 21% |
| Low-risk industry | 18% | 13% |
| Other | 5% | 8% |
| Missing data | 0% | 0% |
| Environmental factors | | |
| Living in rural area | 9% | 2% |
| Number of physical therapists per 100,000 population | 66 | 55 |
| Number of chiropractors per 100,000 population | 35 | 27 |
| Median household income | \$62,138 | \$61,252 |
| % below federal poverty level | 5.9% | 6.7% |
| % without health insurance | 7.3% | 10.6% |
| Unemployment rate | 4.8 | 5.1 |
| % with physical activity | 77% | 77% |

continued

Table TA.C10 Comparing Characteristics of the Non-Chiropractic-Only PM Claims between the Matched and Unmatched to Chiropractic-Only PM/EM Claims^a (continued)

| Measure | Non-Chiropractic-Only PM, Matched for Comparison | Non-Chiropractic-Only PM, Not Matched |
|------------------------------|--|---------------------------------------|
| Composition of states | | |
| California | 9% | 34% |
| Connecticut | 3% | 5% |
| Delaware | 0% | 1% |
| Illinois | 11% | 8% |
| Iowa | 3% | 1% |
| Kansas | 1% | 1% |
| Kentucky | 3% | 2% |
| Louisiana | 2% | 1% |
| Maryland | 3% | 4% |
| Massachusetts | 7% | 3% |
| Minnesota | 16% | 1% |
| New Mexico | 2% | 2% |
| New York | 14% | 4% |
| Pennsylvania | 6% | 6% |
| Texas | 7% | 25% |
| Wisconsin | 12% | 2% |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

^a The matched non-chiropractic PM claims are those that were matched to individual claims that received chiropractic-only PM/EM on the likelihood of receiving chiropractic-only PM/EM. See Chapter 2 and Technical Appendix C for a description of propensity score matching. Note that we chose to match three claims in the non-chiropractic-only PM group for each chiropractic-only PM/EM claim to achieve desired comparability and sample size.

Key: EM: evaluation and management; LBP: low back pain; PM: physical medicine; SBE: same billing entity (for pre-PM office visits and initial PM).

The reader may also be concerned about the potential impact of including several states with employer control over selection of providers on the overall results. Among the 16 states included in the statistical analysis, 11 states are employee choice or employee limited choice states and 5 states (Connecticut, Iowa, Kansas, New Mexico, and Pennsylvania) are states with employer control over selection of providers. We tested how sensitive the results would be to the potential differences in the response of workers who received chiropractic care in different policy environments. To do so, we ran the same statistical analysis based on the data for the 11 states where employees can choose their providers. The test results are presented in the second block of Table TA.C11 for the comparison of chiropractic-only PM/EM and a subset of matched non-chiropractic-only PM and Table TA.C12 for the comparison of chiropractic-only PM and matched non-chiropractic-only PM claims.

Table TA.C11 Testing Sensitivity of Results to State Provider Choice Policies: Comparing Outcomes between Chiropractic-Only PM/EM and Non-Chiropractic-Only PM

| Measure | Adjusted Results Reported | | | Adjusted Results Based on Data for Employee Choice and Employee Limited Choice States | | | |
|---------------------------------------|---|---|----------------------|---|---|----------------------|-------|
| | Chiropractic-Only PM/EM, Treatment Group ^a | Non-Chiropractic-Only PM, Matched Comparison Group ^b | % (point) Difference | Chiropractic-Only PM/EM, Treatment Group ^a | Non-Chiropractic-Only PM, Matched Comparison Group ^b | % (point) Difference | |
| Number of claims | 4,547 | 6,716 | | | | | |
| Outcomes | | | | | | | |
| Medical costs | \$1,491 | \$2,794 | -47% | *** | \$1,495 | \$2,870 | -48% |
| Indemnity payments | \$809 | \$1,250 | -35% | *** | \$874 | \$1,328 | -34% |
| Weeks of temporary disability | 1.4 | 1.9 | -26% | *** | 1.5 | 2.0 | -25% |
| Payments for PM services | \$1,145 | \$1,206 | -5% | *** | \$1,128 | \$1,224 | -8% |
| Payments for non-PM medical services | \$378 | \$1,827 | -79% | *** | \$389 | \$1,970 | -80% |
| % received opioid prescriptions | 1.0% | 10.3% | -9.4 | *** | 0.9% | 8.7% | -7.8 |
| % received MRI | 4.3% | 18.9% | -14.7 | *** | 3.8% | 17.3% | -13.6 |
| % received pain management injections | 0.4% | 6.8% | -6.4 | *** | 0.3% | 6.3% | -6.0 |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

^a The treatment group has LBP claims with chiropractic-only PM/EM. We excluded 22 claims (less than 0.5 percent) with chiropractic-only PM/EM from the analysis because there were missing values in a variable used for propensity score estimation.

^b The comparison group is a subset of LBP claims with non-chiropractic PM that had a similar likelihood of receiving chiropractic-only PM/EM as those with chiropractic-only PM/EM. See Chapter 2 and Technical Appendix C for a description of how we constructed the comparison group.

*** Difference is statistically significant at 1 percent.

Key: EM: evaluation and management; LBP: low back pain; MRI: magnetic resonance imaging; PM: physical medicine.

Table TA.C12 Testing Sensitivity of Results to State Provider Choice Policies: Comparing Outcomes between Chiropractic-Only PM and Non-Chiropractic-Only PM

| Measure | Adjusted Results Reported | | | Adjusted Results Based on Data for Employee Choice and Employee Limited Choice States | | |
|---------------------------------------|--|---|----------------------|---|---|----------------------|
| | Chiropractic-Only PM, Treatment Group ^a | Non-Chiropractic-Only PM, Matched Comparison Group ^b | % (point) Difference | Chiropractic-Only PM, Treatment Group ^a | Non-Chiropractic-Only PM, Matched Comparison Group ^b | % (point) Difference |
| Number of claims | 4,530 | 8,563 | | | | |
| Outcomes | | | | | | |
| Medical costs | \$3,170 | \$3,117 | 2% | \$3,272 | \$3,461 | -5% ** |
| Indemnity payments | \$2,500 | \$3,019 | -17% *** | \$2,762 | \$3,508 | -21% *** |
| Weeks of temporary disability | 3.3 | 4.0 | -17% *** | 4.0 | 4.8 | -17% *** |
| Payments for PM services | \$1,149 | \$1,116 | 3% | \$1,247 | \$1,287 | -3% ** |
| Payments for non-PM medical services | \$1,979 | \$2,048 | -3% ** | \$2,101 | \$2,221 | -5% ** |
| % received opioid prescriptions | 11.3% | 13.6% | -2.3 *** | 12.1% | 14.6% | -2.5 *** |
| % received MRI | 17.3% | 22.3% | -5.0 *** | 21.5% | 29.9% | -8.4 *** |
| % received pain management injections | 6.0% | 9.0% | -3.1 *** | 6.3% | 12.0% | -5.7 *** |

Notes: Included are nonsurgical LBP claims with injuries occurring from October 1, 2015, to September 30, 2017, with medical treatments received during the first 18 months after the date of injury, up through March 31, 2019. These are medical-only and indemnity claims. Included in this analysis are the 16 of 28 states where chiropractors were involved in more than 5 percent of LBP claims.

^a The treatment group has LBP claims with chiropractic-only PM. We excluded 53 claims (less than 1.2 percent) with chiropractic-only PM from the analysis because there were missing values in certain variables used for propensity score estimation or they could not be matched with any claims in the non-chiropractic PM group.

^b The comparison group is a subset of LBP claims with non-chiropractic PM that had a similar likelihood of receiving chiropractic-only PM as those with chiropractic-only PM. See Chapter 2 and Technical Appendix C for a description of how we constructed the comparison group.

* Difference is statistically significant at 10 percent; ** difference is statistically significant at 5 percent; *** difference is statistically significant at 1 percent.

Key: LBP: low back pain; MRI: magnetic resonance imaging; PM: physical medicine.

The tables show no material differences in the comparative results between the adjusted results presented in the main report and the results from the sensitivity test.

FACTORS WE COULD AND COULD NOT CONTROL FOR IN COMPARING OUTCOMES

As mentioned above, there is a key assumption for the propensity score matching approach to produce valid comparative results, which is that the variables used in the propensity score matching capture all the factors that influence choice of chiropractic care and outcomes, directly or indirectly. In our analysis, we controlled for many factors, and many of them are important in how they influence the choice of treatment. However, it is important to better understand how well we captured those factors by controlling for the variables we had and what else we may not be able to control for. Table TA.C13 lists all the factors we considered that may influence choice of chiropractic care and outcomes, and the variables we measured and controlled for in our statistical analysis. We used Andersen's Behavioral Model as a guide.⁵ In short, this framework divides all factors into one of three categories: predisposing factors, need factors, and enabling factors. The predisposing factors include an individual's sociodemographic characteristics (e.g., worker's age, gender, education, occupation, and family status) and contextual factors predisposing individuals to the use of health services (e.g., demographic and social composition of communities, and cultural norms). The need factors include perceived need for health care (by the patient) and evaluated need (by health care providers) as well as environmental need (health-related conditions in the environment). These may include medical severity, comorbidities, disability status, and patient complexity. The enabling factors are those factors enabling health care services, which may include state policies, provider supply and organization, and local practice norms.

⁵ This conceptual framework, initially developed by Andersen (1995) and later explicated by Andersen and Davidson (2001), has been used in a number of studies investigating the use of health services (Chevan and Riddle, 2011; Babitsch et al., 2012; Blanchette et al., 2016a).

Table TA.C13 Capturing Factors Affecting Treatment Choice and Outcomes

| Factors | How the Factors Are Addressed |
|--|--|
| Predisposing factors | |
| <i>Individual's demo-socio-economic factors</i> | |
| Age | Worker's age (DBE variable). |
| Gender | Worker's gender (DBE variable). |
| Marital status | Marital status (DBE variable). |
| Tenure with preinjury employer | Job tenure in years (DBE variable). |
| Average weekly wage | Preinjury average weekly wage (DBE variable). |
| Job industry | Industry group of worker's preinjury job (DBE variable). |
| <i>Contextual factors (external data)</i> | |
| Urban/rural area | Urban/rural designated to the area where the worker lives, based on the Area Health Resource File (using ZIP code Rural-Urban Commuting Areas [RUCAs] geographic taxonomy, available at https://ruralhealth.und.edu/ruca). |
| Education (college or above) | Percentage of population with college or higher degree for a given county where the worker with LBP resided. The data are based on the 2012–2016 American Community Survey (ACS) Summary File, U.S. Census Bureau, merged to the study sample by zip code. |
| Neighborhood economic status | % of population that is below the federal poverty level. The below federal poverty level data are from the 2012–2016 American Community Survey (ACS) Summary File, U.S. Census Bureau, at the county level for a given county where the worker with LBP resided. |
| Median household income | Median household income for a given county where the worker with LBP resided. The data are based on the 2012–2016 American Community Survey (ACS) Summary File, U.S. Census Bureau, merged to the study sample by zip code. |
| Unemployment rate | The county-level unemployment rate is based on U.S. Bureau of Labor Statistics' Local Area Unemployment Statistics (LAUS), available at https://www.bls.gov/lau/ . |
| Need factors | |
| <i>Evaluated need factors (severity and comorbidities)</i> | |
| Neuro back claims | Neuro back claims were identified based on ICD-10 codes and how they were mentioned in the detailed medical transactions. See Technical Appendix A for more detail. |
| Comorbidities | Seven types of comorbidities were identified by checking pre-designated codes in the multiple ICD-10 fields, including alcohol or drug abuse, chronic pain or symptoms within 3 months postinjury, diabetes, obesity, psychosocial issues, smoking, and other lifestyle issues (e.g., lack of physical activities). We controlled for at least one comorbidity and multiple comorbidities. See Technical Appendix A for more discussion. |
| Had mobility diagnosis | Indicates noted mobility deficits or mobilization issues, a proxy for severity. The variable was created based on the ICD-10 codes recorded in the medical details. ^a |
| <i>Perceived need factors</i> | |
| Patient self-reported health status | No data |
| <i>Patient health status and utilization of medical services prior to injury</i> | |
| Pre-conditions | No data in workers' compensation |
| Medical resource utilization prior to LBP treatment | No data in workers' compensation |
| <i>Public health indicators</i> | |
| Health insurance coverage | % of population that is not covered by health insurance at the county level for a given county where the worker with LBP resided. The health insurance coverage data are from the Bureau of Census' Small Area Health Insurance Estimates (SAHIE) file, merged to our study sample by zip code. |
| Physical activity | % of population that had any physical activity published by IHME based on self-reported data in the Behavioral Risk Factor Surveillance System (BRFSS), a state-based random-digit telephone survey that covers the majority of U.S. counties. |

continued

Table TA.C13 Capturing Factors Affecting Treatment Choice and Outcomes (continued)

| Factors | How the Factors Are Addressed |
|--|---|
| Enabling factors | |
| Attorney involvement (Indicates possible issues, including injury reporting, pending compensability determination, and direction of care. These issues may influence treatment paths for individual workers and their outcomes.) | Attorney involvement is used as a proxy to capture these possible issues. The DBE defense attorney variable, which we used in the analysis, is more consistent across data sources than the claimant attorney variable. See the early physical therapy report (Wang, Mueller, and Lea, 2020) for a discussion regarding defense and claimant attorney involvement and related sensitivity tests. |
| Injury reporting | We do not have consistent data on the timing of injury reporting across the whole sample. |
| Access to care | The number of days from injury to first medical visit (access to medical providers and issues arising from the administrative process, such as delays in case management and pending compensability issues). |
| PM referrals/initiation | The number of days from the first medical visit to first PM visit (PM referrals). |
| <i>Provider practice factors (derived based on the DBE data)</i> | |
| Same billing entity for PM | Variable created based on detailed medical data. The variable was assigned value 1 if the tax ID for the PM provider was the same as that for the office visits prior to PM treatment, 0 otherwise. |
| Direct access to PM | Variable created based on detailed medical data. The variable was assigned value 1 if there were no office visits prior to PM treatment, 0 otherwise. |
| Multiple billing entities for PM treatment | Variable created based on detailed billing data for PM services. The variable was assigned value 1 if a claim has 2 or more unique tax IDs for PM providers. |
| Cross-disciplinary PM | Variable created based on detailed billing data for PM services. The variable was assigned value 1 if a claim received PM services by both chiropractors and non-chiropractic PM providers (mostly physical therapists) who were affiliated with the same billing entity. The variable serves as an indicator for interdisciplinary PM care within a health care organization. This is only applicable for an analysis examining combined PM care by both chiropractors and non-chiropractors within the same organization. |
| <i>Provider supply and fitness culture (external data)</i> | |
| Access to care | Measured by the waiting time to initial medical visit, to PT, and to MT. |
| Provider supply | Number of physical therapists per 100,000 population. Number of chiropractors per 100,000 population. Data for licensed physical therapists and doctors of chiropractic were from the National Center for the Analysis of Healthcare Data (NCAHD), representing the 2009 licensed physical therapists having a current license and residing within the state of licensure. The denominator is based on the U.S. Census data (2010–2016). |
| Likelihood of having chiropractic care | Used as a proxy for access to chiropractic care, which also helps capture, to some extent, patients' preference and care-seeking behavior. Derived based on the DBE data at the hospital referral region (HRR) level. The variable was created for each claim as the percentage of all other claims in the same HRR area that had a chiropractor involved in care. |
| <i>Health service environment</i> | |
| Physical activities | % of survey respondents who reported having physical activities in the past weeks. Data was aggregated at the county level. The source is the 2011 survey data from the IHME data files. Although the IHME data are not concurrent with our data in years, it is less likely that the county-level characteristics would change dramatically over several years. |
| <i>State-specific policy and environmental factors (state fixed effect)</i> | |
| System features (e.g., TD benefit structure) | Controlled by state fixed effect (i.e., controlled by state dummy variables) |
| Medical management policies (e.g., provider choice/change, UR/preauthorization rules, fee schedule and reimbursement rules) | Controlled by state fixed effect (i.e., controlled by state dummy variables) |
| Health care market conditions, concentration of occupational medical centers/networks | Controlled by state fixed effect (i.e., controlled by state dummy variables) |

^a The ICD-10 codes we identified for mobility diagnoses include R26, R268, R2689 (abnormalities of gait and mobility), R269 (unspecified abnormalities of gait and mobility), and Z740, Z7409 (reduced mobility). Note that the ICF codes referenced in the American Physical Therapy Association guidelines are not present in our data.

Key: DBE: Detailed Benchmark/Evaluation database; IHME: Institute for Health Metrics and Evaluation at the University of Washington; MRI: magnetic resonance imaging; MT: manual therapy; PM: physical medicine; PT: physical therapy; TD: temporary disability; UR: utilization review.

Several factors presented in Table TA.C13 deserve additional notes, which we provide as follows.

STATE POLICIES AND ENVIRONMENT

States policies on choice and change of providers, treatment guidelines and utilization review, reimbursement rules, and benefit structure are likely factors directly or indirectly affecting provider patterns and utilization of PM services as well as costs and outcomes. Other state-specific factors (e.g., differences in the mix of health care organizations with different delivery patterns and outcomes, economic environment) may also affect the results. We adjusted for these state-specific factors with state fixed effects (using state dummy variables). Note that we did not try to isolate different policies because the purpose of our analysis is to compare the outcomes between chiropractic and non-chiropractic care, holding constant all other factors. One might be concerned that controlling state fixed effects may not help address variable responses of treatment and certain key factors.

FACTORS RELATED TO PROVIDER SUPPLY AND PRACTICES

Individual likelihood of having chiropractic care. To capture perception of and access to chiropractic care in a local area, we constructed, for individual workers, a variable that approximates the likelihood of having chiropractic care within the local area. We derived this variable based on the experience of all other workers in the same hospital referral region.⁶ This variable, to some extent, helps capture certain unobserved factors of workers' preference and care-seeking behavior as well as the availability of chiropractors in the local area.⁷

Cross-disciplinary PM care. In some states (e.g., California), PM services were often provided by both chiropractors and non-chiropractic PM providers, mostly physical therapists, over the same period of treatment. Conceivably, the provider pattern of PM care may reflect an integration of PM providers for combined PM care including chiropractic manipulation and physical therapy. This interdisciplinary or multidisciplinary setting for PM treatment is different from conventional chiropractic care and may make a difference in the costs and outcomes. Based on the detailed medical transaction data for PM services, we identified, among the LBP claims with combined PM care, those that received PM services by both chiropractors and non-chiropractors with the same tax ID for billing the services (a.k.a., chiropractic and non-chiropractic PM providers with the same billing entity). This variable helps identify claims that received combined PM care in a cross-disciplinary setting.

Same-billing-entity PM and direct PM. We created this variable to indicate whether PM treatment was referred by a provider within the *same-billing-entity health care organization*.⁸ The same-billing-entity provider may imply one of two things: (1) the treating physician and the PM provider work in the same clinic or medical

⁶ The variable was constructed based on the same idea as in Savych, Neumark, and Lea (2018). Instead of constructing an instrumental variable, we used this as a proxy for patients' preference for and access to chiropractic care.

⁷ By definition, the hospital service area (HAS) could help define smaller areas than the hospital referral region (HRR), but this also creates small sample sizes. Because of this, we chose to use HRR for deriving the variable.

⁸ Specifically, the algorithm compares the unique provider IDs (i.e., encrypted tax ID in this case) between the provider who provided PM services and the provider who saw the patient during an office visit before the first PM visit. If both PM and office visit providers share the same ID, we consider the claim to have same-billing-entity PM treatment. For some claims, there may be more than one PM provider and more than one treating provider whom the worker saw before the first PM visit. If there is more than one pre-PM office visit provider and one of the providers shares the same ID with the PM provider, we consider the claim to have same-billing-entity PM treatment. A few claims had more than two PM providers. In this case, we checked the provider who provided PM services first.

center so that the PM treatments are provided in an in-house setting; or (2) both the treating physician and the PM provider are affiliated with the same health care organization as one billing entity. In the latter case, PM treatments are not done in-house but are referred internally to PM units within the same health care or billing organization. We controlled for same-billing-entity PM to equalize the impact of within-organization PM on choice and outcomes. Note that there is a small percentage of claims that had PM treatment without office visits.⁹

Multiple billing entities for PM treatment. This variable indicates whether providers of PM services are from different organizations (identified as billing entities). When PM care is performed and managed by different providers or organizations, it may signal different levels of patient complexity as well as claim and medical management issues. Although more complex patients may need additional medical services, it is likely that some additional services were used to rectify the issues in a prior treatment or did not help functional improvement. These additional services contribute to higher costs, longer TD duration, and delayed return to work.

UNOBSERVED FACTORS AFFECTING CHOICE OF CARE PROVIDER

For a statistical analysis of outcomes between chiropractic and non-chiropractic care, a key concern is about potential bias on the outcomes due to different medical severity and patient complexity between treatment and comparison groups. Workers with low back pain may have received treatments from different providers because they had different medical conditions and comorbidities. For example, studies suggest that patients with more serious medical conditions and/or two or more comorbidities are likely to receive care from a medical provider. These severity factors may be noted in medical records but are not directly measured using observational data. Even though we controlled for a large number of factors that may represent some of the unobserved severity and patient complexity, we cannot fully address the concern of potential bias without being able to directly measure medical severity and patient complexity.

It should be noted, however, that an individual's predilection for choosing chiropractic care, frequently associated with prior use of chiropractic care, is likely expressed directly in the individual's choice of a chiropractor in states where patients choose their initial provider.

Based on our review of the literature, we believe that the set of factors we controlled for in our statistical analysis covers a vast majority of factors discussed in the existing studies and beyond. In a scoping review of utilization and reasons for seeking chiropractic care, Beliveau et al. (2017) reported that chiropractic patients were more likely to be middle-aged females who were married and employed. Our results are largely consistent with Beliveau et al. (2017), except on gender and marital status.

Weeks et al. (2015b and 2016) examined the characteristics of Medicare beneficiaries with chronic low back pain and multiple comorbidities who received chiropractic manipulative treatment versus those who did not receive CMT. Among this particular cohort, those who received CMT services tended to be younger, male, more likely to be white, more educated, less likely to have illness burden,¹⁰ and less likely to have an indicator

⁹ Most states allow patients to see physical therapists directly without referrals from a doctor. We see a small percentage of claims with direct PM care, likely because of company practices in claim management and reimbursement. It may also be that, in rare cases, chiropractors provided E&M services but did not bill for them or were not reimbursed.

¹⁰ The illness burden includes a set of indicators, such as Charlson comorbidity score, disability as original reason for Medicare enrollment, and total Medicare spending in the year prior to the illness episode studied.

of poverty¹¹ than those who did not receive CMT. Patients who used CMT were more likely to live in zip codes with lower incomes and in hospital referral regions that had a higher per-capita supply of chiropractors, compared to those without CMT (Weeks et al., 2015b and 2016). Since the population studied in Weeks et al. (2015 and 2016) is very different from ours, we did not compare the effect of the factors.

Based on the Medical Expenditure Panel Survey (MEPS) data collected from January 2001 to December 2003, Chevan and Riddle (2011) examined the patient characteristics that are associated with those who receive MD/PT (physician referral for PM treatment) care for LBP, as contrasted with those who receive MD (exclusive physician) or DC (exclusive chiropractic care). The researchers found that increased age, female sex, lower self-health rating, and the presence of at least one disability day were all significantly associated with physician/physical therapist care over chiropractor care. Our results are largely consistent with Chevan and Riddle (2011), except on gender and age.

Blanchette et al. (2016a) found several key factors that most likely influence the choice of initial providers, including age, gender, job tenure, wage, size of employer, rural and urban area, and the size of community. Our study does not directly examine the choice of initial providers, but medical decision making on the specific type of service is strongly associated with the type of provider and provider practices.

Shraim et al. (2017) examined the impact of regional socioeconomic factors on medical costs and disability duration for occupational low back pain, using a payor's data for workers' compensation claims. According to the study, medical costs were higher in more urban, more racially diverse, and lower education neighborhoods. Longer disability duration was associated with neighborhood household income and unemployment rate. Most of these factors are also expected to influence treatment choice.

In all, we were able to control for most of these factors, including demo-socio-economic characteristics of workers; variables that measure or approximate the severity and comorbidities; regional or neighborhood factors in terms of general level of education, median household income, health insurance coverage, local economic conditions, and unemployment rate; and provider factors such as availability of providers. The instrumental-like variable we created at the hospital referral region level helped capture some of the unobserved preference and care-seeking behavior.¹² However, we are limited in our ability to measure patient complexity, treatment preference, and psychosocial factors affecting choice. Some of these have been explored in several studies outside workers' compensation based on diagnoses and utilization of medical services prior to the current episode of illness. Unfortunately, we do not have data to capture preinjury experience. Because of this, our findings only provide evidence of association between chiropractic exclusive PM and matched non-chiropractic-only PM.

OTHER POTENTIAL CONCERNS AND SENSITIVITY TEST

Several other potential concerns should be addressed to make sure that our results are not sensitive to these concerns. The main issues include the following:

- Measurement and use of attorney involvement as a proxy for pending compensability or other issues

¹¹ The poverty indicators are Medicare Part D poverty flag and Medicaid enrollment.

¹² We did not use this hospital-referral-region-level variable as an instrumental variable to estimate the effect of chiropractic care, because we are not convinced that this would be a valid instrumental variable in the context of our study on chiropractic care. This is consistent with what we see in the instrumental test in Stata.

arising from the claims administrative process.

- Large states may be dominating the results.
- Differences in cost of living may affect medical costs.
- Impact of additional control of severity using primary ICD-10 codes.

ATTORNEY INVOLVEMENT

Pending compensability issues often have the effect of delaying care or choice of certain types of care.¹³ The same compensability issues may also create friction or litigation that is associated with a greater use of medical resources and late return to work. It is a valid concern that this confounding factor, if not addressed, will compromise the results from our statistical analyses. Although worker attorney involvement may be helpful to indicate pending compensability issues, we chose to use defense attorney involvement in the analysis for two reasons. First, while our data capturing worker attorney involvement has improved in recent years, the data adequate for analysis cover a smaller set of claims compared with the data on defense attorney involvement. Second, our sensitivity analyses suggested that the results we presented in the main report were not sensitive to the omission of the worker attorney involvement indicator, which is partially because of a strong correlation between the defense and worker attorney involvement variables.¹⁴

While the attorney indicators help approximate compensability issues that might have occurred in the claims, both defense and worker attorney indicators may under- or over-identify claims with pending compensability issues.¹⁵ For example, the defense attorney involvement variable in our data reflects claims with reported payments to a defense attorney. These include payments for in-house and outside counsel that are allocated to claims. On the one hand, it is possible, given the informal dispute resolution processes used in some states, that some compensability issues are resolved without attorney involvement. This would cause us to *under-identify* claims with pending compensability. On the other hand, for states with a formal dispute resolution system, it is more likely that defense attorney involvement captures most of the compensability issues because of the actions taken and resources involved. In this case, the defense attorney indicator may *over-identify* claims with pending compensability. In the 2020 study on early physical therapy, we addressed this concern by performing two sensitivity analyses (Wang, Mueller, and Lea, 2020). The first analysis was to create an attorney indicator so that the value is 1 if either defense or worker attorneys were involved and 0 if neither defense nor worker attorneys were involved. By doing so, we could maximize the capture of pending issues with the available data and see if the results were sensitive to this change. The second analysis was to run the same regressions based on a subset of claims that had neither defense nor worker attorney involvement to eliminate possible differences in the prevalence of pending compensability issues between treatment and comparison

¹³ In some states, medical care is less likely to be affected by compensability issues. This may happen in most workers' compensation jurisdictions except those with pay-without-prejudice. Massachusetts, for example, requires 180 days of pay-without-prejudice, where workers receive medical and indemnity benefits without the insurer accepting liability. Benefits may or may not terminate after 180 days depending on whether the insurer accepts liability based on compensability rules.

¹⁴ See Wang, Mueller, and Lea (2020) and Yang, Rothkin, and Dolinschi (2017).

¹⁵ Defense attorneys may be involved in disputes between the carrier and worker over compensability issues and issues related to maximum medical improvement, impairment/disability ratings, and the determination of permanent partial disability. Defense attorneys could also be involved in disputes over payments and medical necessity issues between the carrier and providers. Time from injury to first medical service may reflect issues that could delay medical care, including pending compensability, delayed injury notice to employers and insurers, access to care, and in some cases, a delay in seeking care on the part of the worker.

groups. Based on these two analyses, we concluded that the results from analyses including defense attorneys are unlikely to change in a material way that affects the findings. See Technical Appendix C of the 2020 report for the results of the sensitivity analyses and a more detailed discussion.

ADDRESSING CONCERNS THAT LARGE STATES MAY BE DOMINATING THE RESULTS

States are different in size, workers' compensation policies, and other factors. As mentioned previously, one way to address this is to control for state fixed effects, which we did in the statistical analysis. For descriptive data (in Chapter 4), we ran descriptive data for the same set of variables applying the state-equal weights. To do so, we created a set of weights that equalize the importance of the individual states (i.e., a smaller weight was assigned to claims in a large state depending on the actual proportion of claims across states) and comparing the results with and without the equal-state weights. There was no material difference in the patterns and outcomes between the weighted and unweighted data.

DIFFERENCES IN COST OF LIVING MAY AFFECT MEDICAL COSTS

Since medical prices vary widely across states, one may be concerned that the variation in "cost of living" may affect the results of our statistical analysis. This is a valid concern because if proportionally more claims with chiropractic care are from states with lower medical costs, the average medical cost per claim would be lower compared with non-chiropractic care that has proportionally more claims from high-cost states. However, we believe that the adjustment for state fixed effect should address this concern. We did run the same analysis for several individual states, such as California, Minnesota, and Wisconsin. The results from these separate runs did not change the major findings.

IMPACT OF ADDITIONAL CONTROL OF SEVERITY USING PRIMARY ICD-10 CODES

Other possible ways to control for additional severity and complexity is to include ICD-10 codes in our statistical analysis. To do so, we derived the primary ICD-10 codes for individual claims and identified LBP claims that had one of the ICD-10 codes.

The primary ICD-10 codes based on our derivation are the ICD-10 codes that capture most of the payments for services rendered in treating the diagnosis. We kept the first 5 characters of the ICD-10 codes, which would be sufficient to differentiate severity based on the ICD-10 hierarchical coding structure.¹⁶ Among the LBP claims we studied, for example, the most common primary ICD-10 codes include S39.0 (injury of muscle, fascia and tendon of low back and pelvic), M54.5 (low back pain), S33.5 (sprains of ligaments of lumbar spine), M54.1 (radiculopathy), M54.4 (lumbago with sciatica), and S30.0 (contusion of low back and pelvis). These codes accounted for more than 75 percent of the claims. Based on our analysis, we concluded that the ability to control for severity using these ICD-10 codes is limited; the results did not change after we included these derived variables in the analysis. Our data show that the claim distribution of these primary ICD-10 codes were not drastically different between the treatment and comparison group, suggesting limited usefulness of

¹⁶ The first 5 characters refer to the first 3 characters, the dot, and the 4th character of the ICD-10 codes. By design, an ICD-10 code can have 3 to 7 characters, with a dot after the first 3 characters. The first 3 characters indicate categories (for injuries and body region). The next 3 characters indicate anatomic site and severity. For back conditions, severity is indicated on the 4th character and the 5th character is for specific regions of the spine. The 7th character indicates episode of care (e.g., initial or subsequent visits), which usually goes with the S codes.

this additional control. We tested the sensitivity of the results to the additional control of these ICD-10 codes. Based on our analysis, we concluded that the ability to control for severity and complexity by using these ICD-10 codes is limited; the results did not change after we included these derived variables in the estimations of treatment choice and outcomes.

GLOSSARY

- case-mix adjustment:** This is a statistical technique that helps hold the mix of claims and injury characteristics constant across different subsets in a statistical analysis so that the adjusted results reflect the difference in the utilization of medical services, not the difference in the mix of cases.
- chiropractic exclusive PM care:** Refers to claims that received physical medicine services by chiropractors only. This includes two subgroups of claims: (1) chiropractic-only PM/EM and (2) chiropractic-only PM.
- chiropractic-only PM:** One of the two treatment groups in our statistical analysis. The chiropractic-only PM group includes LBP claims that received PM treatment by chiropractors only. Workers in this group received E&M services from non-chiropractic providers (e.g., medical and osteopathic doctors, nurse practitioners, and physician assistants). In most cases, chiropractors also provided, billed, and were paid for E&M services.
- chiropractic-only PM/EM:** One of the two treatment groups in our statistical analysis. The chiropractic-only PM/EM group includes LBP claims that received PM treatment only by chiropractors, and all the E&M services were also provided by chiropractors. In the report, this group is often referred to as *exclusive chiropractic care*.
- combined PM care:** Refers to claims that received PM care from both chiropractors and non-chiropractors over an overlapping period of time during the treatment.
- comparison group:** The group of cases receiving treatments that are different from the group receiving the treatment of interest. In this study, we have two treatment groups with chiropractic care and compare these two groups with claims receiving non-chiropractic care. Since many claims with non-chiropractic care do not seem to resemble those with chiropractic care, we applied a propensity score matching approach to construct the comparison group. As a result, the comparison group is a subset of non-chiropractic claims that match the individual claims in each of the chiropractic exclusive PM groups in terms of likelihood of receiving chiropractic care.
- confounding factors:** The factors, observed and unobserved, that influence choice of chiropractic care versus non-chiropractic care. The observed factors we included in our analysis include injury severity, comorbidities, worker and claim characteristics, and environmental factors (rural versus urban area, supplies of physical therapists and chiropractors, unemployment rate, county-level data on median household income, education level, poverty, etc.). Some possible unobserved factors are also discussed in the report.
- cross-disciplinary PM treatment:** Among claims with combined PM treatments performed by both chiropractors and non-chiropractors, we identified a large proportion of claims for which PM services were done during an overlapping period by chiropractors and non-chiropractors who were affiliated with the same billing entity tax ID. The same billing entity may include occupational medicine clinics with integrated chiropractic care, or clinics or providers affiliated with a large hospital/health care organization. Note that some of the same billing entities we identified may also be formed for financial reasons. We are not able to separate such entities from cross-disciplinary clinics. Other literature may refer to this type of care as integrated chiropractic care, or multidisciplinary or interdisciplinary PM care.

low back claims with nerve involvement: The claims we identified based on the ICD-10 codes that had low back conditions being treated as a predominant condition and had at least one diagnosis indicating pain radiating down to the leg or neurological findings. These are the claims that did not have red flag conditions such as tumors, infectious diseases, fractures, and dislocations.

low back pain only claims: The claims we identified using the ICD-10 codes that had low back pain being treated as a predominant condition, but did not have any mention of radiating leg pain or neurological findings. Claims with red flag conditions, such as tumors, infectious diseases, fractures, and dislocations, were excluded from this study.

managed care organization (MCO): Refers to a health care provider or a group or organization that offers managed care health plans. Managed care is a health care delivery system organized to manage cost, utilization, and quality. It is a health care organization that contracts with payors (insurers or self-insured employers) to deliver health care using a specific provider network and specific health care products. MCOs often have their own utilization review and dispute resolution systems, and many states have different regulations for MCOs.

medical treatment guidelines: Also known as clinical guidelines or practice guidelines, which are documents intended to be used for guiding medical decision making by providing criteria regarding diagnosis and medical treatment. In this study, we focus on medical treatment guidelines that have been adopted by a state with the intention of providing a uniform set of clinical standards for medical providers and utilization review professionals, with or without an enforcement mechanism.

non-chiropractic-only PM: A group of claims we identified that received PM treatment by non-chiropractors only (mostly physical therapists and infrequently osteopaths or other non-chiropractic PM providers). The claims with non-chiropractic-only PM also received E&M services from non-chiropractic providers (medical and osteopathic doctors, nurse practitioners, and physician assistants). Because many claims with non-chiropractic-only PM are different from those with chiropractic-only PM, a subset of the non-chiropractic-only PM claims were selected for our statistical analysis through propensity score matching.

physical medicine (PM) treatment: Consists of physical modalities (often referred to as passive physical therapies, such as hot and cold packs, soft-tissue massage, traction, and acupuncture), manual therapy (e.g., joint or soft-tissue mobilization and manipulation, connective tissue massage, and manual tractions, etc.), and active therapies (e.g., therapeutic exercises and related education and training, active counseling, and work hardening). Evaluation/measurement and functional assessment are also part of physical medicine to evaluate and monitor the progress of treatment. Physical medicine treatments are performed by chiropractors and non-chiropractors, with the goal of mitigating pain and facilitating functional recovery and return to work. Throughout the report, we use *PM* to refer to physical medicine treatments. This study addresses limited physical medicine treatments only, as described. The study does not explore larger issues encompassed in the full practice of the medical specialty of physical medicine and rehabilitation.

propensity score matching: A statistical technique that is often used to construct a comparison group to ensure the comparability between the treatment and comparison groups. For our study, it predicts the likelihood of having chiropractic care for individual claims with or without chiropractic care, and for each claim in the treatment group (chiropractic-only PM/EM or chiropractic-only PM), it finds one or multiple claims in the non-chiropractic group that have a closely-matched likelihood. The predicted likelihood or propensity score is a composite score calculated based on the estimated

effects of the factors believed to influence the selection. As a result, the matched non-chiropractic-only PM cases will have characteristics that would make them equally likely to have received chiropractic care as those in the chiropractic group. This creates a comparison group that is as similar as possible to the chiropractic group.

provider choice policy: Addresses whether the employer/payor or the employee has control over the choice of treating providers. The policies vary by state, but states may be grouped into employer control, employee choice, and employee limited choice states. For states with employee choice, workers can choose their treating providers and, thus, the selection of chiropractic care will likely reflect their experience and perception of chiropractic care. For states with employer control of provider selection, the employers and carriers may or may not let workers choose chiropractors as a treating provider or include chiropractors in their list or panel of providers. In states with employer control, chiropractor involvement in delivering care may reflect employer/carrier perception of cost-effectiveness of chiropractic care.

reimbursement rules: A set of criteria specified by a workers' compensation jurisdiction that determines what services should or should not be considered for reimbursements. Some jurisdictions, for example, consider all medical services within the parameters of state-adopted treatment guidelines as medically necessary and therefore reimbursable.

same billing entity: Identifies medical service providers who are affiliated with the same tax ID used in billing for services rendered.

sequential PM care: Refers to claims that received PM care from both chiropractors and non-chiropractors, and there is no overlapping treatment period between chiropractic and non-chiropractic PM treatment.

treatment group: Refers to a group of cases that received a certain treatment, which is of interest for a comparative cost-effectiveness study that compares the outcomes between the treatment group and another group of cases that received different treatment. In this study, we have two treatment groups (claims with chiropractic-only PM/EM and claims with chiropractic-only PM) to compare chiropractic care with non-chiropractic-only PM care for workers with LBP.

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