

***Buprenorphine Prescribing by Nurse Practitioners,  
Physician Assistants and Physicians  
After CARA 2016***

Final Research Report  
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## **Final Research Report: *Buprenorphine Prescribing by Nurse Practitioners, Physician Assistants, and Physicians after CARA 2016***

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## Table of Contents

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Table of Exhibits .....	iii
Abbreviations .....	vi
Executive Summary .....	7
<b>1 Introduction.....</b>	<b>13</b>
<b>2 Background.....</b>	<b>15</b>
<b>3 Research Questions.....</b>	<b>17</b>
<b>4 Methodology .....</b>	<b>18</b>
4.1 Data Source .....	18
4.2 Privacy Protections.....	18
4.3 Study Variables and Population .....	18
4.4 Data Analysis .....	20
<b>5 Findings.....</b>	<b>23</b>
5.1 Prescriber Patterns and Trends .....	23
5.2 Patient Patterns and Trends.....	25
5.3 Patient Patterns and Trends — Medicaid Beneficiaries .....	27
5.4 Variation in Patterns for Medicaid Beneficiaries Based on Age and Gender .....	28
5.5 Comparison between Medicaid and Other Payer Types.....	31
5.6 Urban-Rural Differences.....	36
5.7 Influence of State Prescriptive Authority for NPs .....	42
5.8 Factors Associated with Advanced Practitioner Prescribing .....	45
5.9 Patient Load for each Prescriber Type.....	47
<b>6 Conclusions .....</b>	<b>49</b>
6.1 Summary of Findings .....	49
6.2 Issues for Future Consideration .....	50
6.3 Limitations .....	52
<b>7 References .....</b>	<b>54</b>
<b>APPENDIX A. Buprenorphine Formulations for OUD .....</b>	<b>56</b>
<b>APPENDIX B. NP and PA Prescribing Authority by State.....</b>	<b>57</b>
<b>APPENDIX C. Cohort Formation Table .....</b>	<b>60</b>
<b>APPENDIX D: Regression Models – Methods and Results .....</b>	<b>61</b>
Methods .....	61
Results.....	64
<b>APPENDIX E. Supplemental Results for Medicaid Beneficiaries.....</b>	<b>78</b>
<b>APPENDIX F. National Maps on Key Measures of Interest.....</b>	<b>83</b>
Prescriber-level Maps.....	84

Patient-level Maps ..... 92

## Table of Exhibits

---

Exhibit 1. Timeline Authorizing NPs and PAs to Prescribe Buprenorphine for OUD .....	16
Exhibit 2. Study Variables .....	19
Exhibit 3. Number of NPs, PAs, and Physicians Prescribing Buprenorphine for OUD, July 2017 – June 2018 .....	23
Exhibit 4. Proportion of OUD Prescribers by Provider Type, July 2017-June 2018.....	24
Exhibit 5. Advanced Practitioner Proportion of Buprenorphine for OUD Prescribers, by State .....	25
Exhibit 6. Number of Patients Receiving Buprenorphine Prescriptions for OUD, by Prescriber Type, July 2017 – June 2018 .....	26
Exhibit 7. Number of Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD, by Prescriber Type, July 2017 – June 2018 .....	27
Exhibit 8. Proportion of Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners, by State .....	28
Exhibit 9. Number of Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD, by Prescriber Type and Patient Gender, July 2017 – June 2018 .....	29
Exhibit 10. Number of NPs, PAs, and Physicians Prescribing Buprenorphine for OUD, by Medicaid Beneficiaries' Gender, July 2017 – June 2018 .....	29
Exhibit 11. Number of Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD, by Prescribe Type and Patient Age Group, July 2017 – June 2018 .....	30
Exhibit 12. Number of NPs, PAs, and Physicians Prescribing Buprenorphine for OUD, by Payer Type, July 2017 – June 2018.....	33
Exhibit 13. Number of Patients Receiving Buprenorphine Prescriptions for OUD, by Prescriber and Payer Type, July 2017 – June 2018.....	35
Exhibit 14. Payer Mix of Patients Receiving Buprenorphine for OUD Prescriptions, by Prescriber Type, July 2017 – June 2018.....	36
Exhibit 15. Number of NPs, PAs, and Physicians Prescribing Buprenorphine for OUD in Urban vs. Rural Areas, July 2017 – June 2018 .....	37
Exhibit 16. Number of Patients Receiving Buprenorphine for OUD from Urban vs. Rural Prescribers, July 2017 - June 2018 .....	38
Exhibit 17. Number of Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD from Urban vs. Rural Prescribers, July 2017 – June 2018 .....	39
Exhibit 18. Number of Medicare Beneficiaries Receiving Buprenorphine Prescriptions for OUD from Urban vs. Rural Prescribers, July 2017 – June 2018 .....	40
Exhibit 19. Number of Patients with Commercial Insurance Receiving Buprenorphine Prescriptions for OUD from Urban vs. Rural Prescribers, July 2017 – June 2018 .....	41

Exhibit 20. Number of Cash-paying Patients Receiving Buprenorphine Prescriptions for OUD from Urban vs. Rural Prescribers, July 2017 – June 2018 .....	42
Exhibit 21. Average Number of NPs, PAs, and Physicians Prescribing Buprenorphine per State, by State Prescriptive Authority for NPs, July 2017 – June 2018.....	44
Exhibit 22. Average Number of Patients Receiving Buprenorphine Prescriptions for OUD per State, by State Prescriptive Authority for NPs, July 2017 – June 2018 .....	44
Exhibit 23. Patients' Probability of Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners, July 2017 – June 2018.....	46
Exhibit 24. Patient Load of Prescribers with Buprenorphine Prescriptions for OUD, by Prescriber Type..	48
Exhibit A-1. Buprenorphine Formulations FDA-Approved for Opioid Dependence .....	56
Exhibit B-1. State Prescriptive Authority for Buprenorphine for OUD; Study Sample; State Population Estimates .....	57
Exhibit B-2. Average Number of Buprenorphine for OUD Prescribers per 100,000 Population per State, by State Prescriptive Authority for NPs, July 2017 – June 2018 .....	59
Exhibit D-1. Patients' Probability of Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners, July 2017 – June 2018.....	64
Exhibit D-2. Patients' Probability of Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners, Full sample and Medicaid-only Sub-sample, July 2017 – June 2018.....	65
Exhibit D-3. Patients' Probability of Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners by Payer Type, July 2017 – June 2018.....	68
Exhibit D-4. Proportion of Patients who Received Buprenorphine Prescriptions for OUD from Advanced Practitioners, Urban versus Rural Areas, July 2017 – June 2018 .....	70
Exhibit D-5. Proportion of Patients who Received Buprenorphine Prescriptions for OUD from Advanced Practitioners, States with and without Full NP Prescriptive Authority, July 2017 – June 2018 .....	72
Exhibit D-6. Patients' Probability of Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners, July 2017 – June 2018.....	74
Exhibit D-6a. Patients' Probability of Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners, July 2017 – June 2018, with State Fixed Effects .....	76
Exhibit E-1. Number of NPs, PAs, and Physicians Prescribing Buprenorphine for OUD, by Medicaid Beneficiaries' Age Group, July 2017 – June 2018 .....	78
Exhibit E-2. Number of NPs, PAs, and Physicians Prescribing Buprenorphine for Male Medicaid Beneficiaries' by Patient Age Group, July 2017 – June 2018 .....	79
Exhibit E-3. Number of NPs, PAs, and Physicians Prescribing Buprenorphine for Female Medicaid Beneficiaries' by Patient Age Group, July 2017 – June 2018 .....	80
Exhibit E-4. Number of Male Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD, by Prescriber Type and Patient Age Group, July 2017 – June 2018.....	81
Exhibit E-5. Number of Female Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD, by Prescriber Type and Patient Age Group, July 2017 – June 2018 .....	82

Exhibit F-1. Advanced Practitioner Proportion of Buprenorphine for OUD Prescribers, July 2017 – June 2018 .....	84
Exhibit F-2. Advanced Practitioner Proportion of Buprenorphine for OUD Prescribers (Payment Type Medicaid), July 2017 – June 2018 .....	85
Exhibit F-3. Advanced Practitioner Proportion of Buprenorphine for OUD Prescribers (Payment Type Cash), July 2017 – June 2018 .....	86
Exhibit F-4. Advanced Practitioner Proportion of Buprenorphine for OUD Prescribers (Payment Type Commercial), July 2017 – June 2018 .....	87
Exhibit F-5. Advanced Practitioner Proportion of Buprenorphine for OUD Prescribers (Payment Type Medicare), July 2017 – June 2018 .....	88
Exhibit F-6. Proportion of Advanced Practitioners' Patients with Buprenorphine for OUD Paid for by Medicaid, July 2017 - June 2018 .....	89
Exhibit F-7. Advanced Practitioner Proportion of Rural Buprenorphine for OUD Prescribers, July 2017 – June 2018 .....	90
Exhibit F-8. Advanced Practitioner Proportion of Urban Buprenorphine for OUD Prescribers, July 2017 – June 2018 .....	91
Exhibit F-9. Proportion of Patients Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners, July 2017 – June 2018 .....	92
Exhibit F-10. Proportion of Patients Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners (Payment Type Medicaid), July 2017 – June 2018 .....	93
Exhibit F-11. Proportion of Patients Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners (Payment Type Cash), July 2017 – June 2018 .....	94
Exhibit F-12. Proportion of Patients Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners (Payment Type Commercial), July 2017 – June 2018 .....	95
Exhibit F-13. Proportion of Patients Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners (Payment Type Medicare), July 2017 – June 2018 .....	96
Exhibit F-14. Proportion of Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD from Rural Advanced Practitioners, July 2017 – June 2018 .....	97
Exhibit F-15. Proportion of Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD from Urban Advanced Practitioners, July 2017 – June 2018 .....	98

## Abbreviations

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CARA	Comprehensive Addiction and Recovery Act
DATA	Drug Addiction Treatment Act
DEA	Drug Enforcement Administration
FDA	Food and Drug Administration
HHS	U. S. Department of Health and Human Services
IDV®	Integrated Dataverse®
MACPAC	Medicaid and CHIP Payment and Access Commission
MAT	Medication-assisted treatment
NPPES	National Plan and Provider Enumeration System
NP	Nurse practitioner
NPI	National provider identifier
OTP	Opioid treatment program
ODD	Opioid use disorder
PA	Physician assistant
SAMHSA	Substance Abuse and Mental Health Services Administration
USC	Uniform System of Classification
USDA ERS	U.S. Department of Agriculture Economic Research Service



## Executive Summary

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### Key points

- Increasing the number of waived providers who can provide medication-assisted treatment (MAT) with buprenorphine is a major strategy to improve access to treatment for opioid use disorder (OUD). In early 2017, nurse practitioners (NPs) and physician assistants (PAs) who met certain state and federal requirements started obtaining Drug Enforcement Administration (DEA) waivers to prescribe buprenorphine as part of MAT for OUD.
- Analyses of retail pharmacy claims data from July 2017 to June 2018 found that 37,380 providers wrote prescriptions for buprenorphine with a Food and Drug Administration (FDA) approved indication for treating OUD, resulting in over 10 million claims, to more than 900,000 patients.

### Prescriber patterns and trends

- Over the full study year, nearly one-fifth of the buprenorphine prescribers were advanced practitioners — 4,828 NPs (13 percent) and 2,099 PAs (6 percent) — and the rest were physicians.
- The number of buprenorphine prescribers increased by 12 percent between the first (July-September 2017 or Q1) and last (April-June 2018 or Q4) study quarter. The number of NPs prescribing buprenorphine increased by almost 80 percent from 1,889 in Q1 to 3,377 in Q4. During the same period, the number of PAs grew almost by 50 percent from 909 to 1,353, and that of physicians grew more modestly, from 20,812 to 21,754 (4.5 percent).
- Rural counties had a higher proportion of advanced practitioner prescribers (24 percent) than did urban counties (18 percent).
- Some states allow NPs to prescribe buprenorphine for OUD independently while others require physician oversight, at least for a certain period. Over the full study year, states with full NP prescriptive authority had a higher proportion of advanced practitioner prescribers than did states with limited NP prescriptive authority (25 percent vs. 16 percent).
- Across states, the proportion of buprenorphine prescribers who were advanced practitioners ranged from 6 percent in Alabama to 33 percent in Wyoming.

## Patient patterns and trends

- The number of patients prescribed buprenorphine increased by 6 percent from 581,596 in Q1 to 616,220 in Q4. Over the full study year, 909,300 unique patients received buprenorphine prescriptions.
- Most patients (97 percent) received prescriptions from physicians, with about 9 percent receiving prescriptions from NPs and 4 percent from PAs, and 9 percent from both advanced practitioners and physicians. During the study period, 81,742 of the 111,184 patients (74 percent) who received a buprenorphine prescription from an advanced practitioner also received a prescription from a physician.
- The number of patients treated by advanced practitioners increased sharply during the year. The largest increase was among patients receiving prescriptions from NPs. This number rose from 17,821 in Q1 to 50,317 in Q4, a 182 percent increase. The number of patients receiving prescriptions from PAs also rose substantially, from 8,559 in Q1 to 20,734 in Q4 — a 142 percent increase. In contrast, the number of patients receiving prescriptions from physicians increased less markedly, from 570,450 in Q1 to 582,420 in Q4 (2 percent increase).

## Medicaid patterns and trends

- About 40 percent of patients with buprenorphine prescriptions (365,591 patients) had at least one prescription fill paid for by Medicaid. The number of Medicaid beneficiaries with buprenorphine prescriptions rose from 204,127 in Q1 to 228,556 in Q4. This increase of 12 percent was twice that observed for patients overall.
- The proportion of Medicaid beneficiaries receiving buprenorphine prescriptions from advanced practitioners was 15 percent across the full study year, which is higher than the proportion for all patients (12 percent).
- The number of Medicaid beneficiaries receiving buprenorphine prescriptions from advanced practitioners more than tripled (317 percent increase) over the full study year. This increase was higher than the increases observed for Medicare (246 percent), commercial insurance (227 percent), and cash-paying patients (243 percent).
- Regression analysis adjusting for patient gender and age, prescriber's rural vs. urban location, and state NP prescriptive authority status showed that Medicaid beneficiaries were more likely to receive buprenorphine prescriptions from advanced practitioners than patients covered by Medicare or commercial insurance, and those who paid in cash.

- Medicaid paid for prescriptions filled by about half of advanced practitioners' patients, and commercial insurance paid for prescriptions filled by two-fifths of their patients. Specifically, the proportion of Medicaid beneficiaries among the patient population with buprenorphine prescriptions was 53 percent for NPs and 45 percent for PAs. This pattern was nearly reversed among physicians — commercial insurance paid for a little more than half of their patients' prescription fills and Medicaid paid for 40 percent.
- Providers who prescribed buprenorphine to one or more Medicaid beneficiaries in June 2018, the last study month, treated more patients per provider that month than providers who did not prescribe buprenorphine to Medicaid beneficiaries in that month (a median monthly patient load per provider of 16 vs. 2).

## **Background**

Opioid addiction, misuse, and fatalities have created a national crisis in the United States, especially among Medicaid beneficiaries. MAT with buprenorphine, together with counseling and social support, is a key strategy for treating people with opioid dependency. However, there is an insufficient number of healthcare providers who are trained, authorized, and willing to provide MAT. The Comprehensive Addiction and Recovery Act of 2016 (CARA) (P.L. 114-198) sought to address this gap by expanding the Drug Addiction Treatment Act of 2000 (DATA 2000) to allow (“waive”) NPs and PAs to prescribe buprenorphine to the extent allowed by applicable state laws.

## **Objectives**

The principal objective of the study was to assess patterns and trends in prescribing buprenorphine for OUD by NPs and PAs for the Medicaid population since the implementation of DATA 2000 waiver eligibility — specifically, from July 2017 to June 2018. Additionally, the study examined and compared patterns and trends for physicians and patients with other payer types during this period.

## **Analytic Approach**

We used data from Symphony Health Integrated Dataverse® (IDV®), spanning July 2017 to June 2018, to examine the patterns and trends in buprenorphine prescriptions written by NPs, PAs, and physicians in the United States. IDV® captures over 90 percent of prescriptions filled from retail pharmacies in the United States. Each prescription fill record contains detailed information including the fill date, national drug code (NDC), prescriber national provider identifier (NPI), and selected patient information.

We restricted the analysis to claims for buprenorphine drugs with an FDA-approved indication for treating OUD and refer to these interchangeably as “buprenorphine for OUD” and “buprenorphine”. Prescribers were categorized as physicians, NPs, or PAs based on taxonomy codes from the National Plan and Provider Enumeration System (NPPES). Prescriber urban/rural location was determined based on the 2013 Urban Influence Codes.

The analyses rely primarily on descriptive statistics such as counts and percentages as well as cross-tabulations across various dimensions of interest. Summary statistics such as means and medians are used to characterize the central tendency of prescribing for each type of prescriber. We further visualized counts and percentages in maps and trend graphs and supplemented descriptive statistics with a set of regression models that identified statistically significant associations.

## **Prescriber Patterns and Trends**

The study found that 37,380 providers prescribed buprenorphine for OUD between July 2017 and June 2018 in the United States. Of these prescribers, 18.5 percent were advanced practitioners, including 4,828 NPs and 2,099 PAs. The number of observed prescribers rose each study quarter for every prescriber category. A sharp increase of almost 80 percent occurred for NPs, followed by a nearly 50 percent increase for PAs and a 4.5 percent increase for physicians.

A total of 22,599 providers (60.5 percent all observed providers) prescribed buprenorphine for OUD to Medicaid beneficiaries from July 2017 to June 2018. Among Medicaid prescribers, NPs increased from 1,040 in the first study quarter of July to September 2017 (Q1) to 2,298 in the last study quarter of April to June 2018 (Q4), an increase of 121.0 percent. Over the same period, the number of PAs increased 86.8 percent from 432 to 807 and the number of physicians increased 5.9 percent from 12,966 to 13,735. For Medicaid beneficiaries, the share of prescribers that were NPs grew from 7.2 percent in Q1 to 13.6 percent in Q4 and that of PAs grew from 3.0 percent to 4.8 percent.

Around half of the patients receiving buprenorphine prescriptions from advanced practitioners had prescriptions paid for by Medicaid, and roughly two-fifths had prescriptions paid for by commercial insurance. This pattern is nearly reversed among physicians — a little more than half of their patients had prescriptions paid for by commercial insurance. In June 2018, the observed patient load — defined as the median number of patients per prescriber — was 7 for physicians, 5 for NPs, and 4 for PAs. Among prescribers who treated Medicaid patients, the corresponding patient load was 19 for physicians, 9 for NPs, and 11 for PAs.

## Patient Patterns and Trends

The number of patients prescribed buprenorphine for OUD in the United States increased from 581,596 in Q1 to 616,200 in Q4. The most prominent increase came from patients who received prescriptions from NPs. This number rose from 17,821 in Q1 to 50,317 in Q4, a 182.3 percent increase. The number of patients receiving prescriptions from PAs also rose substantially, from 8,559 in Q1 to 20,734 in Q4 (a 142.2 percent increase). In contrast, the number of patients receiving prescriptions from physicians increased less markedly, from 570,450 in Q1 to 582,420 in Q4 (only a 2.1 percent increase). Over the study year, 12.2 percent of patients received prescriptions from advanced practitioners.

Two-fifths of patients in our dataset received at least one buprenorphine prescription for OUD paid for by Medicaid. Over the study year, the proportion of Medicaid beneficiaries who received prescriptions from advanced practitioners was 15.1 percent. The number of Medicaid beneficiaries who received prescriptions from each provider type rose over the study year, but the percent increase was much higher among advanced practitioners than physicians, especially among NPs (231.7 percent increase). Correspondingly, the proportion of Medicaid beneficiaries who received prescriptions from NPs grew from 3.9 percent in Q1 to 11.5 percent in Q4, and the proportion of patients who received prescriptions from PAs grew from 1.5 percent to 4.0 percent.

## State and Urban-rural Variation

By state, the proportion of providers who were advanced practitioners ranged from 5.6 percent in Alabama to 32.9 percent in Wyoming. The proportion of providers who were advanced practitioners was higher in states with full NP prescriptive authority than in states with limited NP prescriptive authority (25.2 percent vs 16.3 percent).

Rural areas had a higher proportion of advanced practitioner prescribers than urban areas in every quarter. Over the full year, 24.0 percent of rural prescribers were advanced practitioners — 17.8 percent NPs and 6.2 percent PAs. In urban areas, advanced practitioners made up 17.8 percent of total prescribers over the study period — 12.2 percent NPs and 5.5 percent PAs.

## Limitations

The data used for this study cover the vast majority of retail prescriptions for buprenorphine for OUD, but some misclassification is typical for claims-based studies. Additionally, the data do not capture buprenorphine treatment for OUD when the drug is administered or directly dispensed to patients in settings outside retail pharmacies (including for emergency treatment).

## Conclusions

This study assessed patterns and trends in outpatient prescribing of buprenorphine for OUD by analyzing a nationally representative prescription claims dataset covering the period from July 2017 to June 2018. Results indicate a strong and robust increase in the number of buprenorphine prescribers, especially NPs, and patients over this period. Close to two-fifths of patients in the analytic dataset had at least one prescription fill paid for by Medicaid. Medicaid beneficiaries were more likely to receive buprenorphine from advanced practitioners. The number of Medicaid beneficiaries who received buprenorphine prescriptions from advanced practitioners more than tripled over the study year. Rural counties had a higher share of advanced practitioner providers than did urban counties. States with full NP prescriptive authority had a higher proportion of advanced practitioner prescribers than did states with limited NP prescriptive authority.

# 1 Introduction

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Overdose deaths involving prescription and illicit opioids have climbed in the last two decades, leading to a public health crisis in the United States. More than 47,000 Americans died of overdoses in 2017, and drug overdose rates have increased in most states since 2013 (Scholl et al. 2019). The death rate for synthetic opioids like fentanyl has tripled since 2013. These numbers do not account for the millions of people currently addicted to opioids, who are constantly at risk for opioid overdose. As of 2017, about 1.7 million Americans had a substance-use disorder involving prescription pain relievers (U.S. Department of Health and Human Services (HHS) 2018). Heroin overdoses have increased fourfold since 2010. The opioid epidemic has disproportionately affected Medicaid beneficiaries, who account for roughly half of all opioid-related overdose deaths in some states (Medicaid and CHIP Payment and Access Commission (MACPAC) 2017).

Providing more access to treatment is a critical method for tackling the opioid epidemic. Treatment options for OUD include MAT. MAT is a highly effective treatment that combines behavioral therapy and medications to treat substance-abuse disorders. Buprenorphine, a partial opioid agonist, is one of the medications that is approved by the FDA to treat opioid dependence in combination with counseling and psychosocial support. However, treatment capacity lags behind the need, partly due to the insufficient numbers of healthcare providers who are trained, authorized, and willing to provide MAT.

CARA (P.L. 114-198) established a comprehensive set of provisions to address the opioid epidemic. The national emphasis on a coordinated response to the opioid epidemic accelerated in 2018 with the passage of H.R.6 – SUPPORT for Patients and Communities Act. One element of CARA was the authorization for NPs and PAs to obtain a DEA waiver to prescribe buprenorphine to treat OUD. Subsequently, H.R. 6 provided for extended waiver eligibility to additional advanced practitioners, specifically certified nurse-midwives, clinical nurse specialists, and nurse anesthetists.

The principal objective of this study is to assess patterns and trends in buprenorphine prescriptions written by NPs and PAs for the Medicaid population to treat OUD following the DATA 2000 waiver eligibility — specifically, from July 2017 to June 2018. Additionally, the study examines and compares patterns and trends for physicians and patients with payer types other than Medicaid during the same period. Note that this study does not assess H.R.6-related changes, as the legislation passed after this study was initiated.

The report is organized as follows. Section 2 provides background on buprenorphine-based MAT as a critical component of addressing the opioid epidemic. Section 3 details the research

questions and Section 4 details the methods. Section 5 reports national-level study findings with selected state graphs. Section 6 concludes. Appendices A to F provide additional methodological details and findings, including maps summarizing key state-level results. A supplemental file provides state-specific tables for each state, the District of Columbia, and Puerto Rico.



## 2 Background

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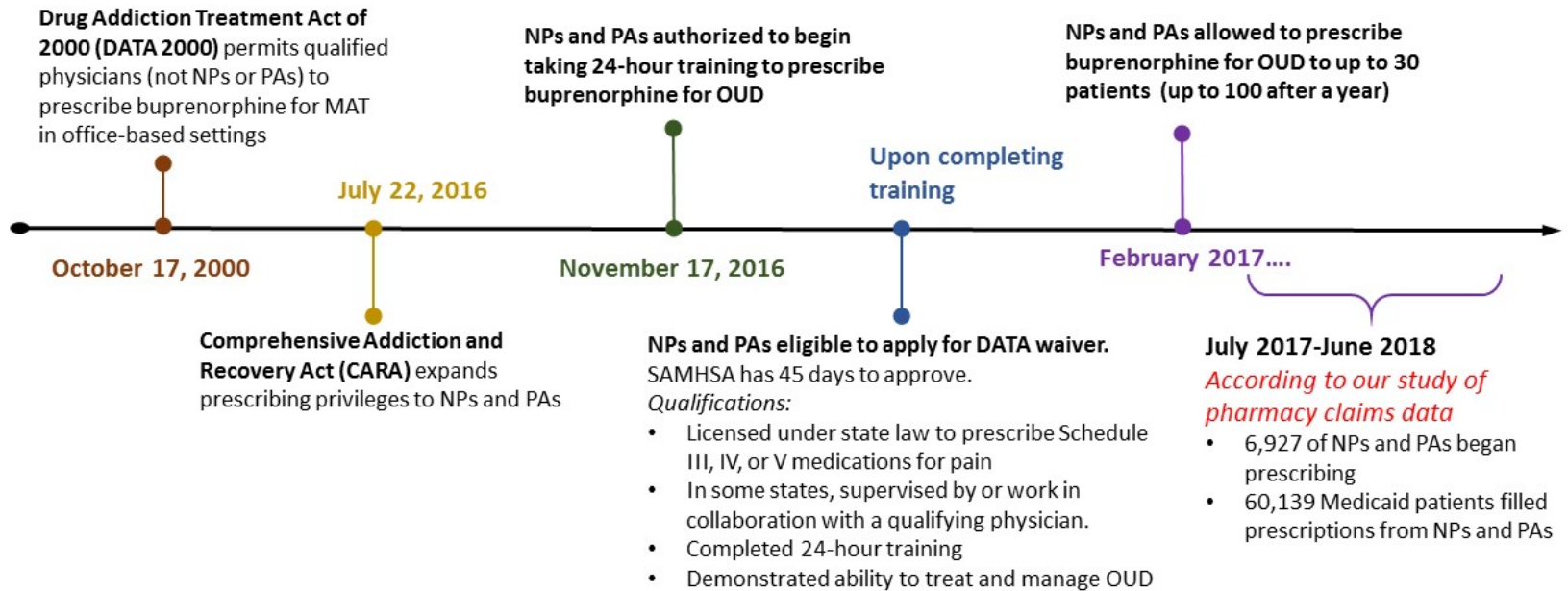
Expanded coverage eligibility under the Affordable Care Act has increased access to OUD treatment, as evidenced by a 70 percent increase in Medicaid-covered buprenorphine prescriptions in states that expanded Medicaid (Wen et al. 2017). And yet, there remains a pressing need for OUD treatment in the Medicaid population (MACPAC 2017).

One reason why there is still a gap between treatment need and availability is the lack of providers who are trained, authorized, and willing to provide evidence-based treatment services, including MAT prescribing and counseling. Furthermore, communities with the greatest need for OUD treatment often have the largest clinician gaps. For example, Andrilla and colleagues recently found that although the availability of physicians with DEA waivers to provide office-based MAT increased from 2012 to 2017, more than half of all rural counties still lack a qualified provider (Andrilla et al. 2019).

CARA sought to address this gap by expanding DATA 2000 to allow (“waive”) NPs and PAs to prescribe buprenorphine to the extent allowed by applicable state laws. Per CARA, NPs and PAs, collectively referred to as “advanced practitioners,” or, in specific reference to controlled substance prescribing authority, “mid-level practitioners,” who have completed the required training and application will be authorized to prescribe buprenorphine for up to 30 patients concurrently. One year after the initial waiver approval, these providers may request an increase to treat up to 100 patients. In addition to obtaining a DEA waiver, prescribers must overcome other barriers before treating OUD patients with buprenorphine. These barriers include financial/reimbursement concerns, lack of sufficient time, concerns of diversion or misuse of prescribed medication, and lack of available mental health or psychosocial referral services (Hutchinson et al. 2014). State-specific scope of practice regulations that limit the ability or extent to which NPs and PAs can prescribe buprenorphine for the treatment of OUD (summarized in **Appendix B**) could further restrict the ability of NPs and PAs to fill treatment gaps (Andrilla et al. 2018).

As summarized in **Exhibit 1**, NPs and PAs were authorized to begin completing DEA waiver training and applications in November 2016. The first waivers for NPs and PAs were approved in February 2017 (Jones and McCance-Katz 2019). Based on the timeline, we expected buprenorphine prescriptions by NPs and PAs to increase starting in 2017, with some lag as the process gained momentum.

**Exhibit 1. Timeline Authorizing NPs and PAs to Prescribe Buprenorphine for OUD**



### 3 Research Questions

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We explored patterns and trends of prescriptions for buprenorphine for OUD across providers, payers, and states to address the following main research questions. These questions are addressed in the aggregate for advanced practitioners, as well as stratified by individual prescriber groups (NPs, PAs, and physicians), as applicable.

1. How many providers are prescribing buprenorphine-based drugs approved for OUD? What are the trends in the number and proportion of advanced practitioners and physicians prescribing buprenorphine?
2. How many patients received prescriptions for buprenorphine for OUD? What are the trends in the number and proportion of patients receiving buprenorphine prescriptions for OUD from each prescriber type?
3. How many Medicaid beneficiaries were prescribed buprenorphine for OUD? What are the trends in the number and proportion of Medicaid beneficiaries receiving buprenorphine prescriptions from each prescriber type?
4. Are there differences in observed trends based on demographic characteristics of Medicaid beneficiaries, such as age and gender?
5. How do prescriber and patient trends for the Medicaid population compare with those of other payer types?
6. Are there urban-rural differences in observed prescribing patterns and trends?
7. How do the prescriber and patient trends vary for states that allow full NP prescribing authority for buprenorphine for OUD vs limited NP prescribing authority?
8. How do the patterns and trends in buprenorphine prescribing by advanced practitioners, NPs, and PAs, compare with those of physicians? What are the factors associated with a patient receiving a buprenorphine prescription from an advanced practitioner?
9. What is the buprenorphine patient load for each prescriber type?

## 4 Methodology

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### 4.1 Data Source

The data source for this study was the Symphony Health IDV<sup>®</sup> spanning July 2017 to June 2018. IDV<sup>®</sup> captures over 90 percent of prescriptions from retail pharmacies in the United States (ranging by state from 83.17 percent to 98.36 percent). Each prescription fill record contains detailed information including the fill date, NDC, and NPI. Through an anonymization process, IDV<sup>®</sup> identifies unique patients over time, along with selected patient information. IDV<sup>®</sup> includes data obtained directly from pharmacies and adjudication networks that are verified against standard reporting information to the U.S. government. The pharmacy must resubmit data files with more than 1 percent error in required fields, which yields a more accurate snapshot of event details.

### 4.2 Privacy Protections

All patient-level data are anonymized, so human subjects and privacy reviews are not required. However, following best practices reflected in the CMS cell size suppression policy (RESDAC 2017), counts between 1 and 10 are suppressed as <11 in study results.

### 4.3 Study Variables and Population

We restricted our analysis to claims for buprenorphine products that are approved for opioid dependence and excluded claims for buprenorphine injections or implants, since they are not dispensed through the outpatient pharmacy. Specifically, the buprenorphine prescription pharmacy fills that are included in our analytic sample are buccal/sublingual tablet and oral strip formulations with an FDA indication for OUD. These are drugs that are classified as “specific antagonists” under the Uniform System of Classification (USC) and listed in **Appendix A**. In this report, we refer to these interchangeably as “buprenorphine for OUD” and “buprenorphine.”

We further excluded claims that could not be linked to a prescriber or contained no prescriber-identifying information. Prescription fills observed outside of the United States or Puerto Rico were excluded from the study due to small volume. The national results discussed in the report do not include the counts for Puerto Rico. The findings for Puerto Rico are separately reported in the **Supplemental File. Appendix C** provides additional detail on study exclusions. Our final sample for the United States included 37,380 prescribers, 909,300 patients, and 10,200,652 claims.

**Exhibit 2** lists the variables used in the analysis, and additional descriptions follow.

## Exhibit 2. Study Variables

Variable	Definition
Buprenorphine prescriber specialty	NP PA Allopathic or osteopathic physician
Payer type	Medicaid Medicare Commercial Insurance Cash
Prescription fill quarter	Quarter 1: Jul-Sep 2017 Quarter 2: Oct-Dec 2017 Quarter 3: Jan-Mar 2018 Quarter 4: Apr-Jun 2018
Patient demographics	Age groups: <18, 18-39, 40-64, 65+ Gender: Male and female
Buprenorphine prescribers' urban/rural status	Urban: Metropolitan counties defined by the 2013 Urban Influence Codes Rural: Non-metropolitan counties defined by the 2013 Urban Influence Codes
State prescriptive authority	States with full NP prescriptive authority States with limited NP prescriptive authority State with no NP prescriptive authority

To identify each prescriber's specialty type, we cross-walked the NPI with their primary taxonomy code from the NPPES (CMS 2011). Providers with specialty type NP, PA, or physician were then identified based on information from the National Uniform Claim Committee taxonomy code set (National Uniform Claim Committee 2019).

The payer types explored in the study are Medicaid, Medicare, commercial insurance, and cash. A patient with at least one prescription fill covered by a given payer was assigned that payer type for the respective quarter. Patients could be assigned more than one payer type in a quarter or year. Claims paid by assistance programs (e.g., discount cards and manufacturer coupons) were grouped into commercial insurance or cash based on their IDV<sup>®</sup> "plan type." We did not analyze assistance programs as a separate category because they are typically used together with commercial insurance to lower patients' cost-sharing responsibilities (i.e., co-pays) or used as cash payment.

To classify prescribers' rural/urban status, we used 2013 Urban Influence Codes developed by the U.S. Department of Agriculture Economic Research Service (USDA ERS) and classified counties as urban if they were metropolitan and rural if they were non-metropolitan (USDA ERS 2013; Andrilla et al. 2018). Prescribers' ZIP codes were assigned to a county based on the ZIP code crosswalk file from the U.S. Department of Housing and Urban Development (U.S. Department of Housing and Urban Development 2019). Multi-county ZIP codes were assigned to the county where the majority of the ZIP code population is located (Wilson and Din 2018).

To analyze state scope of practice laws on buprenorphine prescribing, we grouped states into two categories: full NP prescriptive authority and limited NP prescriptive authority if physician oversight is needed (**Appendix B**). States that require a transition period during which physician oversight is required but after which NPs may start prescribing independently were included in the limited prescriptive authority group. We did not include Tennessee, which prohibits buprenorphine prescribing by NPs and PAs, in scope of practice analyses.

## 4.4 Data Analysis

### Topics of analysis

The primary focus of this study was buprenorphine prescribing for OUD during the study period for Medicaid beneficiaries, particularly by advanced practitioners. Additionally, we analyzed the other topics addressed by the research questions (**Section 3**). In addition to assessing the patterns and trends in Medicaid beneficiaries' receipt of buprenorphine for OUD from various prescriber types overall, we conducted sub-group analyses by patient gender and age. We also compared prescriber and patient trends for the Medicaid population with those of patients receiving buprenorphine for OUD paid for by Medicare, commercial insurance, and cash.

To assess rural-urban differences in buprenorphine prescribing for OUD, we assessed prescribing patterns and trends for providers in rural and urban areas. We looked at the differences in prescribing patterns and trends for states with full NP prescriptive authority and states where independent prescribing by NPs is still restricted. These geographic location-based analyses were conducted for both the Medicaid population and patients with other payer types.

We also examined the average patient load of each prescriber type, defined as the average and median number of patients with buprenorphine prescriptions for OUD per prescriber during the month of June 2018, the most recent month for which data are available. We stratified this analysis by prescriber type and further by providers who did and did not prescribe to Medicaid patients in June 2018.

### Analytic methods

We used descriptive statistics, cross-tabulations, and regression models to explore the patterns and trends in buprenorphine prescribing for OUD between July 2017 and June 2018.

Tabulations were conducted separately for each quarter and for the full one-year study period. We conducted these analyses on a national level for the United States, including all 50 states and the District of Columbia. **Appendix F** provides national maps facilitating easy comparison across states for key measures of interest. In addition, we replicated cross-tabulations for each

state, the District of Columbia, and Puerto Rico. The accompanying **Supplemental File** presents these state-level results. **Section 2** of the **Supplemental File** provides state-by-state tables for all measures and **Section 3** provides the tables for Puerto Rico.

To statistically test the change in trends over time for advanced practitioner buprenorphine prescribing overall and for various sub-groups of interest (e.g., the change over time in the probability of a Medicaid beneficiary receiving a prescription from an advanced practitioner), we implemented a series of linear regression models. Additionally, we implemented a regression including all the patient, prescriber, payer, and geographic factors of interest within a single model to explore the association between these factors and the receipt of buprenorphine prescriptions for OUD from advanced practitioners. Specifications of the various regression models are provided in **Appendix D**.

To examine variation in buprenorphine prescribing for OUD between the groups of states with full and limited NP prescriptive authority, we used two methods. The first method, which used state population-weighted means, gave more weight to more populous states within a group when generating the average number of prescribers and patients per state within a group. The second method gave equal weight to every state by estimating the provider-to-population ratio of the number of prescribers of buprenorphine for OUD per 100,000 population.

For this study, we defined patient load as the number of unique patients to whom a prescriber prescribed buprenorphine for OUD in a given month. The monthly count of patients is a metric used in research to assess patient limits (Jones and McCance-Katz 2019; Stein et al. 2016). Prescribers can have different number of buprenorphine patients at different months, and this number is likely to increase over time for the newly waived NPs and PAs that are a focus of this study. Therefore, rather than calculating patient load for the entire study period, we assigned to each prescriber the number of patients he/she prescribed buprenorphine for OUD in the “most recent month” (June 2018, the most recent month for which data are available for this study) and used this number as the prescriber’s patient load.

### **Units of analysis**

We explored buprenorphine for OUD patterns and trends at two levels: (1) prescribers and (2) patients. To explore prescriber trends, we analyzed and observed buprenorphine prescribing for OUD by NPs, PAs, and physicians separately, by quarter, and over the full year. In addition to generating absolute counts of prescribers by specialty type, we calculated the proportion of prescribers of each type. Tables were stratified by variables relevant to the research question of interest, for example, payer type.

Analogous to the prescriber-level analysis, we calculated the number and proportion of patients who received prescriptions for buprenorphine for OUD from each prescriber type, by quarter and over the full study year. We also calculated the number of patients who obtained prescriptions from both a physician and an advanced practitioner (NP or PA) during a period of interest.



## 5 Findings

### 5.1 Prescriber Patterns and Trends

**Research Questions:** *How many providers are prescribing buprenorphine-based drugs approved for OUD? What are the trends in the number and proportion of advanced practitioners and physicians prescribing buprenorphine?*

In this section we explore the number and proportion of NPs, PAs, and physicians with at least one prescription of buprenorphine for OUD quarterly and annually from July 2017 to June 2018 (Q1 to Q4). We assess trends over time and statistically test the differences in trends between advanced practitioner prescribing and physician prescribing. In subsequent sections, the overall numbers presented in this section are broken out by payer, gender, age, urban/rural status, and the level of state prescriptive authority.

A total of 37,380 providers prescribed buprenorphine for OUD from July 2017 to June 2018 in the United States (**Exhibit 3**). They included 4,828 NPs, 2,099 PAs, and 30,453 physicians. Advanced practitioners made up 18.5 percent of the total — 12.9 percent were NPs and 5.6 percent were PAs.

The number of prescribers rose steadily, from 23,610 in Q1 to 26,484 in Q4. Across the study year, the number of prescribers increased by 12.2 percent. The number of NPs prescribing buprenorphine increased from 1,889 in Q1 to 3,377 in Q4, an increase of 78.8 percent. During the same period, the number of PAs grew 48.8 percent from 909 to 1,353, and the number of physicians increased from 20,812 to 21,754 (4.5 percent).

**Exhibit 3. Number of NPs, PAs, and Physicians Prescribing Buprenorphine for OUD, July 2017 – June 2018**

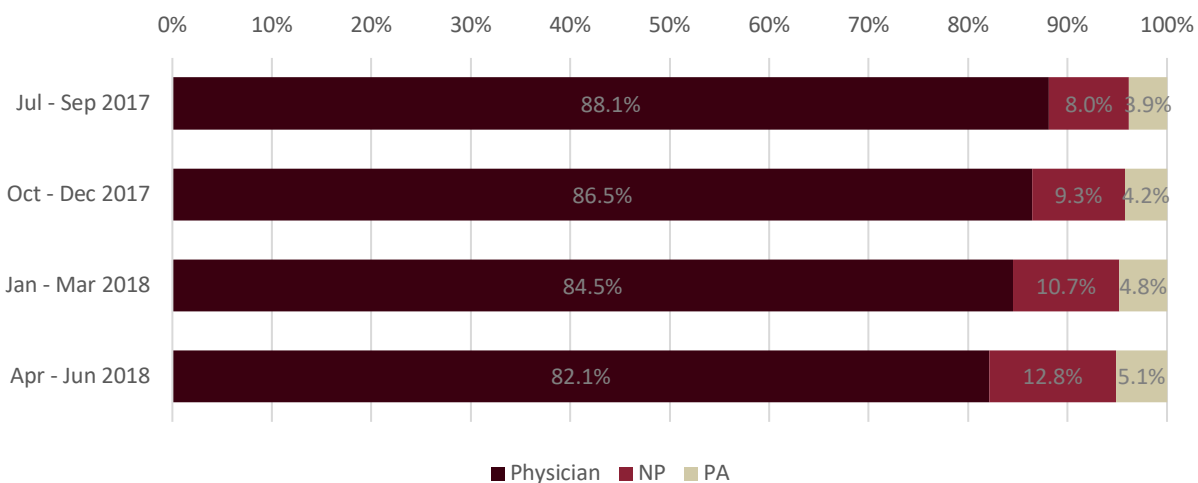
Prescriber Type	Buprenorphine Prescribers									
	Jul 17 –Sep 17		Oct 17 –Dec 17		Jan 18 –Mar 18		Apr 18 –Jun 18		Full Year <sup>a</sup>	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
Advanced practitioners <sup>b</sup>	2,798	11.9	3,283	13.5	3,904	15.5	4,730	17.9	6,927	18.5
NPs	1,889	8.0	2,255	9.3	2,695	10.7	3,377	12.8	4,828	12.9
PAs	909	3.9	1,028	4.2	1,209	4.8	1,353	5.1	2,099	5.6
Physicians	20,812	88.1	20,946	86.5	21,271	84.5	21,754	82.1	30,453	81.5
<b>Total providers</b>	<b>23,610</b>	<b>100</b>	<b>24,229</b>	<b>100</b>	<b>25,175</b>	<b>100</b>	<b>26,484</b>	<b>100</b>	<b>37,380</b>	<b>100</b>

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because providers either do not prescribe in all quarters or prescribe in multiple quarters.

<sup>b</sup> Advanced practitioners are NPs and PAs combined.

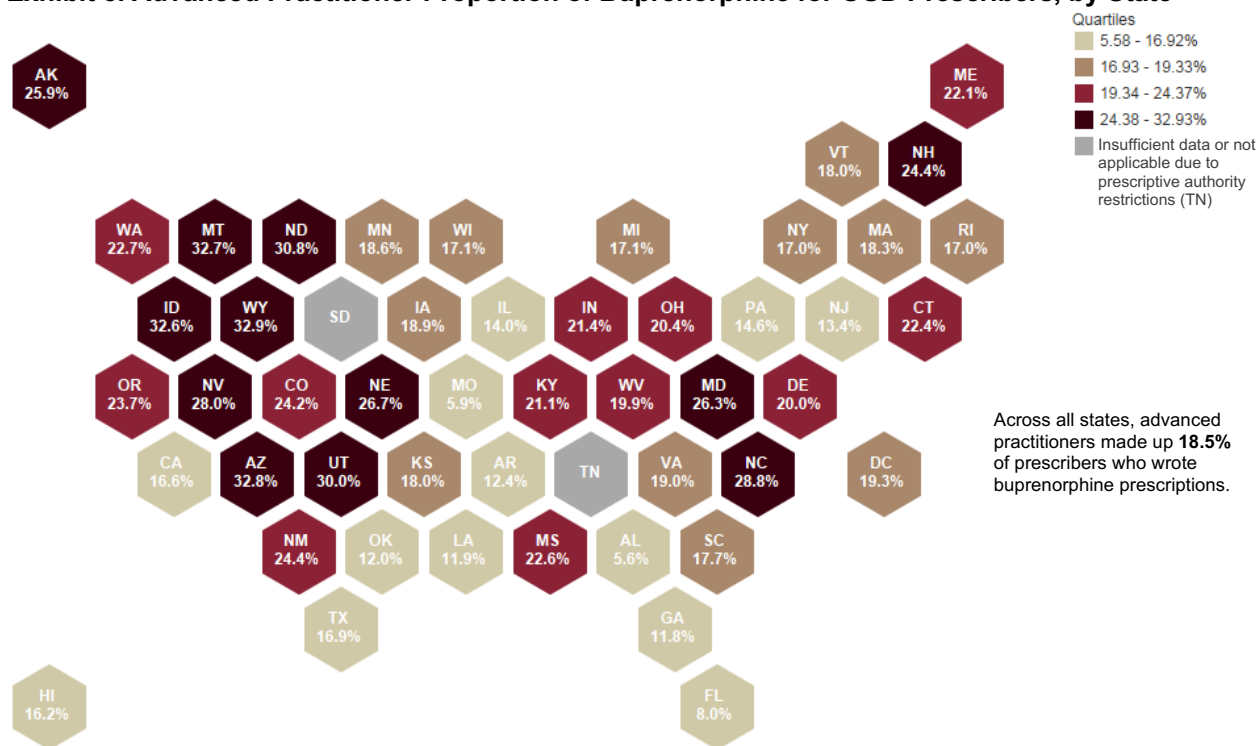
The proportion of prescribers that were NPs among all prescriber types grew from 8.0 percent in Q1 to 12.8 percent in Q4. The proportion of PAs grew from 3.9 percent to 5.1 percent between July 2017 and June 2018 (**Exhibit 4**).

**Exhibit 4. Proportion of OUD Prescribers by Provider Type, July 2017-June 2018**



**Exhibit 5** depicts variation by state. The observed proportion of advanced practitioners ranged from 5.6 percent in Alabama to 32.9 percent in Wyoming. It should be noted that IDV<sup>®</sup> coverage varies by state (see **Supplemental File, Exhibit 1**), which could make state comparisons not entirely reliable.

**Exhibit 5. Advanced Practitioner Proportion of Buprenorphine for OUD Prescribers, by State**



## 5.2 Patient Patterns and Trends

**Research Questions:** *How many patients received prescriptions for buprenorphine for OUD? What are the trends in the number and proportion of patients receiving buprenorphine prescriptions for OUD from each prescriber type?*

In this section, we explore the number of patients with prescriptions from each type of prescriber, as well as multiple prescriber types in a given quarter and for the full study year. In subsequent sections, the overall numbers presented in this section are broken out by payer, gender, age, urban/rural status, and the level of state prescriptive authority.

A total of 909,300 unique patients received buprenorphine prescriptions for OUD between July 2017 and June 2018 in the United States (**Exhibit 6**). Most patients (96.8 percent) received prescriptions from physicians, with about nine percent receiving prescriptions from NPs and almost four percent from PAs. Over the full year, 9 percent of patients received prescriptions from multiple prescriber types, explaining why the percentages add up to more than 100 percent.

The number of unique patients receiving buprenorphine prescriptions grew 6 percent from 581,596 in Q1 to 616,200 in Q4. The largest increase was among patients receiving prescriptions from NPs. This number rose from 17,821 in Q1 to 50,317 in Q4, a 182.3 percent

increase. The number of patients receiving prescriptions from PAs also rose substantially, from 8,559 in Q1 to 20,734 in Q4 — a 142.2 percent increase. In contrast, the number of patients receiving prescriptions from physicians increased less markedly, from 570,450 in Q1 to 582,420 in Q4 (2.1 percent increase). The number of patients receiving buprenorphine prescriptions from multiple prescriber types exhibited a considerable increase over the full study year, from 14,899 in Q1 to 35,294 in Q4 (136.9 percent), suggesting that patients who were treated by an advanced practitioner may also have been treated by a physician in the same period.

In addition to the absolute increases, the proportion of patients receiving prescriptions from NPs, PAs, and multiple prescriber types increased over the year, while the proportion of patients receiving prescriptions from physicians decreased correspondingly. In Q1, 4.5 percent of patients were prescribed buprenorphine for OUD by advanced practitioners — 3.1 percent from NPs and 1.5 percent from PAs. By Q4, the proportion of patients receiving prescriptions from NPs and PAs rose to 8.2 percent and 3.4 percent, respectively. Meanwhile, the proportion of patients receiving prescriptions from physicians decreased from 98.1 percent to 94.5 percent. **Appendix F, Exhibit F-9** provides a map which depicts variation by state.

**Exhibit 6. Number of Patients Receiving Buprenorphine Prescriptions for OUD, by Prescriber Type, July 2017 – June 2018**

Prescriber Type	All Patients									
	Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>a</sup>	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
Advanced practitioners	26,045	4.5	36,388	6.2	46,453	7.7	69,094	11.2	111,184	12.2
NPs	17,821	3.1	25,681	4.4	32,979	5.6	50,317	8.2	81,278	8.9
PAs	8,559	1.5	11,246	1.9	14,217	2.4	20,734	3.4	34,561	3.8
Physicians	570,450	98.1	570,596	97.0	580,312	98.7	582,420	94.5	879,858	96.8
Multiple provider types <sup>b</sup>	14,899	2.6	19,020	3.2	23,073	3.9	35,294	5.7	81,742	9.0
<b>Total patients<sup>c</sup></b>	<b>581,596</b>	<b>100</b>	<b>587,964</b>	<b>100</b>	<b>603,692</b>	<b>100</b>	<b>616,220</b>	<b>100</b>	<b>909,300</b>	<b>100</b>

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because patients can be observed in only one quarter or in multiple quarters.

<sup>b</sup> Count of the number of patients who receive prescriptions from multiple prescriber types (e.g., a physician and an NP [not two MDs]) within the same period.

<sup>c</sup> Rows are not mutually exclusive. Totals may exceed 100% because patients may have received prescriptions from multiple prescriber types within the same period.

A regression-based test on the change in buprenorphine prescribing supports what we observed above: The quarterly increase of buprenorphine prescriptions for OUD written by advanced practitioners rose more than that for physicians. Results in **Appendix D, Exhibit D-1** show that, relative to the baseline period of Q1, the likelihood that patients received buprenorphine prescriptions for OUD from advanced practitioners rose each quarter, and all increases were statistically significant ( $p < 0.01$ ).

### 5.3 Patient Patterns and Trends — Medicaid Beneficiaries

**Research Questions:** How many Medicaid beneficiaries were prescribed buprenorphine for OUD? What are the trends in the number and proportion of Medicaid beneficiaries receiving buprenorphine prescriptions from each prescriber type?

In this section, we explore the subset of patients who are Medicaid beneficiaries, the primary population of interest for this study. We assess the patterns and trends in Medicaid beneficiaries receiving buprenorphine for OUD from each type of prescriber or multiple prescriber types.

As shown in **Exhibit 7**, about 40.0 percent of patients in the analytic dataset had at least one prescription fill paid by Medicaid. This number rose from 204,127 in Q1 to 228,556 in Q4. This increase of 12 percent was twice that observed for patients overall. As with all patients, most Medicaid beneficiaries (95.7 percent) received their prescriptions from physicians. However, the proportion of them receiving prescriptions from advanced practitioners was 15.4 percent across the full study year, which is higher than the proportion for all patients (12.2 percent). The number of patients who received prescriptions increased for each prescriber type over time, and yet the percent increase was much higher among advanced practitioners than physicians (231.7 percent increase among NPs and 197.2 among PAs).

Correspondingly, the proportion of Medicaid beneficiaries who received prescriptions from NPs grew from 3.9 percent in Q1 to 11.5 percent in Q4, and the proportion receiving prescriptions from PAs grew from 1.5 percent to 4.0 percent. Meanwhile, the proportion of Medicaid beneficiaries who received prescriptions from physicians declined from 97.9 percent in Q1 to 92.7 percent in Q4. **Appendix F, Exhibit F-10** provides a map which depicts variation by state.

**Exhibit 7. Number of Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD, by Prescriber Type, July 2017 – June 2018**

Prescriber Type	Medicaid Beneficiaries									
	Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>a</sup>	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
Advanced practitioners	10,895	5.3	16,765	8.0	22,106	10.0	34,487	15.1	56,458	15.4
NPs	7,927	3.9	12,460	5.9	16,529	7.5	26,293	11.5	43,095	11.8
PAs	3,114	1.5	4,556	2.2	5,932	2.7	9,256	4.0	15,663	4.3
Physicians	199,778	97.9	202,166	96.4	210,391	95.2	211,964	92.7	349,793	95.7
Multiple provider types <sup>b</sup>	6,546	3.2	9,134	4.4	11,439	5.2	17,895	7.8	40,660	11.1
<b>Total patients<sup>c</sup></b>	<b>204,127</b>	<b>100</b>	<b>209,797</b>	<b>100</b>	<b>221,058</b>	<b>100</b>	<b>228,556</b>	<b>100</b>	<b>365,591</b>	<b>100</b>

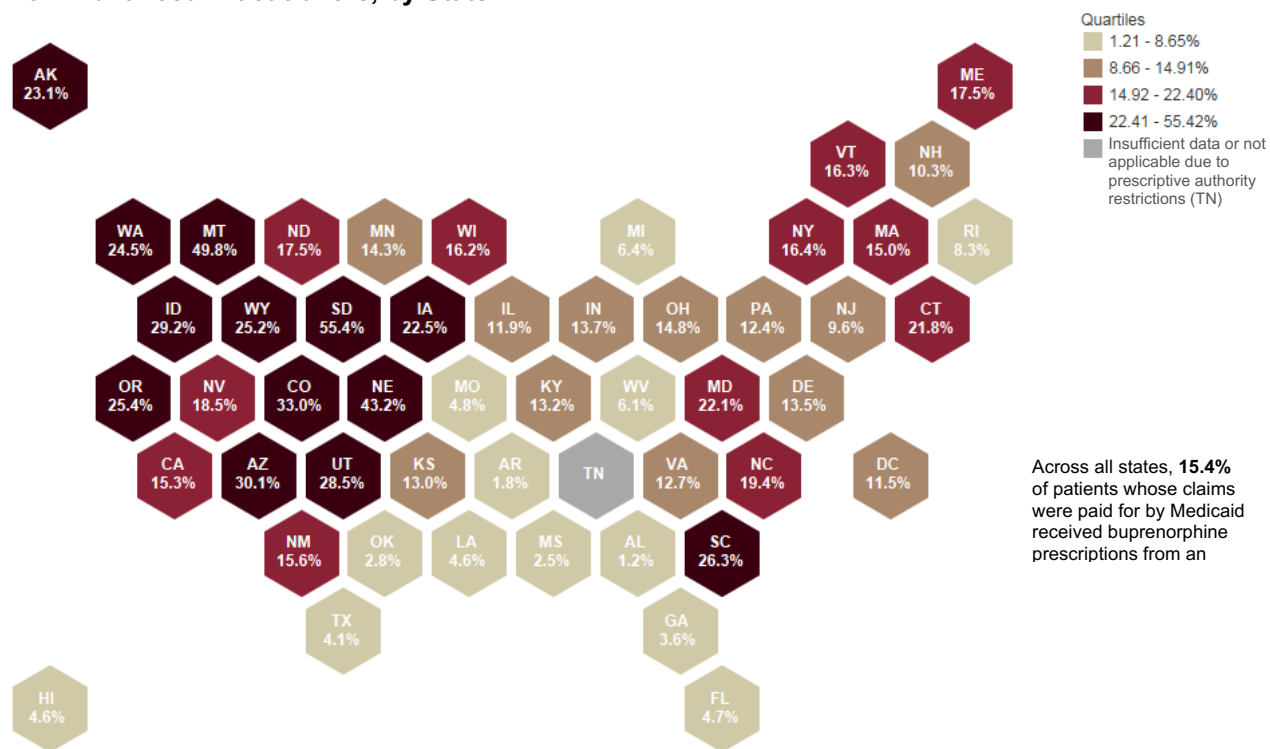
<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because patients can be observed in only one quarter or in multiple quarters.

<sup>b</sup> Count of the number of patients who receive prescriptions from multiple provider types (e.g., a physician and an NP [not two MDs]) within the same period.

<sup>c</sup> Rows are not mutually exclusive. Totals may exceed 100% because patients may receive prescriptions from multiple provider types within the same period.

**Exhibit 8** depicts variation by state. The observed proportion of Medicaid beneficiaries receiving prescriptions from advanced practitioners ranged from 1.2 percent in Alabama to 55.4 percent in South Dakota.

**Exhibit 8. Proportion of Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners, by State**



## 5.4 Variation in Patterns for Medicaid Beneficiaries Based on Age and Gender

**Research question:** Are there differences in observed trends based on demographic characteristics of Medicaid beneficiaries, such as age and gender?

To explore potential differences in prescribing patterns and trends based on demographic characteristics of Medicaid beneficiaries, we stratified the results in the previous section into males and females, four age groups, and gender-by-age groups.

### Patterns by gender

As shown in **Exhibit 9**, more female than male Medicaid beneficiaries received buprenorphine for OUD over the study year (189,465 versus 176,126). However, the proportion of beneficiaries receiving prescriptions from advanced practitioners was slightly higher for males than for females (15.7 percent versus 15.2 percent). Corresponding prescriber-level analysis (**Exhibit**

10) reflects the same pattern: More prescribers wrote prescriptions for female beneficiaries than for male beneficiaries, and those treating female beneficiaries were slightly more likely to be advanced practitioners.

**Exhibit 9. Number of Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD, by Prescriber Type and Patient Gender, July 2017 – June 2018**

Patient Gender	Prescriber Type	Medicaid Patients									
		Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>a</sup>	
		Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>Male</b>	Advanced practitioners	5,114	5.4	7,945	8.1	10,706	10.3	16,803	15.7	27,698	15.7
	NPs	3,710	3.9	5,931	6.1	8,030	7.7	12,840	12.0	21,188	12.0
	PAs	1,467	1.5	2,135	2.2	2,838	2.7	4,453	4.2	7,582	4.3
	Physicians	92,623	97.8	93,976	96.2	98,605	95.0	98,645	92.3	167,955	95.4
	Multiple provider types	3,006	3.5	4,224	4.7	5,485	5.7	8,570	8.6	19,527	12.6
	<b>Total patients<sup>b</sup></b>	<b>94,731</b>	<b>100</b>	<b>97,697</b>	<b>100</b>	<b>103,826</b>	<b>100</b>	<b>106,878</b>	<b>100</b>	<b>176,126</b>	<b>100</b>
<b>Female</b>	Advanced practitioners	5,781	5.3	8,820	7.9	11,400	9.7	17,684	14.5	28,760	15.2
	NPs	4,217	3.9	6,529	5.8	8,499	7.2	13,453	11.1	21,907	11.6
	PAs	1,647	1.5	2,421	2.2	3,094	2.6	4,803	3.9	8,081	4.3
	Physicians	107,155	98.0	108,190	96.5	111,786	95.4	113,319	93.1	181,838	96.0
	Multiple provider types	3,540	3.2	4,910	4.4	5,954	5.1	9,325	7.7	21,133	11.2
	<b>Total patients</b>	<b>109,396</b>	<b>100</b>	<b>112,100</b>	<b>100</b>	<b>117,232</b>	<b>100</b>	<b>121,678</b>	<b>100</b>	<b>189,465</b>	<b>100</b>

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because patients can be observed in only one quarter or in multiple quarters.

<sup>b</sup> Within each gender stratum, provider type rows are not mutually exclusive. Totals may exceed 100% because patients may receive prescriptions from multiple provider types within the same period.

**Exhibit 10. Number of NPs, PAs, and Physicians Prescribing Buprenorphine for OUD, by Medicaid Beneficiaries' Gender, July 2017 – June 2018**

Patient Gender	Prescriber Type	Buprenorphine Prescribers									
		Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>a</sup>	
		Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>Male</b>	Advanced practitioners	1,045	9.2	1,424	12.1	1,853	14.9	2,432	18.4	3,132	17.7
	NPs	729	6.4	1,039	8.8	1,343	10.8	1,805	13.7	2,287	13.0
	PAs	316	2.8	385	3.3	510	4.1	627	4.7	845	4.8
	Physicians	10,306	90.8	10,343	87.9	10,579	85.1	10,784	81.6	14,520	82.3
	<b>Total providers</b>	<b>11,351</b>	<b>100</b>	<b>11,767</b>	<b>100</b>	<b>12,432</b>	<b>100</b>	<b>13,216</b>	<b>100</b>	<b>17,652</b>	<b>100</b>
<b>Female</b>	Advanced practitioners	1,171	9.6	1,583	12.5	1,967	14.8	2,575	18.1	3,373	17.9
	NPs	834	6.9	1,142	9.0	1,434	10.8	1,920	13.5	2,474	13.1
	PAs	337	2.8	441	3.5	533	4.0	655	4.6	899	4.8
	Physicians	11,004	90.4	11,120	87.5	11,282	85.2	11,615	81.9	15,462	82.1

Patient Gender	Prescriber Type	Buprenorphine Prescribers									
		Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>a</sup>	
		Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>Total providers</b>		<b>12,175</b>	<b>100</b>	<b>12,703</b>	<b>100</b>	<b>13,249</b>	<b>100</b>	<b>14,190</b>	<b>100</b>	<b>18,835</b>	<b>100</b>

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because providers either do not prescribe in all quarters or prescribe in multiple quarters

## Patterns by age

As **Exhibit 11** shows, over two-thirds of patients with buprenorphine prescriptions paid by Medicaid were between the ages of 18 and 39, and almost one-third of them were in the 40-64 age group. Only 1,663 patients age 65 or older and 137 patients younger than 18 received buprenorphine prescriptions for OUD over the study year. A slightly higher proportion of patients aged 18 to 39 received prescriptions from advanced practitioners than that of patients aged 40 to 64 (15.7 versus 15.0 percent). The number and proportion of providers prescribing buprenorphine to patients in each age group showed corresponding patterns (**Appendix E**).

### Exhibit 11. Number of Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD, by Prescribe Type and Patient Age Group, July 2017 – June 2018

Patient Age Group	Prescriber Type	Medicaid Patients									
		Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>a</sup>	
		Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>&lt; 18</b>	Advanced practitioners	< 11	22.9	< 11	15.5	< 11	17.2	< 11	19.3	18	13.1
	NPs	< 11	22.9	< 11	15.5	< 11	17.2	< 11	19.3	13	9.5
	PAs	< 11	22.9	< 11	15.5	< 11	17.2	< 11	19.3	< 11	8.0
	Physicians	46	95.8	67	94.4	60	93.8	56	98.2	131	95.6
	Multiple provider types <sup>b</sup>	< 11	22.9	< 11	15.5	< 11	17.2	< 11	19.3	12	8.8
	<b>Total patients<sup>c</sup></b>	<b>48</b>	<b>100</b>	<b>71</b>	<b>100</b>	<b>64</b>	<b>100</b>	<b>57</b>	<b>100</b>	<b>137</b>	<b>100</b>
<b>18 - 39</b>	Advanced practitioners	7,355	5.4	11,389	8.1	15,030	10.2	23,606	15.4	38,742	15.7
	NPs	5,365	3.9	8,448	6.0	11,159	7.6	17,949	11.7	29,465	11.9
	PAs	2,078	1.5	3,116	2.2	4,111	2.8	6,426	4.2	10,891	4.4
	Physicians	133,437	97.9	135,417	96.3	140,557	95.1	141,577	92.6	236,141	95.7
	Multiple provider types	4,506	3.6	6,259	4.8	7,862	5.7	12,292	8.6	28,038	12.8
	<b>Total patients</b>	<b>136,286</b>	<b>100</b>	<b>140,547</b>	<b>100</b>	<b>147,725</b>	<b>100</b>	<b>152,891</b>	<b>100</b>	<b>246,845</b>	<b>100</b>
<b>40 - 64</b>	Advanced practitioners	3,491	5.2	5,316	7.8	6,992	9.6	10,765	14.4	17,510	15.0
	NPs	2,534	3.8	3,971	5.8	5,307	7.3	8,247	11.0	13,476	11.5
	PAs	1,012	1.5	1,419	2.1	1,799	2.5	2,806	3.8	4,710	4.0
	Physicians	65,511	97.8	65,993	96.4	69,050	95.2	69,585	93.0	111,942	95.7



Patient Age Group	Prescriber Type	Medicaid Patients									
		Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>a</sup>	
		Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
	Multiple provider types	2,020	3.3	2,850	4.5	3,547	5.2	5,559	7.9	12,506	12.0
	<b>Total patients</b>	<b>66,982</b>	<b>100</b>	<b>68,459</b>	<b>100</b>	<b>72,495</b>	<b>100</b>	<b>74,791</b>	<b>100</b>	<b>116,946</b>	<b>100</b>
<b>65 +</b>	Advanced practitioners	45	5.5	51	7.1	79	10.2	110	13.5	188	11.3
	NPs	25	3.1	35	4.9	60	7.8	92	11.3	141	8.5
	PAs	23	2.8	18	2.5	20	2.6	22	2.7	56	3.4
	Physicians	784	96.7	689	95.7	724	93.5	746	91.3	1,579	94.9
	Multiple provider types	18	2.2	20	2.8	29	3.7	39	4.8	104	6.3
	<b>Total patients</b>	<b>811</b>	<b>100</b>	<b>720</b>	<b>100</b>	<b>774</b>	<b>100</b>	<b>817</b>	<b>100</b>	<b>1,663</b>	<b>100</b>

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because patients can be observed in only one quarter or in multiple quarters.

<sup>b</sup> Count of the number of patients who received prescriptions from multiple prescriber types (e.g., a physician and an NP [not two MDs]) within the same period.

<sup>c</sup> Within each age group, provider type rows are not mutually exclusive. Totals may exceed 100% because patients may receive prescriptions from multiple provider types within the same time period.

<sup>d</sup> Following the CMS cell size suppression policy, we have suppressed absolute numbers smaller than 11. A value of zero is, however, reported. For numbers between 1 and 10, we calculate their corresponding proportions by dividing 11 to the row margins.

## Patterns by age and gender

Tables with age by gender stratifications are in **Appendix E**. Our regression results (**Appendix D, Exhibit D-2**) show that, among Medicaid beneficiaries, females and males were equally likely to receive buprenorphine prescriptions for OUD from advanced practitioners in Q1 (July to September 2017). But, as time progressed, male Medicaid beneficiaries became slightly more likely than female beneficiaries to receive their prescriptions for OUD from advanced practitioners, holding age constant.

## 5.5 Comparison between Medicaid and Other Payer Types

**Research Question:** *How do prescriber and patient trends for the Medicaid population compare with those of other payer types?*

In this section, we first analyze trends for providers who prescribed buprenorphine for OUD to Medicaid beneficiaries. We then analyze prescriber and patient patterns for each payer type and compare patterns for Medicaid to other payer types. In all analyses in this section, we note that

payer types are not mutually exclusive as it is possible for a patient to fill prescriptions covered by multiple payer types during a quarter or over the full year.<sup>1</sup>

### **Medicaid prescriber trends**

**Exhibit 12** shows that 22,599 providers prescribed buprenorphine for OUD to Medicaid beneficiaries from July 2017 to June 2018. These prescribers included 2,985 NPs, 1,137 PAs, and 18,477 physicians.

The number of Medicaid buprenorphine prescribers increased from 14,438 in Q1 to 16,840 in Q4, or 16.6 percent. This increase was higher than the 12.2 percent increase observed for all prescribers over the study period (**Section 5.1**). Among Medicaid prescribers, the number of NPs increased from 1,040 in Q1 to 2,298 in Q4, an increase of 121.0 percent. Over the same period, the number of PAs increased 86.8 percent from 432 to 807, and the number of physicians increased 5.9 percent from 12,966 to 13,735.

The proportion of Medicaid prescribers that were NPs grew from 7.2 percent in Q1 to 13.6 percent in Q4 and that of PAs grew from 3.0 percent to 4.8 percent. **Appendix F, Exhibit F-2** provides a map which depicts variation in the proportion of advanced practitioners by state.

The 22,599 Medicaid prescribers represent 60.5 percent of the 37,380 total buprenorphine prescribers (**Exhibit 3**). Over the course of the study, the proportion of total providers who prescribed buprenorphine for OUD to at least one Medicaid beneficiary remained relatively stable for physicians but rose from Q1 to Q4 for NPs (55.1 percent to 68.0 percent) as well as for PAs (47.5 percent to 59.6 percent).

### **Prescriber trends for Medicare, cash, and commercial payer types**

Over the study year, 27,958 providers prescribed buprenorphine to patients with commercial insurance—more than the number of Medicaid prescribers. Fewer providers prescribed to patients with Medicare or cash as payer types (19,143 and 19,817 respectively). The number of providers who prescribed buprenorphine to patients with Medicare, commercial, or cash payer types rose steadily from Q1 to Q4; this pattern was similar to the pattern observed for prescribers of buprenorphine to Medicaid beneficiaries.

Trends in physicians versus advanced practitioners were similar for Medicare prescribers. The number of observed Medicare prescribers increased 14.6 percent over the study year, with the

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<sup>1</sup> In interpreting trends for Medicare compared to Medicaid, it should be noted that Medicaid-Medicare dual-eligible beneficiaries cannot be distinguished from beneficiaries only eligible for Medicare, given that dual-eligible beneficiary prescriptions are typically covered by their Medicare Part D benefit (CMS 2018).

number of NPs increasing 124.4 percent and the number of physicians and PAs increasing 5.8 and 69.0 percent respectively. The proportion of Medicare prescribers who were advanced practitioners was 16.6 percent over the full year, slightly lower than that among the Medicaid prescribers.

For patients with a payer type of commercial insurance or cash, the relative increase in the number of observed prescribers was smaller. Specifically, their numbers increased by 9.5 and 8.8 percent over the study year, respectively. However, the number of advanced practitioners for these two payer types demonstrated substantial increases (74.7 and 98.0 percent). The proportion of prescribers who were advanced practitioners was 17.1 for patients with commercial insurance and 15.0 for cash-paying patients.

**Appendix F, Exhibit F-3, F-4 and F-5** provide maps which depict state-level variation in the proportion of advanced practitioners for the payer types of cash, commercial insurance and Medicare, respectively.

**Exhibit 12. Number of NPs, PAs, and Physicians Prescribing Buprenorphine for OUD, by Payer Type, July 2017 – June 2018**

Payer Type	Prescriber Type	Buprenorphine Prescribers									
		Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>a</sup>	
		Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>Medicaid</b>	Advanced practitioners	1,472	10.2	1,921	12.8	2,406	15.3	3,105	18.4	4,122	18.2
	NPs	1,040	7.2	1,386	9.2	1,734	11.0	2,298	13.6	2,985	13.2
	PAs	432	3.0	535	3.6	672	4.3	807	4.8	1,137	5.0
	Physicians	12,966	89.8	13,134	87.2	13,369	84.7	13,735	81.6	18,477	81.8
	<b>Total providers</b>	<b>14,438</b>	<b>100</b>	<b>15,055</b>	<b>100</b>	<b>15,775</b>	<b>100</b>	<b>16,840</b>	<b>100</b>	<b>22,599</b>	<b>100</b>
<b>Medicare</b>	Advanced practitioners	1,124	9.0	1,425	10.9	1,840	13.5	2,297	16.0	3,169	16.6
	NPs	717	5.7	956	7.3	1,251	9.1	1,609	11.2	2,201	11.5
	PAs	407	3.2	469	3.6	589	4.3	688	4.8	968	5.1
	Physicians	11,409	91.0	11,598	89.1	11,836	86.5	12,068	84.0	15,974	83.4
	<b>Total providers</b>	<b>12,533</b>	<b>100</b>	<b>13,023</b>	<b>100</b>	<b>13,676</b>	<b>100</b>	<b>14,365</b>	<b>100</b>	<b>19,143</b>	<b>100</b>
<b>Commercial</b>	Advanced practitioners	1,963	10.4	2,317	12.1	2,796	14.0	3,429	16.6	4,787	17.1
	NPs	1,299	6.9	1,580	8.2	1,905	9.6	2,438	11.8	3,328	11.9
	PAs	664	3.5	737	3.8	891	4.5	991	4.8	1,459	5.2
	Physicians	16,894	89.6	16,889	87.9	17,120	86.0	17,220	83.4	23,171	82.9
	<b>Total providers</b>	<b>18,857</b>	<b>100</b>	<b>19,206</b>	<b>100</b>	<b>19,916</b>	<b>100</b>	<b>20,649</b>	<b>100</b>	<b>27,958</b>	<b>100</b>
<b>Cash</b>	Advanced practitioners	1,013	8.0	1,233	9.6	1,599	11.9	2,006	14.5	2,970	15.0
	NPs	666	5.2	829	6.5	1,099	8.2	1,428	10.3	2,092	10.6
	PAs	347	2.7	404	3.2	500	3.7	578	4.2	878	4.4

Physicians	11,698	92.0	11,580	90.4	11,851	88.1	11,821	85.5	16,847	85.0
<b>Total providers</b>	<b>12,711</b>	<b>100</b>	<b>12,813</b>	<b>100</b>	<b>13,450</b>	<b>100</b>	<b>13,827</b>	<b>100</b>	<b>19,817</b>	<b>100</b>

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because providers either do not prescribe in all quarters or prescribe in multiple quarters.

## Patient trends

Expanding on **Exhibit 7**, where we focused on Medicaid beneficiaries, **Exhibit 13** displays information for patients whose prescription fills were paid for by Medicare, commercial insurance, or in cash. Medicare paid for prescription fills for 90,847 patients, noticeably fewer than the 365,591 patients whose prescription fills were paid for by Medicaid. However, the 12.5 percent increase in Medicare beneficiaries between Q1 and Q4 is comparable to the 12.0 percent increase observed in Medicaid beneficiaries.

A total of 484,722 patients received prescription fills paid for by commercial insurance, and 229,624 patients used cash to pay for their prescription fills over the study year. Between Q1 and Q4, there was a slight decline in the number of patients whose prescription fills were paid for by commercial insurance, but an increase of 4.1 percent for patients who paid for their prescription fills in cash.<sup>2</sup>

Trends in the proportion of patients receiving buprenorphine prescriptions from a given type of provider are similar across the four payer types, with the largest percent increase occurring among advanced practitioners, especially NPs. Compared to patients with other payer types, the proportion of patients receiving buprenorphine prescriptions from advanced practitioners increased the most among Medicaid beneficiaries. For example, the number of Medicaid beneficiaries who received prescriptions from NPs increased by 231.7 percent between Q1 and Q4, while the number of Medicare and cash-paying patients who received prescriptions from NPs both increased by approximately 165 percent over the same period.

**Appendix F, Exhibit F-11, F-12 and F-13** provide maps which depict state-level variation in the proportion of patients receiving buprenorphine prescriptions from advanced practitioners for the payer types of cash, commercial insurance and Medicare, respectively.

<sup>2</sup> As noted in **Section 4.2**, the cash payer type includes patients who used assistance programs, and the commercial payer type includes patients who used manufacturer coupons. Since our dataset contains information only on a given patient's primary payer type, a definitive categorization of patients who used coupons or assistance programs is not possible.

**Exhibit 13. Number of Patients Receiving Buprenorphine Prescriptions for OUD, by Prescriber and Payer Type, July 2017 – June 2018**

Payer Type	Prescriber Type	Patients									
		Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>a</sup>	
		Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<i>Medicaid</i>	Advanced practitioners	11,285	5.5	17,230	8.2	22,674	10.3	35,273	15.4	60,139	16.4
	NPs	8,189	4.0	12,792	6.1	16,948	7.7	26,883	11.8	45,785	12.5
	PAs	3,257	1.6	4,711	2.2	6,119	2.8	9,523	4.2	17,007	4.7
	Physicians	199,984	98.0	202,437	96.5	210,717	95.3	212,475	93.0	351,192	96.1
	Multiple provider types <sup>b</sup>	7,142	3.5	9,870	4.7	12,333	5.6	19,192	8.4	45,740	12.5
	<b>Total patients<sup>c</sup></b>	<b>204,127</b>	<b>100</b>	<b>209,797</b>	<b>100</b>	<b>221,058</b>	<b>100</b>	<b>228,556</b>	<b>100</b>	<b>365,591</b>	<b>100</b>
<i>Medicare</i>	Advanced practitioners	3,003	5.4	3,910	6.7	5,051	8.3	7,362	11.8	12,132	13.4
	NPs	1,888	3.4	2,615	4.5	3,366	5.6	5,029	8.1	8,385	9.2
	PAs	1,154	2.1	1,361	2.3	1,764	2.9	2,551	4.1	4,341	4.8
	Physicians	53,992	97.6	56,358	96.7	57,933	95.6	58,697	94.3	87,940	96.8
	Multiple provider types	1,670	3.0	1,975	3.4	2,402	4.0	3,803	6.1	9,225	10.2
	<b>Total patients</b>	<b>55,325</b>	<b>100</b>	<b>58,293</b>	<b>100</b>	<b>60,582</b>	<b>100</b>	<b>62,256</b>	<b>100</b>	<b>90,847</b>	<b>100</b>
<i>Commercial</i>	Advanced practitioners	11,630	3.8	15,168	5.0	18,639	6.2	26,330	8.7	49,035	10.1
	NPs	7,648	2.5	10,241	3.4	12,662	4.2	18,364	6.1	34,448	7.1
	PAs	4,130	1.4	5,155	1.7	6,264	2.1	8,635	2.9	16,666	3.4
	Physicians	299,441	98.3	294,242	97.6	291,556	96.8	288,842	95.7	473,561	97.7
	Multiple provider types	6,509	2.1	7,805	2.6	9,094	3.0	13,386	4.4	37,874	7.8
	<b>Total patients</b>	<b>304,562</b>	<b>100</b>	<b>301,605</b>	<b>100</b>	<b>301,101</b>	<b>100</b>	<b>301,786</b>	<b>100</b>	<b>484,722</b>	<b>100</b>
<i>Cash</i>	Advanced practitioners	3,763	4.1	4,968	5.6	6,384	6.6	8,820	9.1	24,878	10.8
	NPs	2,555	2.8	3,528	4.0	4,582	4.8	6,481	6.7	18,214	7.9
	PAs	1,251	1.3	1,512	1.7	1,928	2.0	2,609	2.7	7,761	3.4
	Physicians	91,355	98.4	86,060	97.4	93,088	96.8	92,473	95.6	224,436	97.7
	Multiple provider types	2,247	2.4	2,671	3.0	3,334	3.5	4,569	4.7	19,690	8.6
	<b>Total patients</b>	<b>92,871</b>	<b>100</b>	<b>88,357</b>	<b>100</b>	<b>96,138</b>	<b>100</b>	<b>96,724</b>	<b>100</b>	<b>229,624</b>	<b>100</b>

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because patients can be observed in only one quarter or in multiple quarters.

<sup>b</sup> Count of the number of patients who receive prescriptions from multiple provider types (e.g., a physician and an NP [not two MDs]) within the same period.

<sup>c</sup> Within each age group, provider type rows are not mutually exclusive. Totals may exceed 100% because patients may receive prescriptions from multiple provider types within the same period.

Regression results lend support to what we observed above: Patients whose prescription fills were paid for by Medicaid have the highest likelihood of receiving prescriptions from advanced practitioners. This finding remains robust over time. **Appendix D, Exhibit D-3** gives the regression results and a detailed discussion.

## Payer mix

To have a more nuanced understanding of how prescribing patterns vary by patient payer types, we tabulated the payer mix for each prescriber type. Specifically, we tabulated the proportion of patients with buprenorphine prescriptions written by a given prescriber type against each of the four payer types. For this analysis, we performed the calculation over the full study year.

Because patients may use multiple payer types, the total proportion for each provider type can exceed 100 percent.

**Exhibit 14** shows that Medicaid paid for prescriptions filled by about half of advanced practitioners' patients, and commercial insurance paid for prescription filled by two-fifths of their patients. This pattern is nearly reversed among physicians — commercial insurance paid for a little more than half of their patients' prescription fills. **Appendix F, Exhibit F-6** provides a map which depicts variation by state in the payer mix of advanced practitioners.

### Exhibit 14. Payer Mix of Patients Receiving Buprenorphine for OUD Prescriptions, by Prescriber Type, July 2017 – June 2018

Prescriber Type	Patient Payer Type (July 2017 – June 2018)			
	Medicaid	Medicare	Commercial	Cash
	%	%	%	%
Advanced practitioners	50.8	10.3	37.9	13.6
NPs	53.0	9.7	36.1	13.4
PAs	45.3	11.8	41.3	13.0
Physicians	39.8	10.0	53.5	25.0

<sup>a</sup> The sum of columns in a given row can exceed 100% as patients may use multiple methods to pay for prescription fills.

## 5.6 Urban-Rural Differences

**Research Question:** *Are there urban-rural differences in observed prescribing patterns and trends?*

To assess whether patterns and trends in buprenorphine prescribing varies between urban and rural areas, we explored the number and percentage of NPs, PAs, and physicians who prescribed buprenorphine for OUD in urban and rural counties. We also estimated the number and percentage of patients of each payer type who received buprenorphine from urban and rural prescribers.

### Prescriber trends

As shown in **Exhibit 15**, a total of 32,859 prescribers in urban areas and 4,521 providers in rural areas prescribed buprenorphine for OUD between July 2017 and June 2018. Over the full study year, the proportion of buprenorphine prescribers that were advanced practitioners increased in

both geographic areas — from 11.4 percent to 17.2 percent in urban areas and from 15.5 percent to 23.0 percent in rural areas.

A higher proportion of advanced practitioners in rural areas prescribed buprenorphine for OUD than they did in urban areas in every quarter. Over the full year, 24.0 percent of rural prescribers were advanced practitioners — 17.8 percent NPs and 6.2 percent PAs. In urban areas, advanced practitioners made up 17.8 percent of the total prescribers over the full year — 12.2 percent were NPs and 5.5 percent PAs. **Appendix F, Exhibit F-7 and F-8** provide maps which depict state-level variation in the proportion of advanced practitioners in rural and urban areas, respectively.

**Exhibit 15. Number of NPs, PAs, and Physicians Prescribing Buprenorphine for OUD in Urban vs. Rural Areas, July 2017 – June 2018**

Prescriber Type	Buprenorphine Prescribers									
	Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>a</sup>	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>Urban<sup>b</sup></b>										
Advanced practitioners	2,377	11.4	2,771	13.0	3,289	14.8	3,996	17.2	5,842	17.8
NPs	1,583	7.6	1,879	8.8	2,245	10.1	2,822	12.1	4,024	12.2
PAs	794	3.8	892	4.2	1,044	4.7	1,174	5.0	1,818	5.5
Physicians	18,520	88.6	18,613	87.0	18,920	85.2	19,298	82.8	27,017	82.2
<b>Total Prescribers</b>	<b>20,897</b>	<b>100</b>	<b>21,384</b>	<b>100</b>	<b>22,209</b>	<b>100</b>	<b>23,294</b>	<b>100</b>	<b>32,859</b>	<b>100</b>
<b>Rural</b>										
Advanced practitioners	421	15.5	512	18.0	615	20.7	734	23.0	1,085	24.0
NPs	306	11.3	376	13.2	450	15.2	555	17.4	804	17.8
PAs	115	4.2	136	4.8	165	5.6	179	5.6	281	6.2
Physicians	2,292	84.5	2,333	82.0	2,351	79.3	2,456	77.0	3,436	76.0
<b>Total prescribers</b>	<b>2,713</b>	<b>100</b>	<b>2,845</b>	<b>100</b>	<b>2,966</b>	<b>100</b>	<b>3,190</b>	<b>100</b>	<b>4,521</b>	<b>100</b>

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because providers either do not prescribe in all quarters or prescribe in multiple quarters.

<sup>b</sup> Counties are classified as urban if they are defined as metropolitan areas according to the 2013 Urban Influence Codes (USDA ERS 2013) and rural otherwise.

## Patient trends

Across the four payer types, 139,261 patients received buprenorphine prescriptions from prescribers practicing in rural areas, and 815,436 patients received prescriptions from urban prescribers. Of patients treated by rural prescribers over this period, about 13 percent of them were treated by rural advanced practitioners (**Exhibit 16**).

**Exhibit 16. Number of Patients Receiving Buprenorphine for OUD from Urban vs. Rural Prescribers, July 2017 - June 2018**

Prescriber Type	Patients									
	Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>a</sup>	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>Urban<sup>b</sup></b>										
Advanced practitioners	22,361	4.3	30,702	5.9	39,108	7.3	58,840	10.8	94,690	11.6
NPs	15,447	3.0	21,570	4.1	27,741	5.2	42,572	7.8	68,882	8.4
PAs	7,162	1.4	9,519	1.8	11,978	2.2	17,923	3.3	29,685	3.6
Physicians	506,781	98.1	506,810	97.1	514,330	96.3	516,441	94.6	789,050	96.8
Multiple prescriber types	12,447	2.4	15,775	3.0	19,214	3.6	29,564	5.4	68,304	8.4
<b>Total patients<sup>d</sup></b>	<b>516,695</b>	<b>100</b>	<b>521,737</b>	<b>100</b>	<b>534,224</b>	<b>100</b>	<b>545,717</b>	<b>100</b>	<b>815,436</b>	<b>100</b>
<b>Rural</b>										
Advanced practitioners	3,758	4.9	5,850	7.6	7,586	9.3	10,706	12.9	17,810	12.8
NPs	2,412	3.2	4,217	5.5	5,392	6.6	7,999	9.6	13,156	9.4
PAs	1,414	1.9	1,739	2.3	2,268	2.8	2,873	3.5	5,080	3.6
Physicians	73,963	97.1	73,201	95.0	76,061	93.7	75,969	91.3	130,673	93.8
Multiple prescriber types <sup>c</sup>	1,559	2.0	2,015	2.6	2,438	3.0	3,507	4.2	9,222	6.6
<b>Total patients</b>	<b>76,162</b>	<b>100</b>	<b>77,036</b>	<b>100</b>	<b>81,209</b>	<b>100</b>	<b>83,168</b>	<b>100</b>	<b>139,261</b>	<b>100</b>

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because patients can be observed in only one quarter or in multiple quarters.

<sup>b</sup> Counties are classified as urban if they are defined as metropolitan areas according to the 2013 Urban Influence Codes (USDA ERS 2013) and rural otherwise.

<sup>c</sup> Count of the number of patients who receive prescriptions from multiple prescriber types (e.g., a physician and an NP [not two MDs]) within the same period.

<sup>d</sup> Within each stratum, provider type rows are not mutually exclusive. Totals may exceed 100% because patients may receive prescriptions from multiple provider types within the same period.

As shown in

**Exhibit 17**, 320,114 unique Medicaid beneficiaries obtained buprenorphine prescriptions for OUD from urban prescribers over the study year. Of these patients, 14.6 percent obtained prescriptions from advanced practitioners — 11.1 percent from NPs and 4.1 percent from PAs. During the same time window, 65,667 Medicaid beneficiaries obtained buprenorphine prescriptions from rural prescribers, 15.9 percent of whom had prescriptions written by advanced practitioners.

The number of Medicaid beneficiaries who received prescriptions from advanced practitioners increased by 231.6 percent in rural areas and 215.5 percent in urban areas over the study period. For Medicaid beneficiaries who received buprenorphine prescriptions from rural prescribers, the proportion with a prescription from an advanced practitioner increased from 5.7 percent in Q1 to 16.5 percent in Q4, compared to an increase from 5.2 percent in Q1 to 14.5



percent in Q4 for Medicaid beneficiaries with urban prescribers. Regression results in **Appendix D, Exhibit D-4** also reinforce the finding of the increase over time in the percentage of Medicaid beneficiaries receiving prescriptions from rural prescribers being larger compared to that of urban providers.

**Exhibit 17. Number of Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD from Urban vs. Rural Prescribers, July 2017 – June 2018**

Prescriber Type	Medicaid Patients									
	Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>a</sup>	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>Urban<sup>b</sup></b>										
Advanced practitioners	9,059	5.2	13,567	7.5	17,997	9.5	28,581	14.5	46,786	14.6
NPs	6,661	3.8	10,059	5.6	13,515	7.1	21,664	11.0	35,516	11.1
PAs	2,497	1.4	3,667	2.0	4,751	2.5	7,795	4.0	13,111	4.1
Physicians	172,159	97.9	174,565	96.6	181,472	95.4	182,814	93.0	306,476	95.7
Multiple prescriber types <sup>c</sup>	5,396	3.1	7,353	4.1	9,315	4.9	14,760	7.5	33,148	10.4
<b>Total patients<sup>d</sup></b>	<b>175,822</b>	<b>100</b>	<b>180,779</b>	<b>100</b>	<b>190,154</b>	<b>100</b>	<b>196,635</b>	<b>100</b>	<b>320,114</b>	<b>100</b>
<b>Rural</b>										
Advanced practitioners	1,862	5.7	3,297	9.8	4,258	11.8	6,174	16.5	10,413	15.9
NPs	1,274	3.9	2,461	7.3	3,112	8.6	4,799	12.8	8,026	12.2
PAs	626	1.9	895	2.7	1,192	3.3	1,485	4.0	2,639	4.0
Physicians	31,732	96.6	31,436	93.6	33,224	92.1	33,294	88.8	60,511	92.1
Multiple prescriber types	735	2.2	1,136	3.4	1,419	3.9	1,981	5.3	5,257	8.0
<b>Total patients</b>	<b>32,859</b>	<b>100</b>	<b>33,597</b>	<b>100</b>	<b>36,063</b>	<b>100</b>	<b>37,487</b>	<b>100</b>	<b>65,667</b>	<b>100</b>
<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because patients can be observed in only one quarter or in multiple quarters. <sup>b</sup> Counties are classified as urban if they are defined as metropolitan areas according to the 2013 Urban Influence Codes (USDA ERS 2013) and rural otherwise. <sup>c</sup> Count of the number of patients who receive prescriptions from multiple prescriber types (e.g., a physician and an NP [not two MDs]) within the same period. <sup>d</sup> Within each stratum, provider type rows are not mutually exclusive. Totals may exceed 100% because patients may receive prescriptions from multiple provider types within the same period.										

The proportion of patients receiving prescriptions from advanced practitioners was higher in rural than urban areas for all payer types (**Exhibit 18-20**). Regression results comparing patients' likelihood of receiving buprenorphine prescriptions from advanced practitioners (**Appendix D, Exhibit D-4**) also show that their odds are higher in rural than in urban areas.

Our previous finding (**Section 5.5**) that the proportion of patients receiving prescriptions from advanced practitioners is higher among Medicaid beneficiaries than patients with other payer types continues to hold in both urban and rural areas. **Appendix F, Exhibit F-14 and F-15**

provide maps which depict state-level variation in the proportion of Medicaid beneficiaries receiving prescriptions from advanced practitioners in rural and urban areas, respectively.

The percentage of patients with prescriptions written by advanced practitioners increased in every quarter in both rural and urban areas for all payer types. Additionally, the percentage increase of patients who obtained prescriptions from rural advanced practitioners was higher than that of patients who obtained prescriptions from urban advanced practitioners across all payer types.

**Exhibit 18. Number of Medicare Beneficiaries Receiving Buprenorphine Prescriptions for OUD from Urban vs. Rural Prescribers, July 2017 – June 2018**

Prescriber Type	Medicare Patients									
	Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>a</sup>	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>Urban<sup>b</sup></b>										
Advanced practitioners	2,518	5.1	3,230	6.3	4,186	7.8	6,120	11.1	9,697	12.0
NPs	1,583	3.2	2,149	4.2	2,776	5.2	4,138	7.5	6,660	8.2
PAs	962	2.0	1,129	2.2	1,471	2.8	2,144	3.9	3,461	4.3
Physicians	47,799	97.5	49,806	96.7	51,103	95.7	51,800	94.2	78,127	96.5
Multiple provider types <sup>c</sup>	1,293	2.6	1,524	3.0	1,864	3.5	2,949	5.4	6,835	8.4
<b>Total patients<sup>d</sup></b>	<b>49,024</b>	<b>100</b>	<b>51,512</b>	<b>100</b>	<b>53,425</b>	<b>100</b>	<b>54,971</b>	<b>100</b>	<b>80,989</b>	<b>100</b>
<b>Rural</b>										
Advanced practitioners	429	5.9	598	7.7	782	9.6	1,148	13.7	1,856	13.5
NPs	269	3.7	411	5.3	530	6.5	797	9.5	1,286	9.3
PAs	165	2.3	199	2.6	256	3.2	365	4.3	617	4.5
Physicians	7,065	96.5	7,343	94.8	7,530	92.9	7,641	90.9	12,846	93.3
Multiple provider types	171	2.3	197	2.5	205	2.5	385	4.6	934	6.8
<b>Total patients</b>	<b>7,323</b>	<b>100</b>	<b>7,744</b>	<b>100</b>	<b>8,107</b>	<b>100</b>	<b>8,404</b>	<b>100</b>	<b>13,768</b>	<b>100</b>

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because patients can be observed in only one quarter or in multiple quarters.

<sup>b</sup> Counties are classified as urban if they are defined as metropolitan areas according to the 2013 Urban Influence Codes (USDA ERS 2013) and rural otherwise.

<sup>c</sup> Count of the number of patients who receive prescriptions from multiple prescriber types (e.g., a physician and an NP [not two MDs]) within the same period.

<sup>d</sup> Within each stratum, provider type rows are not mutually exclusive. Totals may exceed 100% because patients may receive prescriptions from multiple provider types within the same period.

**Exhibit 19. Number of Patients with Commercial Insurance Receiving Buprenorphine Prescriptions for OUD from Urban vs. Rural Prescribers, July 2017 – June 2018**

Prescriber Type	Commercial Insurance Patients									
	Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>a</sup>	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>Urban<sup>b</sup></b>										
Advanced practitioners	9,766	3.6	12,754	4.7	15,505	5.7	22,179	8.1	37,139	8.5
NPs	6,470	2.4	8,560	3.1	10,475	3.9	15,339	5.6	25,801	5.9
PAs	3,397	1.2	4,341	1.6	5,234	1.9	7,305	2.7	12,592	2.9
Physicians	269,976	98.2	265,315	97.4	262,230	96.7	259,879	95.5	426,408	97.2
Multiple provider types <sup>c</sup>	4,771	1.7	5,739	2.1	6,581	2.4	9,797	3.6	24,709	5.6
<b>Total patients<sup>d</sup></b>	<b>274,971</b>	<b>100</b>	<b>272,330</b>	<b>100</b>	<b>271,154</b>	<b>100</b>	<b>272,261</b>	<b>100</b>	<b>438,838</b>	<b>100</b>
<b>Rural</b>										
Advanced practitioners	1,321	3.9	1,778	5.4	2,338	6.9	3,064	9.1	5,381	8.6
NPs	798	2.4	1,231	3.7	1,595	4.7	2,165	6.4	3,726	6.0
PAs	539	1.6	574	1.7	760	2.2	929	2.7	1,749	2.8
Physicians	33,001	97.6	31,928	96.2	32,318	94.9	31,644	93.5	59,608	95.3
Multiple provider types	516	1.5	526	1.6	614	1.8	858	2.5	2,436	3.9
<b>Total patients</b>	<b>33,806</b>	<b>100</b>	<b>33,180</b>	<b>100</b>	<b>34,042</b>	<b>100</b>	<b>33,850</b>	<b>100</b>	<b>62,553</b>	<b>100</b>

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because patients can be observed in only one quarter or in multiple quarters.

<sup>b</sup> Counties are classified as urban if they are defined as metropolitan areas according to the 2013 Urban Influence Codes (USDA ERS 2013) and rural otherwise.

<sup>c</sup> Count of the number of patients who receive prescriptions from multiple prescriber types (e.g., a physician and an NP [not two MDs]) within the same period.

<sup>d</sup> Within each stratum, provider type rows are not mutually exclusive. Totals may exceed 100% because patients may receive prescriptions from multiple provider types within the same period.

**Exhibit 20. Number of Cash-paying Patients Receiving Buprenorphine Prescriptions for OUD from Urban vs. Rural Prescribers, July 2017 – June 2018**

Prescriber Type	Cash Paying Patients									
	Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>a</sup>	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>Urban<sup>b</sup></b>										
Advanced practitioners	2,462	3.0	3,267	4.2	4,257	5.1	5,951	7.0	12,370	6.2
NPs	1,716	2.1	2,317	3.0	2,983	3.6	4,314	5.1	8,911	4.4
PAs	757	0.9	971	1.3	1,320	1.6	1,715	2.0	3,670	1.8
Physicians	79,319	97.8	74,705	96.8	80,623	96.1	79,965	94.7	193,072	96.2
Multiple provider types <sup>c</sup>	711	0.9	830	1.1	1,010	1.2	1,448	1.7	4,751	2.4
<b>Total patients<sup>d</sup></b>	<b>81,070</b>	<b>100</b>	<b>77,142</b>	<b>100</b>	<b>83,870</b>	<b>100</b>	<b>84,468</b>	<b>100</b>	<b>200,691</b>	<b>100</b>
<b>Rural</b>										
Advanced practitioners	495	3.8	729	5.9	939	7.0	1,237	9.2	2,801	8.1
NPs	257	2.0	512	4.2	675	5.0	925	6.9	1,993	5.8
PAs	245	1.9	220	1.8	270	2.0	319	2.4	840	2.4
Physicians	12,553	97.0	11,641	95.0	12,576	93.9	12,419	92.1	32,259	93.8
Multiple provider types	101	0.8	111	0.9	129	1.0	177	1.3	682	2.0
<b>Total patients</b>	<b>12,947</b>	<b>100</b>	<b>12,259</b>	<b>100</b>	<b>13,386</b>	<b>100</b>	<b>13,479</b>	<b>100</b>	<b>34,378</b>	<b>100</b>

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because patients can be observed in only one quarter or in multiple quarters.  
<sup>b</sup> Counties are classified as urban if they are defined as metropolitan areas according to the 2013 Urban Influence Codes (USDA ERS 2013) and rural otherwise.  
<sup>c</sup> Count of the number of patients who receive prescriptions from multiple prescriber types (e.g., a physician and an NP [not two MDs]) within the same period.  
<sup>d</sup> Within each stratum, provider type rows are not mutually exclusive. Totals may exceed 100% because patients may receive prescriptions from multiple provider types within the same period.

## 5.7 Influence of State Prescriptive Authority for NPs

**Research Question:** *How do the prescriber and patient trends vary for states that allow full NP prescribing authority for buprenorphine for OUD versus limited NP prescribing authority?*

To characterize how state NP prescriptive authority on buprenorphine for OUD shapes providers' prescribing patterns, we classified states into two groups: States that grant NPs full prescriptive authority and states that impose restrictions (details are in **Appendix B**). During the study period, 18 states including the District of Columbia allowed full NP prescriptive authority, while the other states limited NP prescribing.<sup>3</sup> Among states with full NP prescriptive authority,

<sup>3</sup> Tennessee where NPs do not have prescriptive authority is not included in this analysis. The prescriber and patient tables for Tennessee are available in the **Supplemental File**.

the number of prescribers observed over the year ranged from 38 to 1,408, and the number of prescribers ranged from 90 to 3,519 for states without full NP prescriptive authority. Maps depicting state-level proportions of advanced practitioners among buprenorphine for OUD prescribers, of patients receiving buprenorphine from advanced practitioners, and of Medicaid beneficiaries receiving buprenorphine from advanced practitioners, with states' NP prescriptive authority indicated via white borders in the maps, are provided in **Exhibit F-1**, **Exhibit F-9** and **Exhibit F-10** of **Appendix F**, respectively.

**Exhibit 21 and 22** provide the population-weighted average number of prescribers and patients per state as well as the proportion of prescribers and patients by state NP prescriptive authority status. We weighted the state-level means by each state's population for generating the group means for the two groups of states (as opposed to presenting simple unweighted means) to provide greater weight to the state means of more populous states. (See **Appendix B**, **Exhibit B-1** for state population and prescriber and patient counts.) After adjusting for state population size, the proportion of buprenorphine for OUD prescribers who were advanced practitioners was higher in states with full NP prescriptive authority than in states with limited NP prescriptive authority (25.2 percent vs 16.3 percent, respectively). Furthermore, the proportion of advanced practitioners increased over time for both groups. However, the average number of prescribers per state was higher in the group of states with limited NP prescriptive authority (1,603) than in states with full NP prescriptive authority (591) over the full year. This pattern is driven by states such as California, Texas, and Florida where state population sizes are large and NP prescribing is limited and holds regardless of provider type.

For an alternative way of exploring patterns, we used the group-level average number of prescribers per 100,000 population. We generated this measure by taking the group-level average of the number of prescribers per 100,000 population in each state. This measure gives equal weight to every state irrespective of state population, unlike the previous measure of population-weighted mean. Both groups of states have 11 physicians prescribing buprenorphine for OUD per 100,000 population during the year. However, the corresponding number of advanced practitioners per 100,000 population is four for the full NP prescriptive authority states and two for the limited NP prescriptive authority states (see **Appendix B**, **Exhibit B-2**). Consistent with expectation, the proportion of advanced practitioners was also higher for the group of states with full NP prescriptive authority (26.7 percent) than for the group of states with limited NP prescriptive authority (15.4 percent).

Regression results (**Appendix D**, **Exhibit D-5**) comparing patients' likelihood of receiving buprenorphine for OUD prescriptions from advanced practitioners among states with and without full NP prescriptive authority indicate a higher likelihood for states with full NP prescriptive authority, which lends support to the findings above. Furthermore, patients'

likelihood of receiving prescriptions for buprenorphine for OUD from advanced practitioners rises overall over time and increases more quickly in states with full NP prescriptive authority.

**Exhibit 21. Average Number of NPs, PAs, and Physicians Prescribing Buprenorphine per State, by State Prescriptive Authority for NPs, July 2017 – June 2018**

Prescriber Type	Buprenorphine Prescribers Weighted by State Population <sup>a</sup>									
	Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>b</sup>	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>Full Prescriptive Authority</b>										
Advanced practitioners	60	17.1	73	20.0	86	22.1	104	24.4	149	25.2
NPs	39	11.1	48	13.2	58	14.9	72	16.9	100	16.9
PAs	21	6.0	24	6.6	28	7.2	32	7.5	49	8.3
Physicians	291	82.9	292	80.0	304	78.1	321	75.4	442	74.8
<b>Total providers</b>	<b>351</b>	<b>100</b>	<b>365</b>	<b>100</b>	<b>389</b>	<b>100</b>	<b>426</b>	<b>100</b>	<b>591</b>	<b>100</b>
<b>Limited Prescriptive Authority</b>										
Advanced practitioners	108	10.5	122	11.6	146	13.4	179	15.7	261	16.3
NPs	68	6.6	78	7.4	94	8.6	120	10.5	171	10.7
PAs	41	4.0	45	4.3	53	4.9	60	5.3	91	5.7
Physicians	916	89.5	929	88.4	943	86.6	961	84.4	1,342	83.7
<b>Total providers</b>	<b>1,024</b>	<b>100</b>	<b>1,051</b>	<b>100</b>	<b>1,089</b>	<b>100</b>	<b>1,139</b>	<b>100</b>	<b>1,603</b>	<b>100</b>

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because providers either do not prescribe in all quarters or prescribe in multiple quarters.

<sup>b</sup> The averages are weighted by the state population estimates in 2017. Data for state population estimates come from U.S. Census Bureau (2019).

**Exhibit 22. Average Number of Patients Receiving Buprenorphine Prescriptions for OUD per State, by State Prescriptive Authority for NPs, July 2017 – June 2018**

Prescriber Type	Patients Weighted by State Population									
	Jul 17 - Sep 17		Oct 17 - Dec 17		Jan 18 - Mar 18		Apr 18 - Jun 18		Full Year <sup>a</sup>	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>Full Prescriptive Authority</b>										
Advanced practitioners	571	9.1	777	12.0	984	14.3	1,434	19.5	2,336	20.9
NPs	374	6.0	506	7.8	665	9.7	994	13.5	1,614	14.5
PAs	205	3.3	291	4.5	341	5.0	487	6.6	842	7.5
Physicians	5,921	94.6	5,964	92.5	6,242	90.9	6,438	87.5	10,129	90.8
Multiple Prescriber types <sup>b</sup>	282	4.5	353	5.5	419	6.1	584	7.9	1,556	13.9
<b>Total patients<sup>c</sup></b>	<b>6,256</b>	<b>100</b>	<b>6,449</b>	<b>100</b>	<b>6,868</b>	<b>100</b>	<b>7,355</b>	<b>100</b>	<b>11,157</b>	<b>100</b>
<b>Limited Prescriptive Authority</b>										

Prescriber Type	Patients Weighted by State Population									
	Jul 17 - Sep 17		Oct 17 - Dec 17		Jan 18 - Mar 18		Apr 18 - Jun 18		Full Year <sup>a</sup>	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
Advanced practitioners	915	4.1	1,222	5.5	1,548	6.7	2,320	9.9	3,809	10.5
NPs	598	2.7	823	3.7	1,049	4.6	1,627	6.9	2,689	7.4
PAs	337	1.5	423	1.9	528	2.3	775	3.3	1,279	3.5
Physicians	21,699	98.0	21,701	97.2	22,137	96.4	22,283	95.0	35,057	96.9
Multiple Prescriber types	559	2.5	699	3.1	856	3.7	1,338	5.7	3,207	8.9
<b>Total patients</b>	<b>22,134</b>	<b>100</b>	<b>22,319</b>	<b>100</b>	<b>22,954</b>	<b>100</b>	<b>23,445</b>	<b>100</b>	<b>36,196</b>	<b>100</b>

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because patients can be observed in only one quarter or in multiple quarters.  
<sup>b</sup> Count of the number of patients who receive prescriptions from multiple Prescriber types (e.g., a physician and an NP [not two MDs]) within the same period.  
<sup>c</sup> The averages are weighted by state population estimates in 2017. Data for state population estimates come from U.S. Census Bureau (2019).

## 5.8 Factors Associated with Advanced Practitioner Prescribing

**Research Questions:** *How do the patterns and trends in buprenorphine prescribing by advanced practitioners, NPs, and PAs compare with those of physicians? What are the factors associated with a patient receiving a buprenorphine prescription from an advanced practitioner?*

In this section, we summarize the individual findings from the previous sections into an overall narrative of observed buprenorphine for OUD prescribing patterns. The results presented are from a multivariate linear regression model that assessed the association between the probability of a patient receiving buprenorphine for OUD from advanced practitioners and the various patient, payer, and geographic characteristics explored in the previous sections. We explore associations for the full sample of all patients and the sub-sample of patients who had at least one buprenorphine for OUD claim paid for by Medicaid in a given quarter. (See **Appendix D** for additional discussion.)

**Exhibit 23** reinforces the findings from the previous sections. Medicaid beneficiaries are more likely to receive buprenorphine for OUD prescriptions from advanced practitioners compared to patients with other payer types. The probability of a patient receiving buprenorphine for OUD prescriptions from an advanced practitioner increased over time. Patients are also more likely to receive buprenorphine for OUD prescriptions from advanced practitioners in states with full NP prescriptive authority.

There is suggestive evidence (i.e., the difference is statistically significant only at the 0.1 level) of a higher probability of patients receiving buprenorphine for OUD prescriptions from advanced practitioners when the prescriber’s practice location is a rural area. The evidence on the association between patient gender and the receipt of buprenorphine for OUD prescriptions

from advanced practitioners is also suggestive. Females are slightly more likely than males to receive buprenorphine for OUD prescriptions from advanced practitioners in the full sample of patients with all payer types and less likely in the sub-sample of Medicaid beneficiaries. Prescribing patterns along the patient age dimension vary little, and this pattern largely holds for both the full and the Medicaid samples. While in the full sample, patients younger than 18 are estimated to have a higher likelihood of receiving buprenorphine for OUD prescriptions from advanced practitioners than those aged 18 to 39, the differences are only marginally significant, and they are based on a very small sample, warranting caution in interpretation (Greene 2018).<sup>4</sup>

**Exhibit 23. Patients’ Probability of Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners, July 2017 – June 2018**

<i>Dependent Variable: Whether the Patient Received Buprenorphine Prescriptions for OUD from Advanced Practitioners</i>	Full Sample	Medicaid Sub-sample
	Coefficient (Standard Error)	Coefficient (Standard Error)
<i>Reference group: Male</i>		
Female	0.26* (0.15)	-0.45* (0.23)
<i>Ref. group: 18 – 39</i>		
< 18	2.50* (1.27)	-0.14 (1.76)
40 – 64	-0.06 (0.19)	-0.40 (0.24)
65 +	0.46 (0.63)	-0.19 (0.88)
<i>Reference group: Payer Type = Medicaid</i>		
Medicare	-1.26** (0.48)	
Commercial	-3.17*** (0.45)	
Cash	-3.46*** (0.51)	
<i>Reference group: Urban</i>		
Rural	1.46* (0.83)	1.98* (1.02)
<i>Reference group: States with limited NP prescriptive authority</i>		
Full NP prescriptive authority	6.30*** (1.35)	5.64*** (1.68)
<i>Reference group: Jul-Sep17</i>		

A joint test of equality also revealed little difference in prescribing patterns along the age dimension.



<i>Dependent Variable: Whether the Patient Received Buprenorphine Prescriptions for OUD from Advanced Practitioners</i>	Full Sample	Medicaid Sub-sample
	Coefficient (Standard Error)	Coefficient (Standard Error)
Oct17-Dec17	1.65*** (0.18)	2.47*** (0.25)
Jan18-Mar18	3.01*** (0.27)	4.27*** (0.29)
Apr18-Jun18	6.29*** (0.48)	8.93*** (0.47)
Observations	2,722,608	936,175
Adj. R-squared	0.02	0.02

Notes: Standard errors, shown in parentheses, are clustered at the state level.  
\* p < 0.1 \*\* p < 0.05 \*\*\* p < 0.01  
The analysis sample is at the level of patient-by-prescriber type-by-payer type-by-rural/urban-by-state-by-quarter.  
Tennessee with no NP prescriptive authority is not included in the analysis sample.  
Coefficients and standard errors are scaled up 100% for ease of interpretation. Coefficients represent change in percentage points.

## 5.9 Patient Load for each Prescriber Type

**Research Question:** *What is the buprenorphine patient load for each prescriber type?*

In this study, we defined patient load as the number of unique patients to whom a provider prescribed buprenorphine for OUD in June 2018 and calculated the mean and median patient loads for each prescriber type. Monthly count of patients is a metric used in the literature for assessing patient limits (Jones and McCance-Katz 2019; Stein et al. 2016). We calculated patient load for June 2018, the most recent month for which data are available under the study, to provide the most current estimates.

As **Exhibit 24** shows, the median patient load was higher for physicians (7) than for NPs (5) or PAs (4). For all three provider types, patient load varied across prescribers and ranged from 1 to 406, 222, and 226 for physicians, NPs, and PAs, respectively. About 63.6 percent of prescribers observed with buprenorphine for OUD prescriptions in June 2018 had at least one patient with Medicaid as the payer type. When limited to prescribers who treated Medicaid patients, the patient load was much higher — 19 for physicians, 9 for NPs, and 11 for PAs. We note that these estimates, including the observed maximums, do not equate to the number of treated patients defined for a waived provider, as further discussed in **Section 6**.

**Exhibit 24. Patient Load of Prescribers with Buprenorphine Prescriptions for OUD, by Prescriber Type**

Prescriber Type	Number of Prescribers	Patient Load (June 2018)				
		Avg.	Median	Standard Deviation	Min	Max
<b><i>All prescribers</i></b>						
Advanced practitioners	3,749	12	5	19	1	226
NPs	2,706	12	5	19	1	222
PAs	1,043	13	4	19	1	226
Physicians	18,414	26	7	41	1	406
<b>Total prescribers</b>	<b>22,163</b>	<b>23</b>	<b>7</b>	<b>39</b>	<b>1</b>	<b>406</b>
<b><i>Restricted to providers prescribing to Medicaid beneficiaries in June 2018</i></b>						
Advanced practitioners	2,483	17	10	22	1	226
NPs	1,880	16	9	21	1	222
PAs	603	19	11	23	1	226
Physicians	11,610	37	19	47	1	406
<b>Total prescribers</b>	<b>14,093</b>	<b>33</b>	<b>16</b>	<b>44</b>	<b>1</b>	<b>406</b>
<b><i>Restricted to providers not prescribing to Medicaid beneficiaries in June 2018</i></b>						
Advanced practitioners	1,266	4	1	7	1	136
NPs	826	4	1	7	1	136
PAs	440	4	1	7	1	80
Physicians	6,804	7	2	17	1	265
<b>Total prescribers</b>	<b>8,070</b>	<b>6</b>	<b>2</b>	<b>16</b>	<b>1</b>	<b>265</b>

## 6 Conclusions

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### 6.1 Summary of Findings

Increasing the number of waived providers who can provide MAT with buprenorphine is a major strategy to improve access to treatment for OUD. This study assessed trends in outpatient prescribing of buprenorphine for OUD by analyzing a nationally representative prescription claims dataset from July 2017 to June 2018. Our results indicate a strong and robust increase in the number of buprenorphine prescribers, especially NPs, and patients over this period.

The study found that 37,380 providers wrote prescriptions for buprenorphine, resulting in over 10 million claims, to more than 900,000 patients from July 2017 to June 2018. Almost one-fifth of these prescribers were advanced practitioners: 4,828 NPs and 2,099 PAs. Across the study year, the number of buprenorphine prescribers increased by 12 percent overall, with NPs increasing by nearly 80 percent and PAs by nearly 50 percent. The number of physicians prescribing buprenorphine also increased by 4.5 percent during the period. Therefore, there is no evidence that the prescribing activity of advanced practitioners simply replaced that of physicians.

Trends for patients over the study year mirrored the rise in the number of prescribers. The number of patients prescribed buprenorphine increased by six percent from 581,596 in the first study quarter to 616,220 in the last study quarter. Most patients were treated by physicians, but the number treated by advanced practitioners (especially NPs) increased sharply.

Parallel to the striking growth observed in the number of patients who were treated by advanced practitioners, the number of patients treated by multiple prescribers also rose markedly in this time frame. During the study period, 81,742 of the 111,184 patients who received a buprenorphine prescription from an advanced practitioner also received a prescription from a physician. This finding suggests that patients who were treated by an advanced practitioner may also be treated by a physician in the same quarter and the chances that they were treated by multiple prescribers rise over time. However, our study did not assess detailed treatment patterns such as whether a patient switched from a physician to an NP or vice versa either within a single practice site or at distinct practice sites.

Two-fifths of patients received one or more prescription fills paid for by Medicaid, rising from 204,127 in the first study quarter (July – September 2017) to 228,556 in the last study quarter (April – June 2018). The number of Medicaid beneficiaries receiving buprenorphine prescriptions rose for all prescriber types over the year. This increase was particularly

pronounced for advanced practitioners. The number of Medicaid beneficiaries receiving buprenorphine from advanced practitioners more than tripled (23,592 additional Medicaid beneficiaries). These rapid increases in Medicaid beneficiaries receiving buprenorphine for OUD resonate with recent findings that, between 2013 and 2017, Medicaid-covered buprenorphine prescriptions nearly tripled (Clemens-Cope et al. 2019). On average, providers who prescribed to at least one Medicaid beneficiary in the most recent month of the study period had a much higher patient load (33 patients prescribed buprenorphine) compared to prescribers who did not have any patients who had Medicaid as the payer type (6 patients prescribed buprenorphine). This pattern was true for all prescriber types.

While the total number of prescribers and patients was higher in urban than rural areas, rural areas had a higher proportion of advanced practitioner prescribers. Over the full year, nearly one-quarter of prescribers in rural areas were advanced practitioners. Compared to patients whose buprenorphine prescriptions were written by urban prescribers, patients who received prescriptions from rural prescribers were more likely to receive prescriptions written by advanced practitioners. Further, the percent increase in patients treated by rural providers was higher than that of patients treated by urban providers for patients covered by Medicaid, Medicare, and commercial insurance. For cash payers, however, the growth rate was comparable between rural and urban areas.

The proportion of providers who were advanced practitioners was higher in states with full NP prescriptive authority than in states with limited NP prescriptive authority (population-weighted state average of 25.2 percent vs 16.3 percent), and the former had more advanced practitioners prescribing buprenorphine per 100,000 population than the latter.

## **6.2 Issues for Future Consideration**

### **Does the increase in waived providers result in increased access to care by patients?**

Merely having a DEA waiver does not mean that a provider will provide MAT services (Andrilla, Coulthard, and Larson 2017). Waivered providers may end up not prescribing buprenorphine for reasons such as insufficient accompanying staff, stigma, and other obstacles (Lee and McNeely 2019). As of September 8, 2018, 44,968 physicians and 8,825 NPs and PAs were waived to prescribe buprenorphine (HHS 2018). While our study did not link buprenorphine prescribers to waived provider records, our results suggest that a sizeable number of waived providers were prescribing buprenorphine to at least one patient as of June 2018. These results are consistent with survey findings (Jones and McCance-Katz 2019) that approximately 75 percent of newly waived providers go on to write buprenorphine prescriptions during their first year.

The increase in providers that we observed corresponded to an increase in patients receiving buprenorphine prescriptions. However, the extent to which increasing numbers of providers extended capacity in specific practices and settings/models of care is unknown from our study. Further, despite the large percentage increases observed, the number of buprenorphine prescribers in our study still represent a small percentage of total potential prescribers, as do waived providers. For context, the estimated full-time equivalents for all practicing providers in 2016 were 920,397 physicians, 157,025 NPs, and 102,084 PAs (Auerbach, Staiger, and Buerhaus 2018).

### **Are waived providers prescribing to their full capacity?**

This study showed that the median number of patients per provider in June 2018 was seven for physicians and five for advanced practitioners in June 2018, although higher among prescribers who treated Medicaid beneficiaries. The patient load construct used in this study does not translate directly to the number of patients waived practitioners treat at a given time. For example, a provider may treat two patients with a prescription fill in one month consecutively, versus concurrently. The results nonetheless suggest that providers are prescribing to fewer than their waiver limit of 30 patients or more. Our findings are consistent with previous studies. The prescribers who responded to the Jones & McCance-Katz survey (Jones and McCance-Katz 2019) reported a median of 13 patients in a month and up to 90 for 275-patient waived practitioners. Previous claims-based research has also shown that estimated patient censuses were substantially lower than patient limits (Stein et al. 2016).

### **Duration of therapy and guideline-concordant treatment**

While the study captures the number of providers prescribing buprenorphine for OUD and the number of patients receiving these prescriptions, this project does not analyze duration of therapy or guideline-concordant treatment. In previous research based on claims data, Saloner and colleagues (Saloner, Daubresse, and Alexander 2017) found that the likelihood of retaining therapy for six months was lower among Medicaid beneficiaries than patients paying with cash. Understanding how these patterns vary for advanced practitioners and separately for physicians will be valuable to policy makers.

### **How are state-level efforts influencing prescribing?**

The state-level analysis highlights a greater proportion of advanced practitioners prescribing in states with full NP prescriptive authority, as well as substantial interstate variation. In addition to federal efforts, numerous state initiatives and policies have focused on increasing prescribing capacity (Lee and McNeely 2019). Identifying commonalities among states with the largest increases could help identify scalable models. All state Medicaid agencies now cover

buprenorphine, but utilization restrictions may limit treatment (Andrews et al. 2019). Office-based opioid treatment with buprenorphine may be especially critical in states with limited opioid treatment program (OTP) availability (Jones et al. 2018). State-specific scope of practice regulations that limit the ability or extent to which NPs and PAs can prescribe buprenorphine for the treatment of OUD may further restrict the ability of NPs and PAs to fill these treatment gaps (Andrilla et al. 2018). The intersection between state-specific needs, treatment options, and constraints merits further study.

### **Urban-rural variation**

In this study, rural areas had a higher proportion of advanced practitioner prescribers than did urban areas. This resonates with information reported by Andrilla et al. that a larger proportion of newly waived NPs and PAs were located in rural counties compared to their physician counterparts (Andrilla et al. 2019). Based on 2017 data, Andrilla et al. projected that NPs and PAs would increase the number of rural patients treated with buprenorphine by 10,777 (15.2 percent) and we observed a total of 17,810 patients between July 2017 and June 2018. However, rural healthcare infrastructure enhancements include considerations such as OTP and behavioral health service access (Abraham et al. 2019). The interaction between increasing prescribing and treatment in rural areas merits further investigation, including how patterns vary in the most rural areas of the country.

### **Patterns for dual-eligible beneficiaries**

This study did not explore buprenorphine treatment patterns for Medicaid-Medicare dual-eligible beneficiaries as a separate category. This was because they could not be distinguished from other Medicare beneficiaries in our analytic data set given that dual-eligible beneficiary prescriptions are typically covered by their Medicare Part D benefit (CMS 2018). A deeper exploration of this topic is desirable and possible using additional Part D benefits-related data available in IDV<sup>®</sup>.

## **6.3 Limitations**

The claims data used in this study capture the vast majority of retail prescriptions for buprenorphine for OUD, they nonetheless involve several limitations. First, the study does not capture the universe of buprenorphine MAT. This is because data from retail pharmacies do not capture buprenorphine treatment for OUD when the drug is administered or directly dispensed to patients in settings outside retail pharmacies (including for emergency treatment) (SAMHSA 2019). In particular, treatment with two newer medical service treatments — Sublocade<sup>™</sup> injections and Probuphine<sup>®</sup> implants — was excluded in this analysis. Second, buprenorphine

formulations that are FDA-approved for treating OUD may be prescribed off-label for pain management (Chen, Chen, and Mao 2014), potentially overestimating OUD treatment.

Our sample is influenced by the fact that IDV<sup>®</sup> is an open dataset, and some of the increases or decreases in prescribing or use observed in the data may be due to changes in data capture. However, exploratory analyses for two commonly prescribed classes of antidepressant and dyslipidemic drugs showed more stable prescribing over the year, with quarterly variation in the number of prescribers increasing by no more than 1.3 percent, suggesting that the increases we observed for buprenorphine prescribing for OUD are not merely related to data capture changes. IDV<sup>®</sup> had variable coverage by state, which makes the state-specific results less reliable than the national estimates. Data entry errors in source data as well as linkage errors in the anonymization process may lead to some misclassification. This may be an explanation for the small number of observed prescriptions by advanced practitioners in Tennessee, where neither NPs nor PAs has prescriptive authority for buprenorphine formulations indicated for OUD.

Misclassification could also exist in urban/rural assignment, especially for ZIP codes that overlap multiple counties. Urban/rural variability in IDV<sup>®</sup> coverage is, however, unknown. Additionally, it should be noted that urban/rural status was built on prescriber's location of practice, i.e., where patients went for care, and therefore may not reflect patterns according to patient residence. The practice of assigning all non-metropolitan counties as rural that we followed for this study could mean that some suburban communities were counted as rural communities. Lastly, the taxonomy data used to assign provider specialty may include some misclassification, for example, if there is a lag updating clinician classification from trainee to physician upon licensure.



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## APPENDIX A. Buprenorphine Formulations for OUD

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**Exhibit A-1. Buprenorphine Formulations FDA-Approved for Opioid Dependence**

BB USC Name	Generic Name	Brand Name	Dose Form	
	Buprenorphine HCL	Buprenorphine HCL	Sublingual Tablet	
		Subutex	Sublingual Tablet	
	Buprenorphine HCL/Naloxone HCL	Buprenorphine/Naloxone		Sublingual Tablet
				Oral Strip
		Suboxone		Sublingual Tablet
				Oral Strip
		Zubsolv		Sublingual Tablet
		Bunavail		Oral Strip

BB USC Name = Blue Book USC Name.

Note: This analysis excluded Sublocade™ injections and Probuphine® implants that require administration by a clinician or in a facility, since they are not dispensed through the outpatient pharmacy.

## APPENDIX B. NP and PA Prescribing Authority by State

Buprenorphine is subject to state regulations pertaining to the specific drug, as well as to Schedule III controlled substances in general. As summarized in **Exhibit B-1**, PAs may prescribe buprenorphine in all states except Kentucky and Tennessee and in Puerto Rico. NPs are prohibited from prescribing buprenorphine in Tennessee. Some of the remaining states/territories allow NPs full prescribing authority—that is, they are allowed to prescribe buprenorphine independently, while the others require physician oversight (limited prescribing authority). Some states have a transition period in which physician oversight is required for a certain period of time, after which the NP may prescribe independently. For purposes of this analysis, those states where a transition period is required were classified as limited prescribing authority.

To facilitate interpretation of national results presented in Section 5.7, **Exhibit B-1** also includes the number of prescribers (advanced practitioners and physicians combined) and patients in our study sample by state, along with the state population estimates. **Exhibit B-2** summarizes this information with the group-level average for each provider category and prescriptive authority status by quarter.

**Exhibit B-1. State Prescriptive Authority for Buprenorphine for OUD; Study Sample; State Population Estimates**

State	Buprenorphine prescribing allowed (with DATA 2000 waiver) during the time July 2017-June 2018		Study sample, July 2017-June 2018		2017 State Population Estimates <sup>c</sup>
	PAs (with Supervision) <sup>a</sup>	NPs (Prescribing Authority) <sup>b</sup>	Prescribers (PA, NP, Physician)	Patients	
Alabama	Yes	Limited	627	26,130	4,874,747
Alaska	Yes	Full	162	3,412	739,795
Arizona	Yes	Full	725	15,185	7,016,270
Arkansas	Yes	Limited	194	5,653	3,004,279
California	Yes	Limited	3,519	47,896	39,536,653
Colorado	Yes	Transition period required	598	10,288	5,607,154
Connecticut	Yes	Transition period required	612	14,153	3,588,184
Delaware	Yes	Transition period required	119	2,070	693,972
D.C.	Yes	Full	170	6,032	961,939
Florida	Yes	Limited	2,202	57,418	20,984,400
Georgia	Yes	Limited	795	17,134	10,429,379
Hawaii	Yes	Full	167	2,254	1,427,538
Idaho	Yes	Full	224	3,604	1,716,943
Illinois	Yes	Limited	1,015	19,305	12,802,023
Indiana	Yes	Limited	802	30,285	6,666,818
Iowa	Yes	Full	127	2,903	3,145,711
Kansas	Yes	Limited	178	3,447	2,913,123
Kentucky	No	Limited	902	42,495	4,454,189
Louisiana	Yes	Limited	523	21,120	4,684,333
Maine	Yes	Transition period required	462	9,692	1,335,907

State	Buprenorphine prescribing allowed (with DATA 2000 waiver) during the time July 2017-June 2018		Study sample, July 2017-June 2018		2017 State Population Estimates <sup>c</sup>
	PAs (with Supervision) <sup>a</sup>	NPs (Prescribing Authority) <sup>b</sup>	Prescribers (PA, NP, Physician)	Patients	
Maryland	Yes	Transition period required	983	20,698	6,052,177
Massachusetts	Yes	Limited	1,776	46,347	6,859,819
Michigan	Yes	Limited	1,227	30,591	9,962,311
Minnesota	Yes	<b>Full</b>	429	8,031	5,576,606
Mississippi	Yes	Limited	283	7,973	6,113,532
Missouri	Yes	Limited	439	12,736	2,984,100
Montana	Yes	<b>Full</b>	147	2,983	1,050,493
Nebraska	Yes	Transition period required	90	1,569	1,920,076
Nevada	Yes	<b>Full</b>	318	6,125	2,998,039
New Hampshire	Yes	<b>Full</b>	324	10,626	1,342,795
New Jersey	Yes	Limited	985	27,787	9,005,644
New Mexico	Yes	<b>Full</b>	439	9,202	2,088,070
New York	Yes	Limited	2,490	57,959	19,849,399
North Carolina	Yes	Limited	1,175	35,011	10,273,419
North Dakota	Yes	<b>Full</b>	52	2,875	755,393
Ohio	Yes	Limited	1,834	69,447	11,658,609
Oklahoma	Yes	Limited	375	12,659	3,930,864
Oregon	Yes	<b>Full</b>	792	11,228	4,142,776
Pennsylvania	Yes	Limited	1,933	71,175	12,805,537
Puerto Rico	<b>No</b>	Limited	276	8,397	1,059,639
Rhode Island	Yes	<b>Full</b>	429	13,341	5,024,369
South Carolina	Yes	Limited	38	322	869,666
South Dakota	Yes	<b>Full</b>	1,030	47,211	6,715,984
Tennessee <sup>d</sup>	<b>No</b>	<b>No</b>	1,637	29,996	28,304,596
Texas	Yes	Limited	554	11,334	3,101,833
Utah	Yes	<b>Full</b>	256	3,807	623,657
Vermont	Yes	Transition period required	668	25,140	12,802,023
Virginia	Yes	Limited	1,408	25,306	8,470,020
Washington	Yes	<b>Full</b>	332	18,415	7,405,743
West Virginia	Yes	Transition period required	456	10,760	1,815,857
Wisconsin	Yes	Limited	82	1,298	5,795,483
Wyoming	Yes	<b>Full</b>	725	15,185	579,315

<sup>a</sup> State policy specifies whether the supervisory relationship between the PA and the physician is determined at the practice level (within the medical practice where the PA will be practicing), or determined by the state medical board or in state law (scopeofpracticepolicy.org)

<sup>b</sup> Sources: <http://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2017/04/21/nurse-licensing-laws-block-treatment-for-opioid-addiction>; scopeofpracticepolicy.org.

<sup>c</sup> Source: U.S. Census Bureau (2019).

<sup>d</sup> While Tennessee allows advanced practitioners to prescribe Schedule III drugs, providers other than licensed DATA 2000-waived physicians are prohibited from prescribing any buprenorphine product for treatment of OUD (*Tennessee Code Annotated Title 53 Food, Drugs And Cosmetics Chapter 11 Narcotic Drugs and Drug Control Part 3 Regulations and Registration 2017*).

**Exhibit B-2. Average Number of Buprenorphine for OUD Prescribers per 100,000 Population per State, by State Prescriptive Authority for NPs, July 2017 – June 2018**

Provider Specialty	Buprenorphine Prescribers per 100,000 State Population <sup>a</sup>									
	Jul 17 – Sep 17		Oct 17 – Dec 17		Jan 18 – Mar 18		Apr 18 – Jun 18		Full Year <sup>b</sup>	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>Full Prescriptive Authority</b>										
Advanced practitioners	2	22.2	2	22.2	2	20.0	3	3.0	4	26.7
NPs	1	11.1	1	11.1	2	20.0	2	2.0	2	13.3
PAs	1	11.1	1	11.1	1	10.0	1	1.0	1	6.7
Physicians	7	77.8	7	77.8	8	80.0	8	8.0	11	73.3
<b>Total providers</b>	<b>9</b>	<b>100</b>	<b>9</b>	<b>100</b>	<b>10</b>	<b>100</b>	<b>11</b>	<b>100</b>	<b>15</b>	<b>100</b>
<b>Limited Prescriptive Authority</b>										
Advanced practitioners	1	11.1	1	11.1	1	11.1	2	20.0	2	15.4
NPs	1	11.1	1	11.1	1	11.1	1	10.0	2	15.4
PAs	0	0.0	0	0.0	0	0.0	0	0.0	1	7.7
Physicians	8	88.9	8	88.9	8	88.9	8	80.0	11	84.6
<b>Total providers</b>	<b>9</b>	<b>100</b>	<b>9</b>	<b>100</b>	<b>9</b>	<b>100</b>	<b>10</b>	<b>100</b>	<b>13</b>	<b>100</b>

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because providers either do not prescribe in all quarters or prescribe in multiple quarters.

<sup>b</sup> The averages are weighted by the state population estimates in 2017. Data for state population estimates come from the U.S. Census Bureau (2019).

## APPENDIX C. Cohort Formation Table

	Claims		Patients		Providers	
	Num.	%	Num.	%	Num.	%
Extracted from IDV <sup>®</sup> based on claims for Uniform System of Classification [USC] "specific antagonists"	10,732,459	100.00	940,431	100.00	41,092	100.00
Exclusions						
Implants/Injections	333	0.00	81	0.01	3	0.01
Missing Practitioner ID	59,701	0.56	2,148	0.23	N/A <sup>a</sup>	N/A
Practitioner ID cannot be linked to a Physician ID	11,482	0.11	530	0.06	238	0.58
No NPI information	21,301	0.20	822	0.09	621	1.51
NPI cannot be linked to a taxonomy code in the National Plan and Provider Enumeration System	28,778	0.27	1,171	0.12	153	0.37
Provider type other than NP/PA/Physician <sup>b</sup>	380,849	3.55	22,759	2.42	2,502	6.09
Patient missing year of birth	423	0.00	32	0.00	0	0
Patient missing gender	1,144	0.01	299	0.03	4	0.01
Territories other than Puerto Rico	72	0.00	9	0.00	9	0.02
Remainder - U.S.	10,200,652	95.04	909,300	96.69	37,380	90.97
Remainder - Puerto Rico	27,724	0.26	3,401 <sup>c</sup>	0.36	182	0.44

<sup>a</sup> Number of unique providers corresponding to claims with a missing practitioner ID cannot be determined

<sup>b</sup> The most common specific classifications are "Student in an Organized Health Care Education/Training Program," "Specialist," and "Dentist."

<sup>c</sup> Patient numbers in the U.S. and Puerto Rico are not mutually exclusive.

## APPENDIX D: Regression Models – Methods and Results

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### Methods

**Model 1** tests change in the probability of patients receiving buprenorphine prescriptions from advanced practitioners over the study period. We aggregate the claims-level data to the level of patient-by-prescriber type-by-quarter and run the following specification (1) using a linear probability model:

$$Pr(y_{ijt} = 1) = b_0 + \mathbf{b} \sum_{t=2}^4 w_t + \epsilon_{ijt} \quad (1)$$

Variable  $y_{ijt} = 1$  indicates that person  $i$  received a buprenorphine prescription written by an advanced practitioner  $j$  in study quarter  $t$ , and the vector  $w_t$  includes three binary variables, representing quarters October to December 2017, January to March 2018, and April to June 2018 respectively. The coefficient vector  $\mathbf{b}$  reflects the temporal change in such probabilities with respect to the baseline quarter, July to September 2017.

**Model 2** assesses how prescribing patterns vary across patient age and gender dimensions. As above, we use the analysis sample aggregated to the level of patient-by-prescriber type-by-quarter and run specification (2) using a linear probability model:

$$Pr(y_{ijt} = 1) = b_0 + b_1 Female + \mathbf{b}_2 \sum_{a=2}^4 age\_group_a + \mathbf{b}_3 \sum_{t=2}^4 w_t + \mathbf{b}_4 \sum_{t=2}^4 Female * w_t + \mathbf{b}_5 \sum_{a=2}^4 \sum_{t=2}^4 age\_group_a * w_t + \epsilon_{ijt} \quad (2)$$

Variable  $y_{ijt} = 1$  indicates that person  $i$  received a buprenorphine prescription written by an advanced practitioner  $j$  in study quarter  $t$ . *Female* indicates gender and  $age\_group_a$  indicates a given patient's age category associated with the first prescription filled. The interaction terms between gender and time and between age groups and time measure the observed difference in trends. We run specification (2) both on the full sample of all patients and on a sub-sample where prescription fills were paid for by Medicaid.

**Model 3** examines how prescribing patterns differ across patient payer types. We run a model analogous to **Model 2** but aggregate the analysis sample to the level of patient-by-prescriber type-by-payer type-by-quarter. Variable  $y_{ijpt} = 1$  indicates that person  $i$  received a buprenorphine prescription written by an advanced practitioner  $j$  in study quarter  $t$  and paid for

by payer type  $p$ . Differences in trends are reflected in the interaction terms between payer types and time.

$$Pr(y_{ijpt} = 1) = b_0 + \mathbf{b}_1 \sum_{p=2}^4 payer\_type_p + \mathbf{b}_2 \sum_{t=2}^4 w_t + \mathbf{b}_3 \sum_{p=2}^4 \sum_{t=2}^4 payer\_type_p * w_t + \epsilon_{ijpt} \quad (3)$$

**Model 3** above uses payer type Medicaid as the reference group, with the coefficient vector  $\mathbf{b}_1$  denoting the mean difference in the probability of patients receiving buprenorphine prescriptions from advanced practitioners when payer type is Medicaid versus when it is non-Medicaid between July and September 2017. The coefficient vector  $\mathbf{b}_3$  reflects the prescribing differences across payer types over time.

**Model 4** estimates the rural-urban difference in prescribing patterns among advanced practitioners. We define the rural/urban status based on prescribers' county of practice; therefore, we aggregate the claims-level data to the county-by-quarter level.

$$Y_{ct} = b_0 + b_1 Rural_c + \mathbf{b}_2 \sum_{t=2}^4 w_t + \mathbf{b}_3 \sum_{t=2}^4 Rural_c * w_t + \epsilon_{ijt} \quad (4)$$

Variable  $Y_{ct}$  measures the proportion of patients who received buprenorphine prescriptions from advanced practitioners in a given county and quarter, and variable  $Rural_c$  indicates whether prescribers practiced in rural areas. Coefficient  $b_1$  reflects the difference in prescribing patterns between rural and urban areas in the baseline period and the coefficient vector  $\mathbf{b}_3$  records the difference in prescribing patterns over time.

**Model 5**, mirroring **Model 4**, estimates the difference in prescribing trends between states that allow NP independent prescribing and states that limit NP independent prescribing. To facilitate this state-level comparison, we aggregate the claims-level data to the state-by-quarter level and run the following specification (5) using a linear model,

$$Y_{st} = b_0 + b_1 Full\_NP\_auth_s + \mathbf{b}_2 \sum_{t=2}^4 w_t + \mathbf{b}_3 \sum_{t=2}^4 Full\_NP\_auth_s * w_t + \epsilon_{st} \quad (5)$$

Variable  $Y_{st}$  is the proportion of patients in a given state  $s$  and quarter  $t$  who received buprenorphine prescriptions from advanced practitioners. Variable  $Full\_NP\_auth_s$  equals one for states where waived NPs are allowed to prescribe without physician oversight and zero for states where NP independent prescribing is limited. The interaction terms between



$Full\_NP\_auth_s$  and time track the prescribing patterns between these two types of states as time progresses.

**Model 6** combines into a single multivariate regression all factors individually explored in previous models, except for their interactions with quarter binary variables. This model summarizes the association between patient gender, age group, payer types, and their probability of receiving buprenorphine prescriptions from advanced practitioners. It also shows the relationship between geographic factors and patients' likelihood of receiving such prescriptions. Here, we use the analysis sample that is aggregated to the level of patient-by-prescriber type-by-payer type-by-rural/urban status-by-state-by-quarter. We run two versions of this multivariate regression — (1) the full sample of all patients and (2) the sub-sample where patients' prescription fills were paid for by Medicaid. We run **Model 6** using a linear probability model under the following specification:

$$\begin{aligned}
 Prb(y_{ijpsct} = 1) &= b_0 + b_1 Female + \mathbf{b}_2 \sum_{a=2}^4 age\_group_a + \mathbf{b}_3 \sum_{p=2}^4 payer\_type_p \\
 &+ b_4 Full\_NP\_auth_s + b_5 Rural_c + \mathbf{b}_6 \sum_{t=2}^4 w_t + \epsilon_{ijpsct} \quad (6)
 \end{aligned}$$

## Results

Exhibit D-1 shows the regression results for **Model 1**, which tests the change in the probability of patients receiving buprenorphine prescriptions from advanced practitioners over time. Over the study year, patients' probability of receiving buprenorphine prescriptions from advanced practitioners has risen steadily. Specifically, their likelihood of receiving such prescriptions is 1.7 percentage points higher in the second quarter, 3.1 percentage points higher in the third quarter, and 6.5 percentage points higher in the last quarter, relative to the baseline period (July – September 2017).

### Exhibit D-1. Patients' Probability of Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners, July 2017 – June 2018

<i>Dependent Variable: Whether the Patient Received Buprenorphine Prescriptions for OUD from Advanced Practitioners</i>	<b>Coefficient (Standard Error)</b>
<i>Jul-Sep17</i>	<i>Reference</i>
Oct17-Dec17	1.66*** (0.04)
Jan18-Mar18	3.10*** (0.04)
Apr18-Jun18	6.45*** (0.05)
Observations	2,485,332
Adj. R-squared	0.01

Notes: Standard errors, shown in parentheses, are heteroskedasticity-consistent.

\* p < 0.1 \*\* p < 0.05 \*\*\* p < 0.01

The analysis sample is at the patient-by-prescriber type-by-quarter level.

Coefficients and standard errors are scaled up 100% for ease of interpretation. Coefficients represent change in percentage points.

Exhibit D-2 shows results for **Model 2**, which examines how prescribing patterns vary across patient age and gender dimensions. We implement this model for the full sample of all patients as well as for the sub-sample where patients' prescription fills were paid for by Medicaid. In the full sample, we find that females are more likely than males to receive buprenorphine prescriptions for OUD from advanced practitioners, and their likelihood rises more quickly over the study period, albeit males' likelihood also rises. Females' likelihood of receiving such prescriptions is 0.6 percentage points higher than that of males in the baseline period and rises 0.2 percentage points faster in the second and third quarters, and 0.5 percentage points faster in the last quarter. With regard to the prescribing pattern across patient age groups, we find that, between July and September 2017, patients aged 40 and above are more likely to receive buprenorphine prescriptions for OUD from advanced practitioners than patients aged 18 to 39,

holding gender constant. For patients younger than 18, their likelihood of receiving buprenorphine prescriptions for OUD from advanced practitioners is statistically indistinguishable from patients aged 18 to 39, also holding gender constant. Over time, the likelihood increases across the board, but the rate of growth is smaller for those 40 and older compared to patients in the 18 to 39 age group. Noted that comparisons between patients younger than 18 and patients in the 18 to 39 age group should be cautious as only two percent of prescription fills were associated with patients 18 or younger.

Among patients whose prescriptions were paid for by Medicaid, we find that there is little difference in males' and females' likelihood of receiving buprenorphine prescriptions for OUD from advanced practitioners in the baseline period. While the likelihood trends upward for both groups, the rate of growth is slower among females. With respect to the prescribing pattern across patient age groups, there is not much of a clear pattern except that the increase in likelihood is faster among patients age 18 to 39 than those in the 40 to 64 group.

**Exhibit D-2. Patients' Probability of Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners, Full sample and Medicaid-only Sub-sample, July 2017 – June 2018**

<i>Dependent Variable: Whether the Patient Received Buprenorphine Prescriptions for OUD from Advanced Practitioners</i>	<b>Full sample</b>	<b>Medicaid Sub-sample</b>
	Coefficient (Standard Error)	Coefficient (Standard Error)
<i>Male</i>	<i>Reference</i>	<i>Reference</i>
Female (baseline period)	0.58*** (0.05)	-0.11 (0.10)
<i>Age 18 – 39</i>	<i>Reference</i>	<i>Reference</i>
< 18	1.03 (1.97)	2.71 (3.83)
40 – 64	0.17*** (0.05)	-0.16 (0.10)
65+	1.67*** (0.19)	0.46 (0.81)
<i>Jul-Sep17</i>	<i>Reference</i>	<i>Reference</i>
Oct17-Dec17	1.73*** (0.06)	2.68*** (0.13)
Jan18-Mar18	3.23*** (0.07)	4.76*** (0.13)

<i>Dependent Variable: Whether the Patient Received Buprenorphine Prescriptions for OUD from Advanced Practitioners</i>	<b>Full sample</b>	<b>Medicaid Sub-sample</b>
	Coefficient (Standard Error)	Coefficient (Standard Error)
Apr18-Jun18	6.73*** (0.07)	9.95*** (0.14)
<i>Male in Jul-Sep17</i>	<i>Reference</i>	<i>Reference</i>
Female × Oct17-Dec17	0.20** (0.08)	-0.17 (0.15)
Female × Jan18-Mar18	0.23*** (0.09)	-0.45*** (0.16)
Female × Apr18-Jun18	0.46*** (0.09)	-0.99*** (0.17)
<i>Age 18-39 in Jul-Sep17</i>	<i>Reference</i>	<i>Reference</i>
< 18 × Oct17-Dec17	2.57 (2.94)	1.27 (5.33)
< 18 × Jan18-Mar18	1.16 (3.11)	-4.86 (5.06)
< 18 × Apr18-Jun18	-0.33 (3.36)	-6.23 (5.52)
40 – 64 × Oct17-Dec17	-0.33*** (0.08)	-0.18 (0.16)
40 – 64 × Jan18-Mar18	-0.50*** (0.09)	-0.35** (0.17)
40 – 64 × Apr18-Jun18	-1.07*** (0.10)	-0.89*** (0.18)
65+ × Oct17-Dec17	-0.99*** (0.28)	-1.24 (1.25)
65+ × Jan18-Mar18	-1.23***	-0.42

<i>Dependent Variable: Whether the Patient Received Buprenorphine Prescriptions for OUD from Advanced Practitioners</i>	Full sample	Medicaid Sub-sample
	Coefficient (Standard Error)	Coefficient (Standard Error)
	(0.28)	(1.33)
65+ × Apr18-Jun18	-1.98*** (0.30)	-2.06 (1.42)
Observations	2,485,332	910,366
Adj. R-squared	0.01	0.01

Notes: Standard errors, shown in parentheses, are heteroskedasticity-consistent.  
\* p < 0.1 \*\* p < 0.05 \*\*\* p < 0.01  
The analysis sample is at the patient-by-prescriber type-by-quarter level.  
Coefficients and standard errors are scaled up 100% for ease of interpretation. Coefficients represent change in percentage points.

Exhibit D-3 shows results for **Model 3**, which assesses how prescribing patterns vary across patient payer types. The specification shown in column 1 includes only patient payer types and uses Medicaid as the reference category. The specification in column 2 further includes quarter binary variables and patient payer types interacted with quarter binary variables. Results in column 1 suggest that patients whose prescriptions were paid for by Medicaid have the highest likelihood of receiving buprenorphine prescriptions for OUD from advanced practitioners. Specifically, compared to patients whose prescription fills were paid for by Medicaid, the likelihood of patients whose prescription fills were paid for by Medicare is 1.6 percentage points lower, that of patients whose prescription fills were paid for by commercial insurance is 3.9 percentage points lower, and that of patients whose prescription fills were paid in cash is 4.3 percentage points lower.

Including time effects and interactions between patient payer types and time effects does not materially alter the conclusion. Results under column 2 suggest that patients whose prescription fills were paid for by Medicaid have a higher likelihood of receiving buprenorphine prescriptions from advanced practitioners than patients whose fills were paid for by commercial insurance or in cash in the baseline period. The likelihood trends upward for all patients, but the rate of increase is much larger among those whose prescription fills were paid for by Medicaid than by any other payer types.

**Exhibit D-3. Patients' Probability of Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners by Payer Type, July 2017 – June 2018**

<i>Dependent Variable: Whether the Patient Received Buprenorphine Prescriptions for OUD from Advanced Practitioners</i>	Without time or interactions	With time and interactions
	Coefficient (Standard Error)	Coefficient (Standard Error)
<i>Payer Type = Medicaid</i>	<i>Reference</i>	<i>Reference</i>
Medicare	-1.61*** (0.06)	-0.01 (0.11)
Commercial	-3.85*** (0.04)	-1.63*** (0.06)
Cash	-4.31*** (0.05)	-2.07*** (0.07)
<i>Jul-Sep17</i>		<i>Reference</i>
Oct17-Dec17		2.53*** (0.07)
Jan18-Mar18		4.41*** (0.08)
Apr18-Jun18		9.13*** (0.09)
<i>Medicaid × Jul-Sep17</i>		<i>Reference</i>
Medicare × Oct17-Dec17		-1.31*** (0.16)
Medicare × Jan18-Mar18		-1.66*** (0.16)
Medicare × Apr18-Jun18		-3.11*** (0.18)
Commercial × Oct17-Dec17		-1.37*** (0.09)
Commercial × Jan18-Mar18		-2.18*** (0.09)

<i>Dependent Variable: Whether the Patient Received Buprenorphine Prescriptions for OUD from Advanced Practitioners</i>	Without time or interactions	With time and interactions
	Coefficient (Standard Error)	Coefficient (Standard Error)
Commercial × Apr18-Jun18		-4.55*** (0.10)
Cash × Oct17-Dec17		-1.20*** (0.12)
Cash × Jan18-Mar18		-2.19*** (0.12)
Cash × Apr18-Jun18		-4.93*** (0.13)
Observations	2,776,805	2,776,805
Adj. R-squared	0.01	0.01

Notes: Standard errors, shown in parentheses, are heteroskedasticity-consistent.  
\* p < 0.1 \*\* p < 0.05 \*\*\* p < 0.01  
The analysis sample is at the patient-by-prescriber type-by-payer type-by-quarter level.  
Coefficients and standard errors are scaled up 100% for ease of interpretation. Coefficients represent change in percentage points.

Exhibit D-4 shows results for **Model 4**, which examines how prescribing patterns in rural areas differ from those in urban areas. As mentioned above, we define rural and urban areas based on prescribers' county of practice; therefore, the dataset is aggregated to the level of county-by-quarter. To account for potential intertemporal correlations in advanced practitioner prescribing within counties, we cluster standard errors at the county level.

In the baseline period, we find that rural areas have a larger share of patients who received buprenorphine prescriptions from advanced practitioners than do urban areas. Over time, rural areas experience a stronger growth in such a share, but the increase eventually levels off.

In a sub-sample analysis where we restrict attention to patients whose prescription fills were paid for by Medicaid, results suggest that the prescribing patterns do not differ much between rural and urban areas from July to September 2017. Rural areas, however, continue to demonstrate a stronger growth in the share of patients who received buprenorphine prescriptions from advanced practitioners in the second and third study quarter.

**Exhibit D-4. Proportion of Patients who Received Buprenorphine Prescriptions for OUD from Advanced Practitioners, Urban versus Rural Areas, July 2017 – June 2018**

<i>Dependent Variable: Proportion of patients who received buprenorphine prescriptions for OUD from advanced practitioners</i>	Full sample	Medicaid Sub-sample
	Coefficient (Standard Error)	Coefficient (Standard Error)
<i>Urban areas</i>	<i>Reference</i>	<i>Reference</i>
Rural areas	3.01*** (1.05)	1.74 (1.14)
<i>Jul-Sep17</i>	<i>Reference</i>	<i>Reference</i>
Oct17-Dec17	0.55 (0.43)	0.88* (0.47)
Jan18-Mar18	2.71*** (0.53)	3.44*** (0.57)
Apr18-Jun18	5.55*** (0.63)	6.90*** (0.67)
<i>Urban areas × Jul-Sep17</i>	<i>Reference</i>	<i>Reference</i>
Rural areas × Oct17-Dec17	2.89*** (0.97)	4.02*** (1.13)
Rural areas × Jan18-Mar18	1.49 (1.04)	2.57** (1.22)
Rural areas × Apr18-Jun18	0.44 (1.16)	1.20 (1.35)
Observations	7,014	5,876
Adj. R-squared	0.02	0.02

Notes: Standard errors, shown in parentheses, are clustered at the county level.

\* p < 0.1 \*\* p < 0.05 \*\*\* p < 0.01

The analysis sample is at the county-by-quarter level.

Coefficients and standard errors are scaled up 100% for ease of interpretation.

Coefficients represent change in percentage points.

Exhibit D-5 shows results for **Model 5**, which analyzes the difference in prescribing patterns between states with full NP prescriptive authority and states that limit NP independent prescribing. To facilitate this state-level comparison, we aggregate the dataset to the state-by-quarter level; therefore, each cell measures the proportion of patients in a given state and quarter who received buprenorphine prescriptions from advanced practitioners. As above, we



cluster standard errors at the state level to account for any intertemporal correlations. Note that we are unable to control for state fixed effects as states are perfectly nested smaller units within state NP prescriptive authority status.

The estimated coefficients are consistent with our observation from the descriptive statistics: States with full NP prescriptive authority have a larger share of patients who received buprenorphine prescriptions for OUD from advanced practitioners. The difference is present in the baseline period and intensifies as time progresses.

We have also run a regression where patients receiving buprenorphine prescriptions from PAs are excluded as limitations in NP prescriptive authority are only applicable to NPs. The estimated differences are slightly reduced in size, but the statistical significance is comparable (Exhibit D-5, sub-sample).

**Exhibit D-5. Proportion of Patients who Received Buprenorphine Prescriptions for OUD from Advanced Practitioners, States with and without Full NP Prescriptive Authority, July 2017 – June 2018**

<i>Dependent Variable: Proportion of patients who received buprenorphine prescriptions for OUD from advanced practitioners</i>	Full sample	Sub-sample
	Coefficient (Standard Error)	Coefficient (Standard Error)
<i>States with limited NP prescriptive authority</i>	<i>Reference</i>	<i>Reference</i>
States with full NP prescriptive authority	5.03*** (1.42)	2.33** (0.88)
<i>Jul-Sep17</i>	<i>Reference</i>	<i>Reference</i>
Oct17-Dec17	1.43*** (0.23)	1.16*** (0.20)
Jan18-Mar18	2.93*** (0.43)	2.15*** (0.29)
Apr18-Jun18	6.23*** (0.67)	4.48*** (0.46)
<i>States with limited NP prescriptive authority × Jul-Sep17</i>	<i>Reference</i>	<i>Reference</i>
States with full NP prescriptive authority × Oct17-Dec17	2.42** (0.97)	1.93** (0.83)
States with full NP prescriptive authority × Jan18-Mar18	3.62*** (1.24)	3.50*** (1.24)
States with full NP prescriptive authority × Apr18-Jun18	4.16*** (1.47)	4.58*** (1.40)
Observations	200	200
Adj. R-squared	0.33	0.33

Notes: Standard errors, shown in parentheses, are clustered at the state level.

\* p < 0.1 \*\* p < 0.05 \*\*\* p < 0.01

The analysis sample is at the state-by-quarter level.

States with no NP prescriptive authority are dropped.

Coefficients and standard errors are scaled up 100% for ease of interpretation. Coefficients represent change in percentage points.

Lastly, we run **Model 6** to summarize the associations between the various patient, payer and geographic factors explored individually in previous models and the likelihood of receiving buprenorphine prescriptions from advanced practitioners in a single multivariate regression. Exhibit D-6 presents the results. In it, we have excluded the interactions of each variable of

interest and quarter binary variables, retaining only the average effects across the full study year. No strong associations between patients' gender and age and their likelihood of receiving buprenorphine prescriptions from advanced practitioners are observed. Patients whose prescriptions were paid for by Medicaid have the highest likelihood of receiving buprenorphine prescriptions from advanced practitioners than patients whose prescription fills were paid for by other payer types. States with full NP prescriptive authority also have a larger share of patients receiving buprenorphine prescriptions from advanced practitioners.

Results in Exhibit D-6 are generated without the state fixed effects because states are perfectly nested within the policy prescription of full and limited NP prescribing that is at the higher level. However, patients' likelihood of receiving buprenorphine prescriptions from advanced practitioners may be influenced by state-specific heterogeneities that are unobservable to us (for example, efforts to encourage advanced practitioners to become waived). To test the stability of findings in Exhibit D-6, we thus run a multivariate regression with state fixed effects explicitly accounted for and thus dropped the state NP prescriptive authority variable. Results shown in Exhibit D-6a provide a degree of confidence that lessons emerged above are robust to the inclusion of state fixed effects. For instance, the suggestive evidence ( $p$ -value  $< 0.1$ ) on females being slightly more likely than males to receive buprenorphine prescriptions for OUD from advanced practitioners in the full sample but less likely to do so in the Medicaid-only sub-sample becomes stronger. Patients whose prescriptions fills were paid for by Medicaid continue to demonstrate the highest likelihood of receiving their buprenorphine prescriptions from advanced practitioners, though the differences in size are somewhat diminished. The suggestive evidence on patients having a higher likelihood of receiving buprenorphine prescriptions from advanced practitioners in rural areas continues to exist.

**Exhibit D-6. Patients' Probability of Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners, July 2017 – June 2018**

<i>Dependent Variable: Whether the Patient Received Buprenorphine Prescriptions for OUD from Advanced Practitioners</i>	<b>Full Sample</b>	<b>Medicaid Sub-sample</b>
	Coefficient (Standard Error)	Coefficient (Standard Error)
<i>Male</i>	<i>Reference</i>	<i>Reference</i>
Female	0.26* (0.15)	-0.45* (0.23)
<i>Age 18 – 39</i>	<i>Reference</i>	<i>Reference</i>
< 18	2.50* (1.27)	-0.14 (1.76)
40 – 64	-0.06 (0.19)	-0.40 (0.24)
65 +	0.46 (0.63)	-0.19 (0.88)
<i>Payer Type = Medicaid</i>	<i>Reference</i>	
Medicare	-1.26** (0.48)	
Commercial	-3.17*** (0.45)	
Cash	-3.46*** (0.51)	
<i>Urban</i>	<i>Reference</i>	<i>Reference</i>
Rural	1.46* (0.83)	1.98* (1.02)
<i>States with limited NP prescriptive authority</i>	<i>Reference</i>	<i>Reference</i>
Full NP prescriptive authority	6.30*** (1.35)	5.64*** (1.68)
<i>Jul-Sep17</i>	<i>Reference</i>	<i>Reference</i>
Oct17-Dec17	1.65*** (0.18)	2.47*** (0.25)

<b>Dependent Variable: Whether the Patient Received Buprenorphine Prescriptions for OUD from Advanced Practitioners</b>	<b>Full Sample</b>	<b>Medicaid Sub-sample</b>
	Coefficient (Standard Error)	Coefficient (Standard Error)
Jan18-Mar18	3.01*** (0.27)	4.27*** (0.29)
Apr18-Jun18	6.29*** (0.48)	8.93*** (0.47)
Observations	2,722,608	936,175
Adj. R-squared	0.02	0.02

Notes: Standard errors, shown in parentheses, are clustered at the state level.

\* p < 0.1 \*\* p < 0.05 \*\*\* p < 0.01

The analysis sample is at the level of patient-by-prescriber type-by-payer type-by-rural/urban-by-state-by-quarter.

States with no NP prescriptive authority are dropped.

Coefficients and standard errors are scaled up 100% for ease of interpretation. Coefficients represent change in percentage points.

**Exhibit D-6a. Patients' Probability of Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners, July 2017 – June 2018, with State Fixed Effects**

<i>Dependent Variable: Whether the Patient Received Buprenorphine Prescriptions for OUD from Advanced Practitioners</i>	<b>Full sample</b>	<b>Medicaid-only Sub-sample</b>
	Coefficient (Standard Error)	Coefficient (Standard Error)
<i>Male</i>	<i>Reference</i>	<i>Reference</i>
Female	0.33*** (0.12)	-0.30** (0.15)
<i>Age 18 – 39</i>	<i>Reference</i>	<i>Reference</i>
< 18	0.96 (1.20)	-2.49 (1.65)
40 – 64	0.01 (0.17)	-0.27 (0.20)
65 +	0.23 (0.54)	0.27 (0.81)
<i>Payer Type = Medicaid</i>	<i>Reference</i>	
Medicare	-0.85** (0.33)	
Commercial	-2.81*** (0.38)	
Cash	-3.14*** (0.39)	
<i>Urban</i>	<i>Reference</i>	<i>Reference</i>
Rural	1.66 (1.01)	2.76* (1.39)
<i>Jul-Sep17</i>	<i>Reference</i>	<i>Reference</i>
Oct17-Dec17	1.63*** (0.18)	2.46*** (0.25)
Jan18-Mar18	2.98*** (0.27)	4.22*** (0.28)
Apr18-Jun18	6.23***	8.81***

<b>Dependent Variable: Whether the Patient Received Buprenorphine Prescriptions for OUD from Advanced Practitioners</b>	<b>Full sample</b>	<b>Medicaid-only Sub-sample</b>
	Coefficient (Standard Error)	Coefficient (Standard Error)
	(0.47)	(0.46)
Observations	2,722,608	936,175
Adj. R-squared	0.02	0.02

Notes: Standard errors, shown in parentheses, are clustered at the state level.  
\* p < 0.1 \*\* p < 0.05 \*\*\* p < 0.01  
The analysis sample is at the level of patient-by-prescriber type-by-payer type-by-rural/urban-by-state-by-quarter.  
States with no NP prescriptive authority are dropped.  
State fixed effects are included.  
Coefficients and standard errors are scaled up 100% for ease of interpretation. Coefficients represent change in percentage points.

## APPENDIX E. Supplemental Results for Medicaid Beneficiaries

Exhibit E-1. Number of NPs, PAs, and Physicians Prescribing Buprenorphine for OUD, by Medicaid Beneficiaries' Age Group, July 2017 – June 2018

Patient Age Group	Prescriber Type	Buprenorphine Prescribers									
		Jul17-Sep17		Oct17-Dec17		Jan18-Mar18		Apr18-Jun18		Full Year <sup>a</sup>	
		Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>&lt; 18</b>	Advanced Practitioner <sup>b</sup>	<11	*	<11	*	<11	*	<11	*	20	11.3
	NP	<11	*	<11	*	<11	*	<11	*	15	8.5
	PA	<11	*	<11	*	<11	*	<11	*	<11	*
	Physician	50	92.6	72	90.0	65	94.2	68	89.5	157	88.7
	<b>Total Prescribers</b>	<b>54</b>		<b>80</b>		<b>69</b>		<b>76</b>		<b>177</b>	
<b>18 - 39</b>	Advanced Practitioner <sup>b</sup>	1,214	9.8	1,610	12.4	2,025	14.9	2,672	18.4	3,504	18.1
	NP	870	7.0	1,173	9.0	1,464	10.8	1,995	13.8	2,562	13.2
	PA	344	2.8	437	3.4	561	4.1	677	4.7	942	4.9
	Physician	11,235	90.2	11,364	87.6	11,531	85.1	11,833	81.6	15,888	81.9
	<b>Total Prescribers</b>	<b>12,449</b>		<b>12,974</b>		<b>13,556</b>		<b>14,505</b>		<b>19,392</b>	
<b>40 - 64</b>	Advanced Practitioner <sup>b</sup>	934	8.7	1,327	11.9	1,687	14.4	2,205	17.7	2,857	17.2
	NP	650	6.1	954	8.5	1,225	10.4	1,618	13.0	2,079	12.5
	PA	284	2.6	373	3.3	462	3.9	587	4.7	778	4.7
	Physician	9,790	91.3	9,850	88.1	10,044	85.6	10,240	82.3	13,718	82.8
	<b>Total Prescribers</b>	<b>10,724</b>		<b>11,177</b>		<b>11,731</b>		<b>12,445</b>		<b>16,575</b>	
<b>65+</b>	Advanced Practitioner <sup>b</sup>	44	5.5	50	6.8	75	9.5	109	13.3	182	10.7
	NP	24	3.0	34	4.6	55	7.0	87	10.6	133	7.8
	PA	20	2.5	16	2.2	20	2.5	22	2.7	49	2.9
	Physician	761	94.5	683	93.2	715	90.5	708	86.7	1,525	89.3
	<b>Total Prescribers</b>	<b>805</b>		<b>733</b>		<b>790</b>		<b>817</b>		<b>1,707</b>	

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because providers either do not prescribe in all quarters or prescribe in multiple quarters.

<sup>b</sup> Advanced practitioners are NPs and PAs combined.



**Exhibit E-2. Number of NPs, PAs, and Physicians Prescribing Buprenorphine for Male Medicaid Beneficiaries' by Patient Age Group, July 2017 – June 2018**

Patient Age Group	Prescriber Type	Buprenorphine Prescribers									
		Jul17-Sep17		Oct17-Dec17		Jan18-Mar18		Apr18-Jun18		Full Year <sup>a</sup>	
		Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>&lt; 18</b>	Advanced Practitioner <sup>b</sup>	<11	*	<11	*	<11	*	<11	*	<11	*
	NP	<11	*	<11	*	<11	*	<11	*	<11	*
	PA	<11	*	<11	*	<11	*	0	0	<11	*
	Physician	24	85.7	29	87.9	31	93.9	30	93.8	81	90.0
	<b>Total Prescribers</b>	<b>28</b>		<b>33</b>		<b>33</b>		<b>32</b>		<b>90</b>	
<b>18 - 39</b>	Advanced Practitioner <sup>b</sup>	835	8.8	1,144	11.6	1,548	14.9	2,065	18.7	2,657	17.9
	NP	596	6.3	841	8.5	1,124	10.8	1,543	14.0	1,965	13.2
	PA	239	2.5	303	3.1	424	4.1	522	4.7	692	4.7
	Physician	8,610	91.2	8,693	88.4	8,862	85.1	8,988	81.3	12,207	82.1
	<b>Total Prescribers</b>	<b>9,445</b>		<b>9,837</b>		<b>10,410</b>		<b>11,053</b>		<b>14,864</b>	
<b>40 - 64</b>	Advanced Practitioner <sup>b</sup>	649	7.8	965	11.1	1,242	13.7	1,666	17.3	2,168	16.5
	NP	449	5.4	701	8.1	901	9.9	1,238	12.9	1,594	12.2
	PA	200	2.4	264	3.0	341	3.8	428	4.4	574	4.4
	Physician	7,716	92.2	7,699	88.9	7,823	86.3	7,954	82.7	10,946	83.5
	<b>Total Prescribers</b>	<b>8,365</b>		<b>8,664</b>		<b>9,065</b>		<b>9,620</b>		<b>13,114</b>	
<b>65+</b>	Advanced Practitioner <sup>b</sup>	26	4.9	32	6.8	52	9.9	66	13.2	116	10.4
	NP	12	2.3	20	4.3	36	6.9	55	11.0	85	7.6
	PA	14	2.6	12	2.6	16	3.1	11	2.2	31	2.8
	Physician	503	95.1	438	93.2	471	90.1	434	86.8	999	89.6
	<b>Total Prescribers</b>	<b>529</b>		<b>470</b>		<b>523</b>		<b>500</b>		<b>1,115</b>	

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because providers either do not prescribe in all quarters or prescribe in multiple quarters.

<sup>b</sup> Advanced practitioners are NPs and PAs combined.

**Exhibit E-3. Number of NPs, PAs, and Physicians Prescribing Buprenorphine for Female Medicaid Beneficiaries' by Patient Age Group, July 2017 – June 2018**

Patient Age Group	Prescriber Type	Buprenorphine Prescribers									
		Jul17-Sep17		Oct17-Dec17		Jan18-Mar18		Apr18-Jun18		Full Year <sup>a</sup>	
		Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>&lt; 18</b>	Advanced Practitioner <sup>b</sup>	0	0	<11	*	<11	*	<11	*	11	12.1
	NP	0	0	<11	*	<11	*	<11	*	<11	*
	PA	0	0	0	0	0	0	<11	*	<11	*
	Physician	27		43	91.5	34	94.4	38	86.4	80	87.9
	<b>Total Prescribers</b>	<b>27</b>		<b>47</b>		<b>36</b>		<b>44</b>		<b>91</b>	
<b>18 - 39</b>	Advanced Practitioner <sup>b</sup>	963	9.1	1,341	12.2	1,662	14.5	2,226	18.2	2,876	17.6
	NP	691	6.5	974	8.9	1,206	10.5	1,672	13.7	2,120	13.0
	PA	272	2.6	367	3.3	456	4.0	554	4.5	756	4.6
	Physician	9,625	90.9	9,664	87.8	9,789	85.5	10,020	81.8	13,434	82.4
	<b>Total Prescribers</b>	<b>10,588</b>		<b>11,005</b>		<b>11,451</b>		<b>12,246</b>		<b>16,310</b>	
<b>40 - 64</b>	Advanced Practitioner <sup>b</sup>	707	8.3	971	11.0	1,268	13.6	1,697	17.1	2,230	16.7
	NP	496	5.8	691	7.8	924	9.9	1,238	12.5	1,626	12.2
	PA	211	2.5	280	3.2	344	3.7	459	4.6	604	4.5
	Physician	7,852	91.7	7,892	89.0	8,076	86.4	8,239	82.9	11,093	83.3
	<b>Total Prescribers</b>	<b>8,559</b>		<b>8,863</b>		<b>9,344</b>		<b>9,936</b>		<b>13,323</b>	
<b>65+</b>	Advanced Practitioner <sup>b</sup>	19	6.0	20	6.8	27	8.9	47	13.2	75	10.4
	NP	12	3.8	15	5.1	23	7.6	36	10.1	55	7.6
	PA	<11	*	<11	*	<11	*	11	3.1	20	2.8
	Physician	298	94.0	272	93.2	275	91.1	309	86.8	646	89.6
	<b>Total Prescribers</b>	<b>317</b>		<b>292</b>		<b>302</b>		<b>356</b>		<b>721</b>	

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because providers either do not prescribe in all quarters or prescribe in multiple quarters.

<sup>b</sup> Advanced practitioners are NPs and PAs combined.

**Exhibit E-4. Number of Male Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD, by Prescriber Type and Patient Age Group, July 2017 – June 2018**

Patient Age Group	Prescriber Type	Medicaid Beneficiaries									
		Jul17-Sep17		Oct17-Dec17		Jan18-Mar18		Apr18-Jun18		Full Year <sup>a</sup>	
		Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>&lt; 18</b>	Advanced Practitioner	<11	*	<11	*	<11	*	<11	*	<11	*
	NP	<11	*	<11	*	<11	*	<11	*	<11	*
	PA	<11	*	<11	*	<11	*	0	0	<11	*
	Physician	22	91.7	27	87.1	31	91.2	23	95.8	66	91.7
	Multiple prescriber types <sup>b</sup>	<11	*	<11	*	0	0	<11	*	<11	*
	<b>Total Patients<sup>c</sup></b>	<b>24</b>		<b>31</b>		<b>34</b>		<b>24</b>		<b>72</b>	
<b>18 - 39</b>	Advanced Practitioner	3,320	5.5	5,175	8.3	7,025	10.6	11,132	16.3	18,390	16.1
	NP	2,412	4.0	3,840	6.1	5,250	7.9	8,474	12.4	13,997	12.3
	PA	950	1.6	1,416	2.3	1,881	2.8	3,025	4.4	5,148	4.5
	Physician	58,882	97.8	60,049	96.1	62,800	94.8	62,858	92.0	108,592	95.2
	Multiple prescriber types <sup>b</sup>	1,986	3.3	2,770	4.4	3,612	5.5	5,666	8.3	12,970	11.4
	<b>Total Patients<sup>c</sup></b>	<b>60,216</b>		<b>62,454</b>		<b>66,213</b>		<b>68,324</b>		<b>114,012</b>	
<b>40 - 64</b>	Advanced Practitioner	1,763	5.2	2,735	7.9	3,627	9.8	5,603	14.7	9,181	15.0
	NP	1,282	3.8	2,069	6.0	2,742	7.4	4,306	11.3	7,095	11.6
	PA	500	1.5	704	2.0	940	2.5	1,417	3.7	2,396	3.9
	Physician	33,222	97.8	33,476	96.3	35,318	95.2	35,323	92.8	58,341	95.6
	Multiple prescriber types <sup>b</sup>	1,005	3.0	1,441	4.1	1,852	5.0	2,877	7.6	6,482	10.6
	<b>Total Patients<sup>c</sup></b>	<b>33,980</b>		<b>34,770</b>		<b>37,093</b>		<b>38,049</b>		<b>61,040</b>	
<b>65+</b>	Advanced Practitioner	27	5.3	30	6.8	51	10.5	66	13.7	117	11.7
	NP	13	2.5	20	4.5	37	7.6	58	12.1	90	9.0
	PA	16	3.1	12	2.7	15	3.1	11	2.3	34	3.4
	Physician	497	97.3	424	95.9	456	93.8	441	91.7	956	95.4
	Multiple prescriber types <sup>b</sup>	13	2.5	12	2.7	21	4.3	26	5.4	71	7.1
	<b>Total Patients<sup>c</sup></b>	<b>511</b>		<b>442</b>		<b>486</b>		<b>481</b>		<b>1,002</b>	

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because providers either do not prescribe in all quarters or prescribe in multiple quarters.

<sup>b</sup> Count of the number of patients who receive prescriptions from multiple prescriber types (e.g., a physician and an NP [not two MDs]) within the same period.

<sup>c</sup> Within each age group, Prescriber Type rows are not mutually exclusive. Totals may exceed 100% because patients may receive prescriptions from multiple prescriber types within the same period.

**Exhibit E-5. Number of Female Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD, by Prescriber Type and Patient Age Group, July 2017 – June 2018**

Patient Age Group	Prescriber Type	Medicaid Beneficiaries									
		Jul17-Sep17		Oct17-Dec17		Jan18-Mar18		Apr18-Jun18		Full Year <sup>a</sup>	
		Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
<b>&lt; 18</b>	Advanced Practitioner	0	0	<11	*	<11	*	<11	*	<11	*
	NP	0	0	<11	*	<11	*	<11	*	<11	*
	PA	0	0	0	0	0	0	<11	*	<11	*
	Physician	24		40		29	96.7	33		65	
	Multiple prescriber types <sup>b</sup>	0	0	<11	*	<11	*	<11	*	<11	*
	<b>Total Patients<sup>c</sup></b>	<b>24</b>		<b>40</b>		<b>30</b>		<b>33</b>		<b>65</b>	
<b>18 - 39</b>	Advanced Practitioner	4,035	5.3	6,214	8.0	8,005	9.8	12,474	14.8	20,352	15.3
	NP	2,953	3.9	4,608	5.9	5,909	7.2	9,475	11.2	15,468	11.6
	PA	1,128	1.5	1,700	2.2	2,230	2.7	3,401	4.0	5,743	4.3
	Physician	74,555	98.0	75,368	96.5	77,757	95.4	78,719	93.1	127,549	96.0
	Multiple prescriber types <sup>b</sup>	2,520	3.3	3,489	4.5	4,250	5.2	6,626	7.8	15,068	11.3
	<b>Total Patients<sup>c</sup></b>	<b>76,070</b>		<b>78,093</b>		<b>81,512</b>		<b>84,567</b>		<b>132,833</b>	
<b>40 - 64</b>	Advanced Practitioner	1,728	5.2	2,581	7.7	3,365	9.5	5,162	14.0	8,329	14.9
	NP	1,252	3.8	1,902	5.6	2,565	7.2	3,941	10.7	6,381	11.4
	PA	512	1.6	715	2.1	859	2.4	1,389	3.8	2,314	4.1
	Physician	32,289	97.8	32,517	96.5	33,732	95.3	34,262	93.3	53,601	95.9
	Multiple prescriber types <sup>b</sup>	1,015	3.1	1,409	4.2	1,695	4.8	2,682	7.3	6,024	10.8
	<b>Total Patients<sup>c</sup></b>	<b>33,002</b>		<b>33,689</b>		<b>35,402</b>		<b>36,742</b>		<b>55,906</b>	
<b>65+</b>	Advanced Practitioner	18	6.0	21	7.6	28	9.7	44	13.1	71	10.7
	NP	12	4.0	15	5.4	23	8.0	34	10.1	51	7.7
	PA	<11	*	<11	*	<11	*	11	3.3	22	3.3
	Physician	287	95.7	265	95.3	268	93.1	305	90.8	623	94.3
	Multiple prescriber types <sup>b</sup>	<11	*	<11	*	<11	*	13	3.9	33	5.0
	<b>Total Patients<sup>c</sup></b>	<b>300</b>		<b>278</b>		<b>288</b>		<b>336</b>		<b>661</b>	

<sup>a</sup> The sum of quarterly numbers may not equal the totals over the full year because providers either do not prescribe in all quarters or prescribe in multiple quarters.

<sup>b</sup> Count of the number of patients who receive prescriptions from multiple prescriber types (e.g., a physician and an NP [not two MDs]) within the same period.

<sup>c</sup> Within each age group, Prescriber Type rows are not mutually exclusive. Totals may exceed 100% because patients may receive prescriptions from multiple prescriber types within the same period.

## **APPENDIX F. National Maps on Key Measures of Interest**

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Appendix F provides national maps to facilitate comparisons across states for key measures of interest.

IDV<sup>®</sup> patient-level data are anonymized. In addition, following best practices reflected in the CMS cell size suppression policy, counts between 1 and 10 are suppressed as <11 in all study tables.<sup>5</sup> We follow a similar data suppression policy for the maps. For states whose data are suppressed in the corresponding state data table in the Supplemental File, no figures are reported in the maps, with a note in the map indicating that there is “insufficient data” for them. Figures for Tennessee are suppressed in the maps as advanced practitioners in that state were not allowed to prescribe buprenorphine during the study period. Figures for Puerto Rico are not included in the maps.

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<sup>5</sup> RESDAC. 2017. “CMS Cell Size Suppression Policy.” <https://www.resdac.org/articles/cms-cell-size-suppression-policy>.

## Prescriber-level Maps

Exhibit F-1. Advanced Practitioner Proportion of Buprenorphine for OUD Prescribers, July 2017 – June 2018

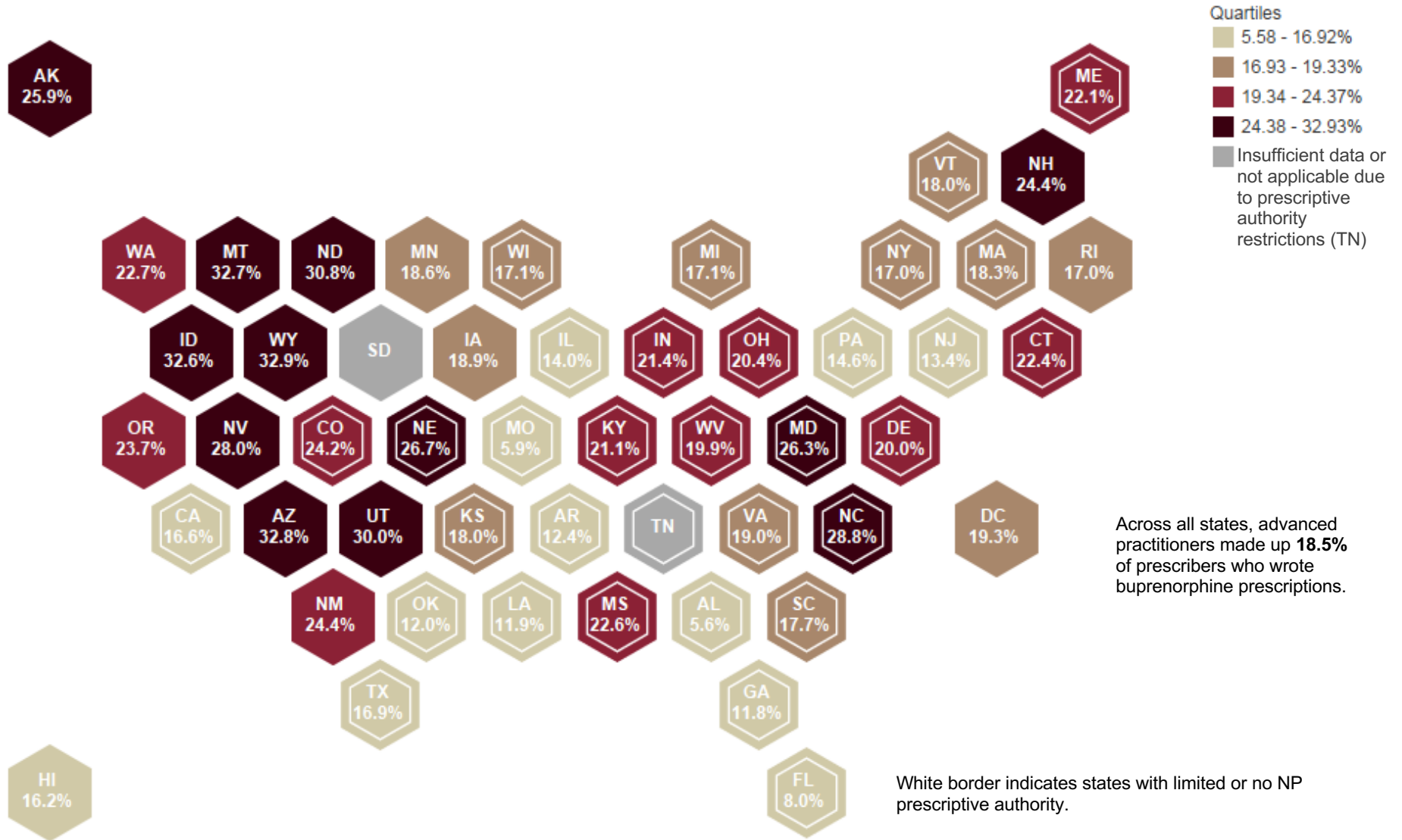


Exhibit F-2. Advanced Practitioner Proportion of Buprenorphine for OUD Prescribers (Payment Type Medicaid), July 2017 – June 2018

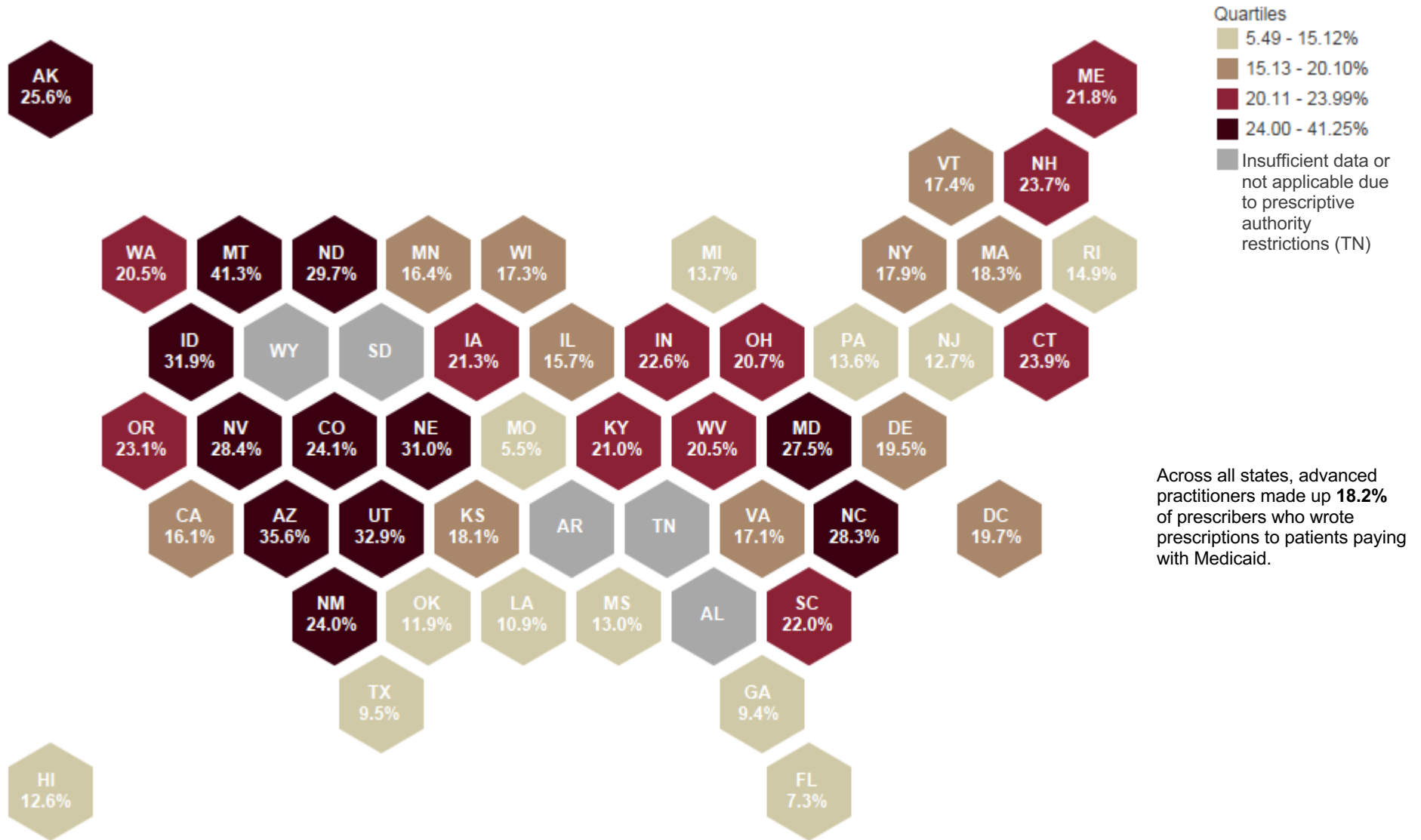
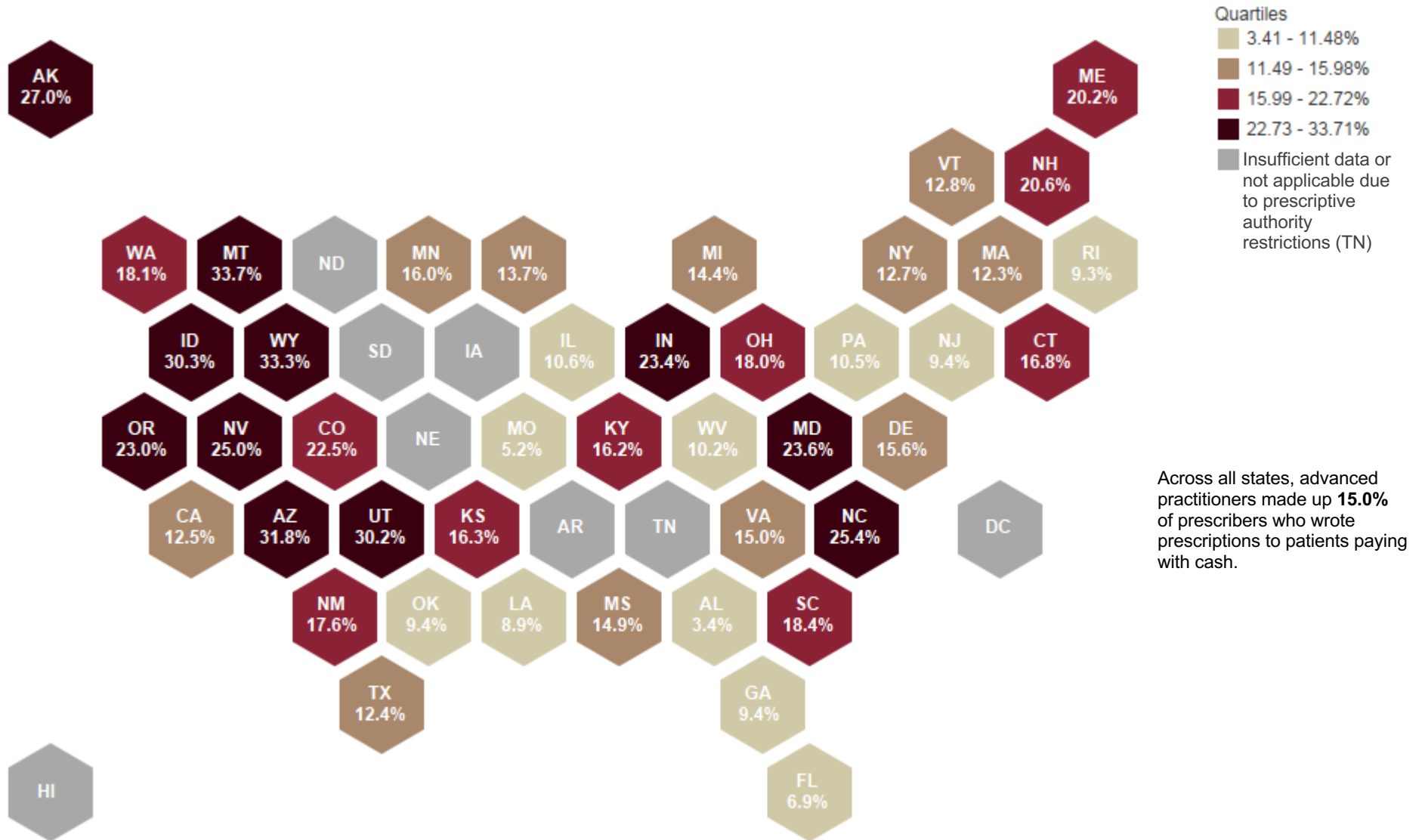


Exhibit F-3. Advanced Practitioner Proportion of Buprenorphine for OUD Prescribers (Payment Type Cash), July 2017 – June 2018





**Exhibit F-4. Advanced Practitioner Proportion of Buprenorphine for OUD Prescribers (Payment Type Commercial), July 2017 – June 2018**

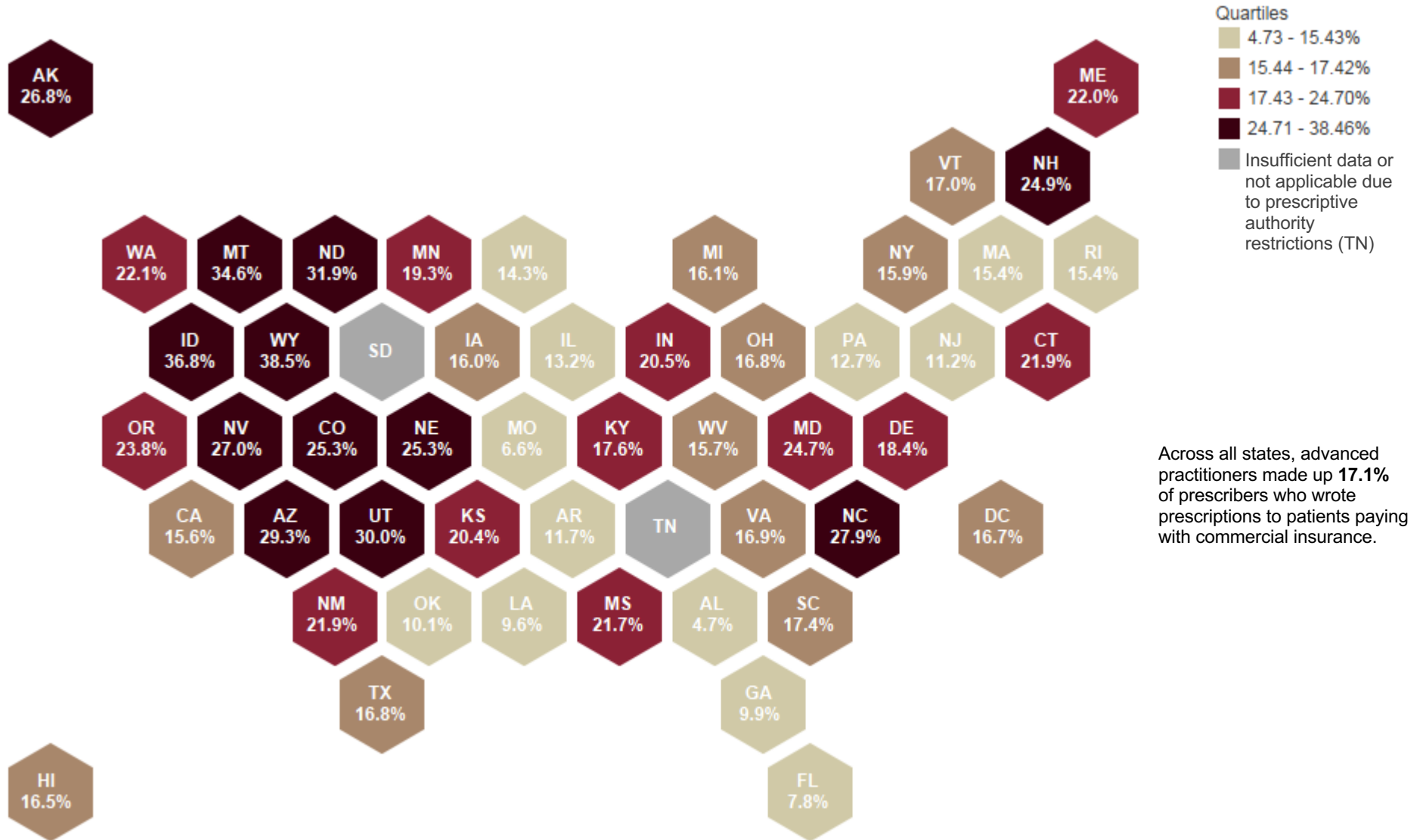


Exhibit F-5. Advanced Practitioner Proportion of Buprenorphine for OUD Prescribers (Payment Type Medicare), July 2017 – June 2018

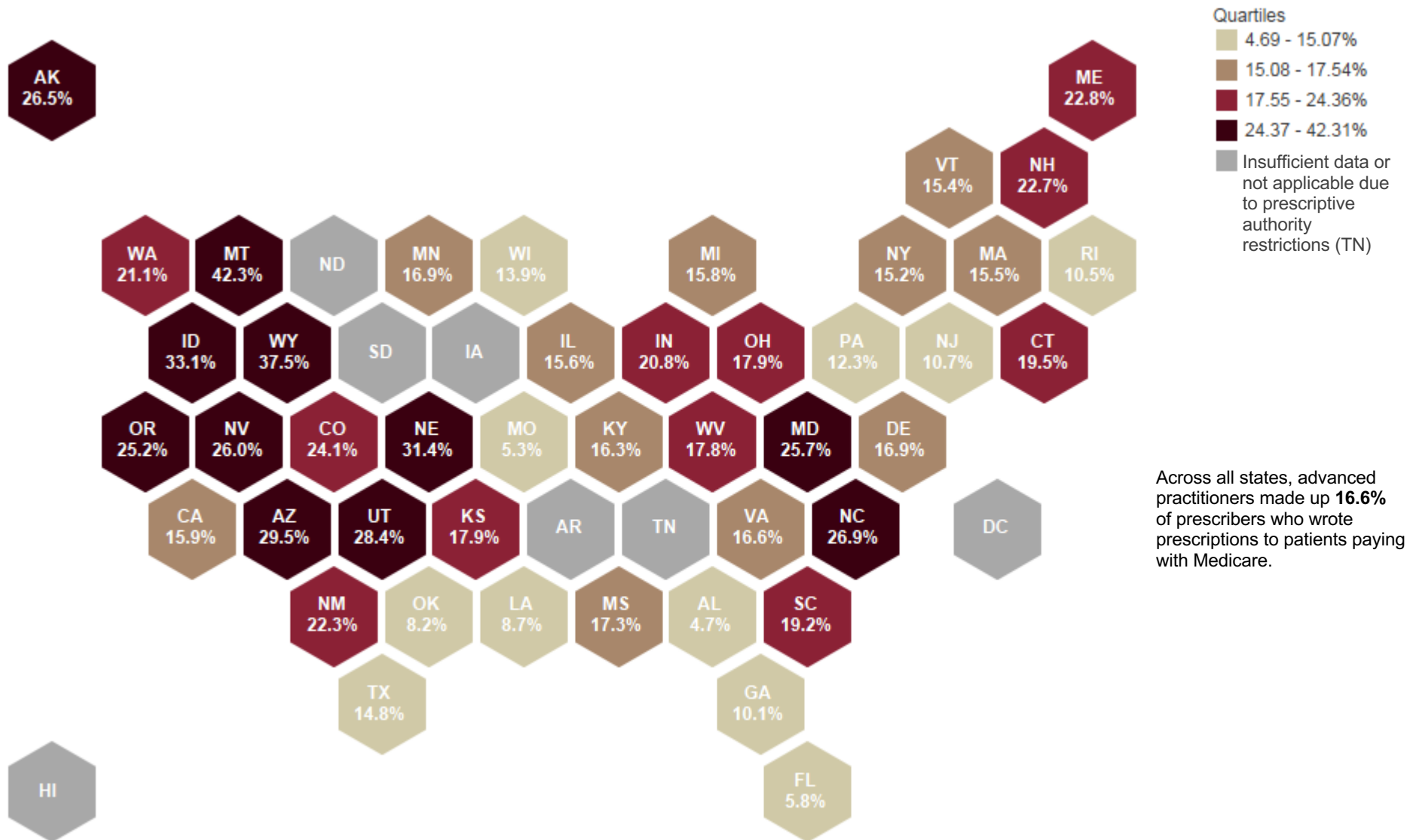


Exhibit F-6. Proportion of Advanced Practitioners' Patients with Buprenorphine for OUD Paid for by Medicaid, July 2017 - June 2018

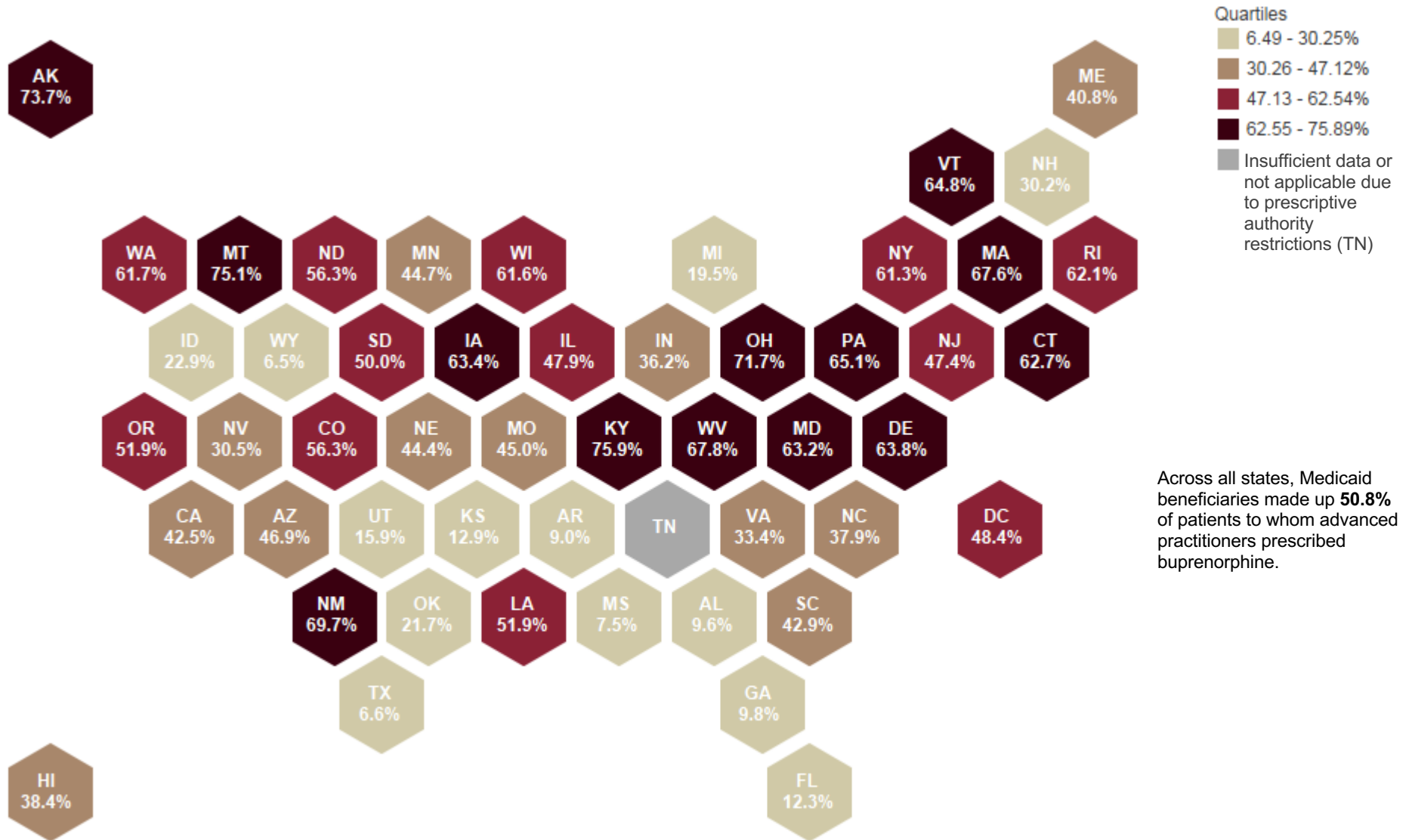


Exhibit F-7. Advanced Practitioner Proportion of Rural Buprenorphine for OUD Prescribers, July 2017 – June 2018

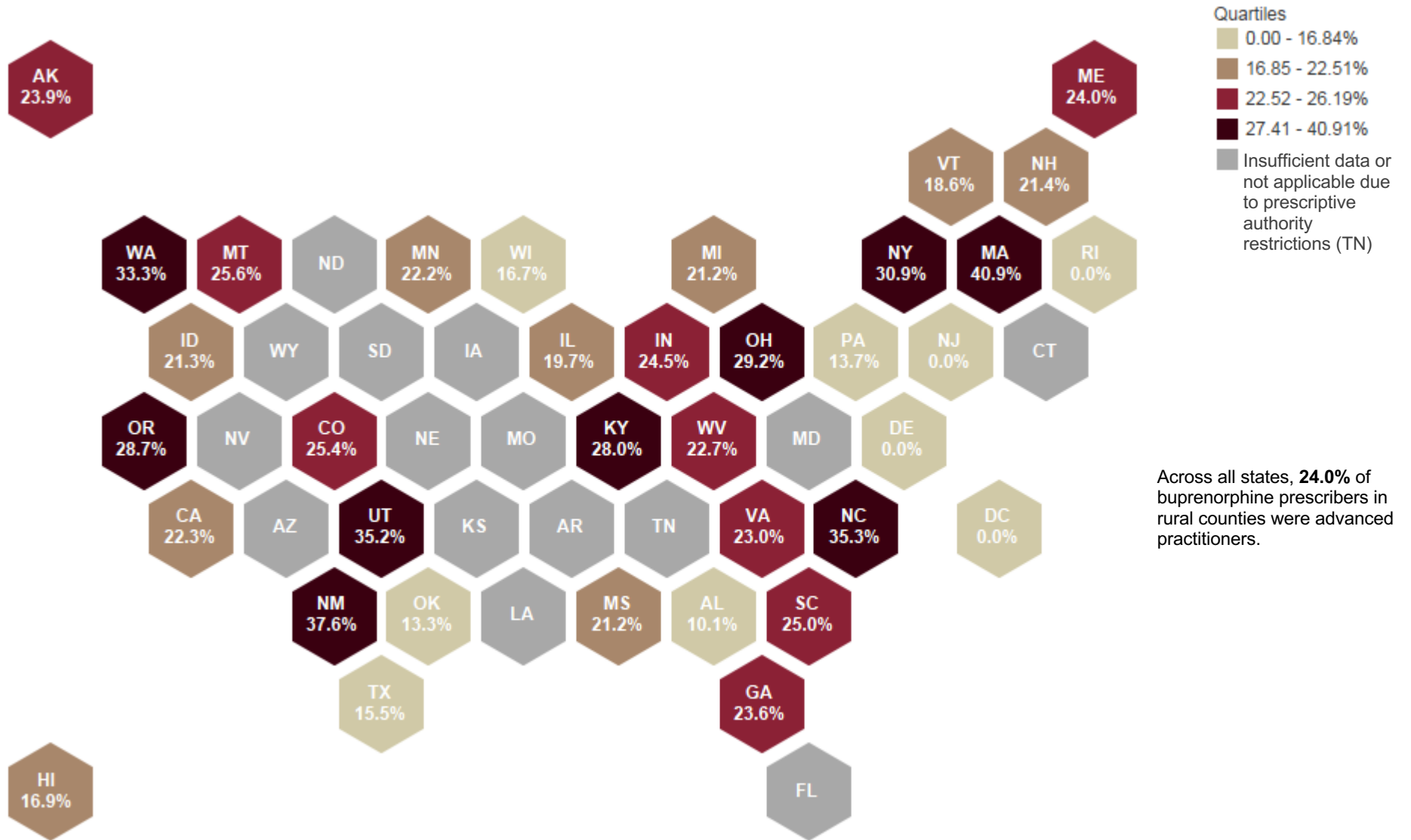
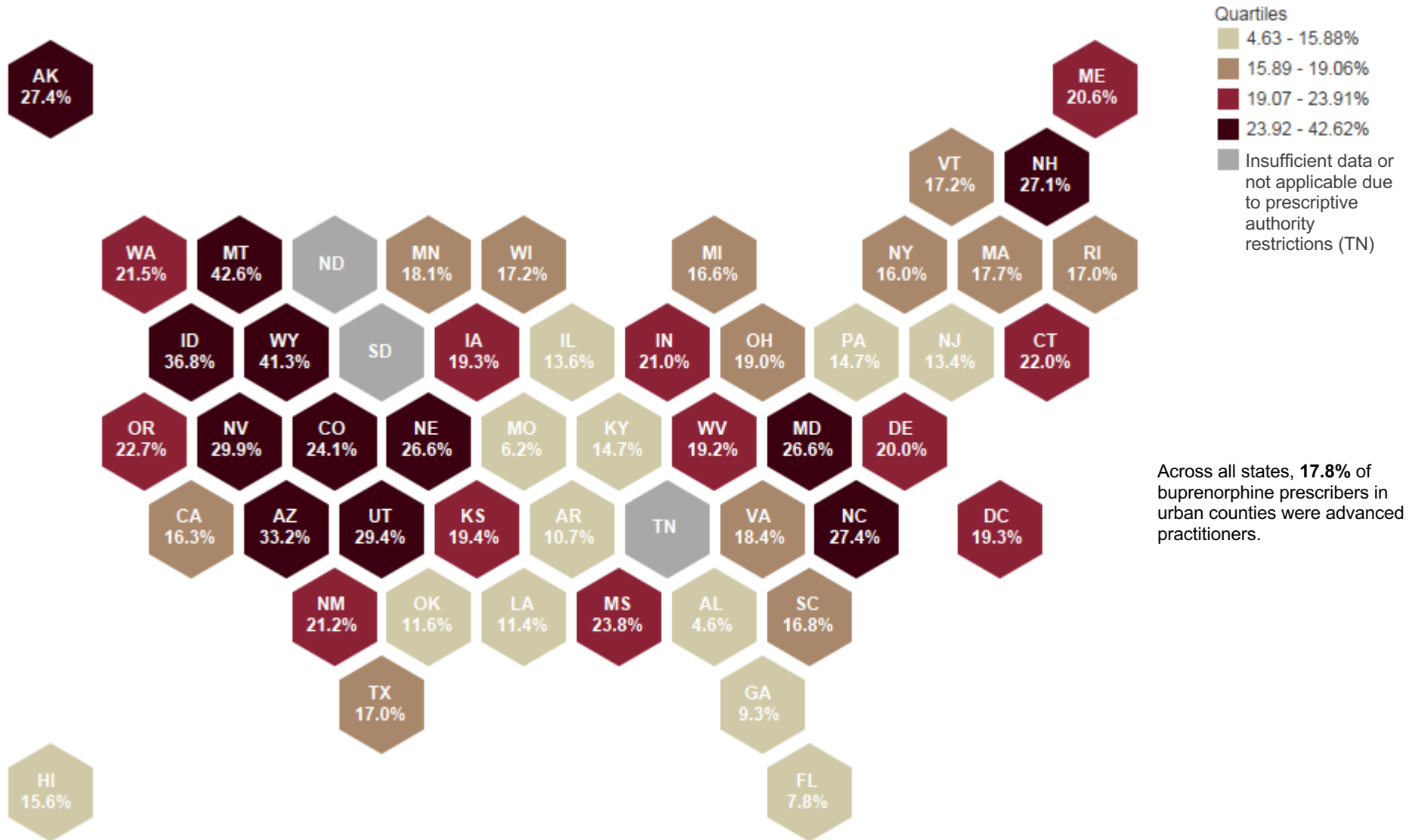
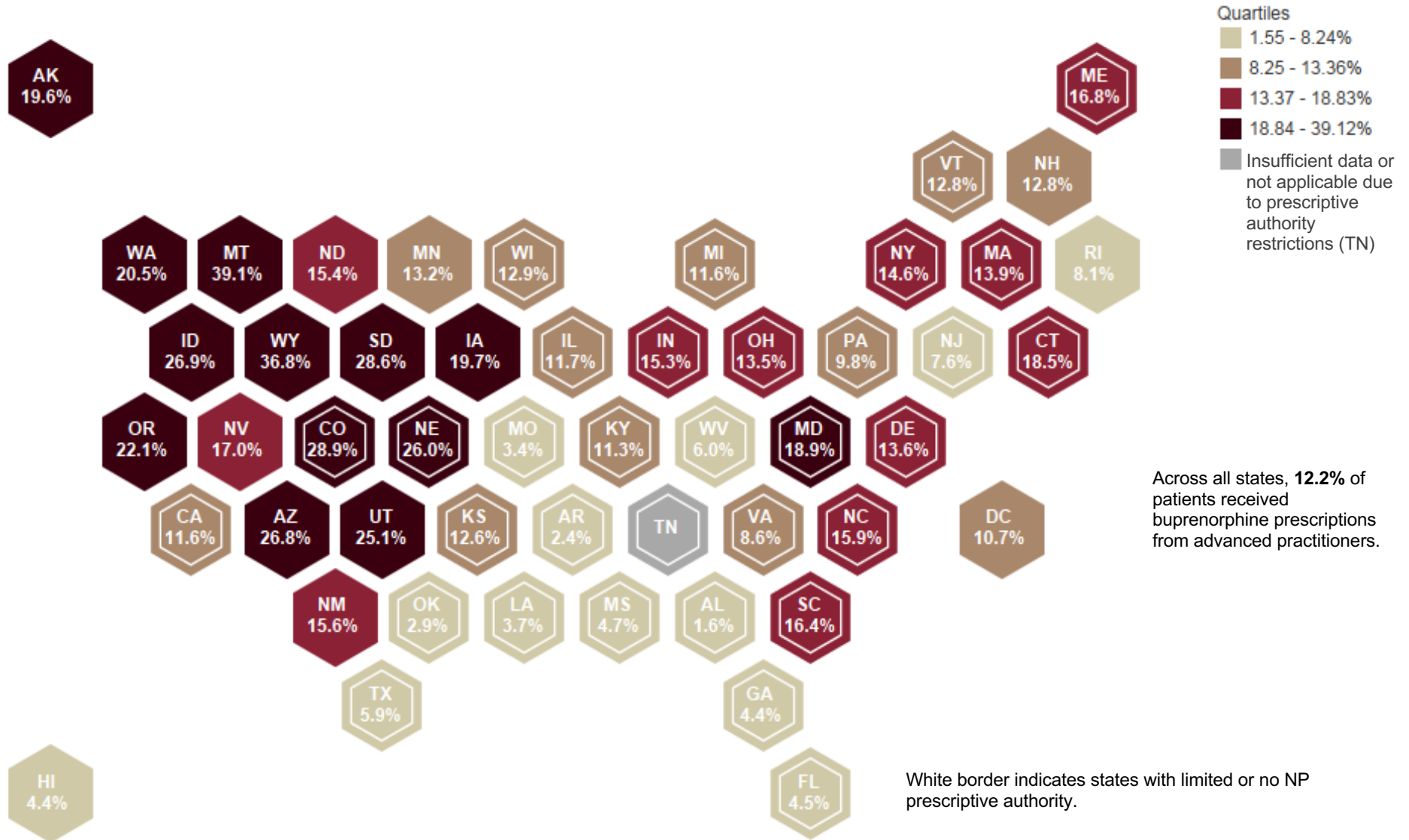


Exhibit F-8. Advanced Practitioner Proportion of Urban Buprenorphine for OUD Prescribers, July 2017 – June 2018

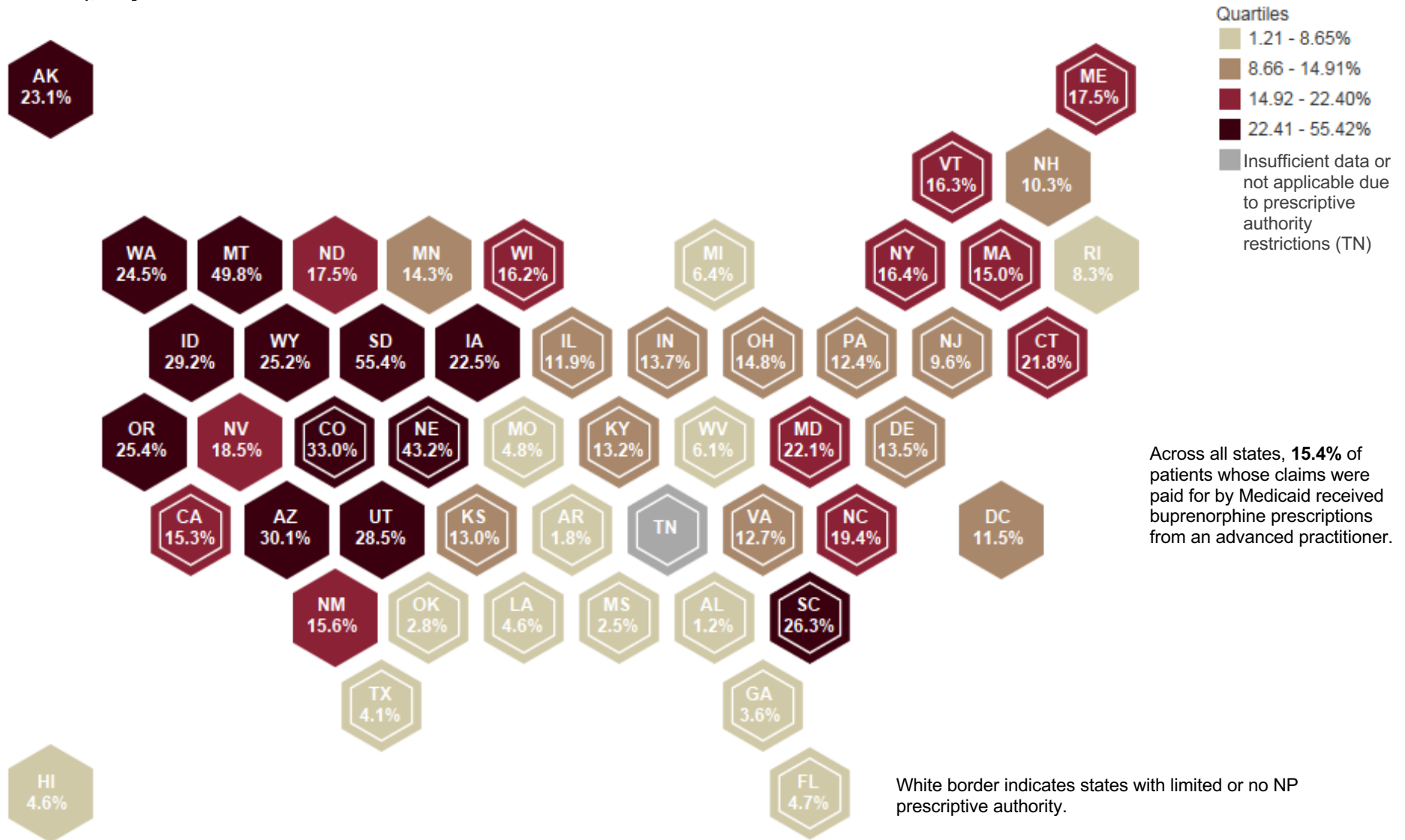


## Patient-level Maps

Exhibit F-9. Proportion of Patients Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners, July 2017 – June 2018

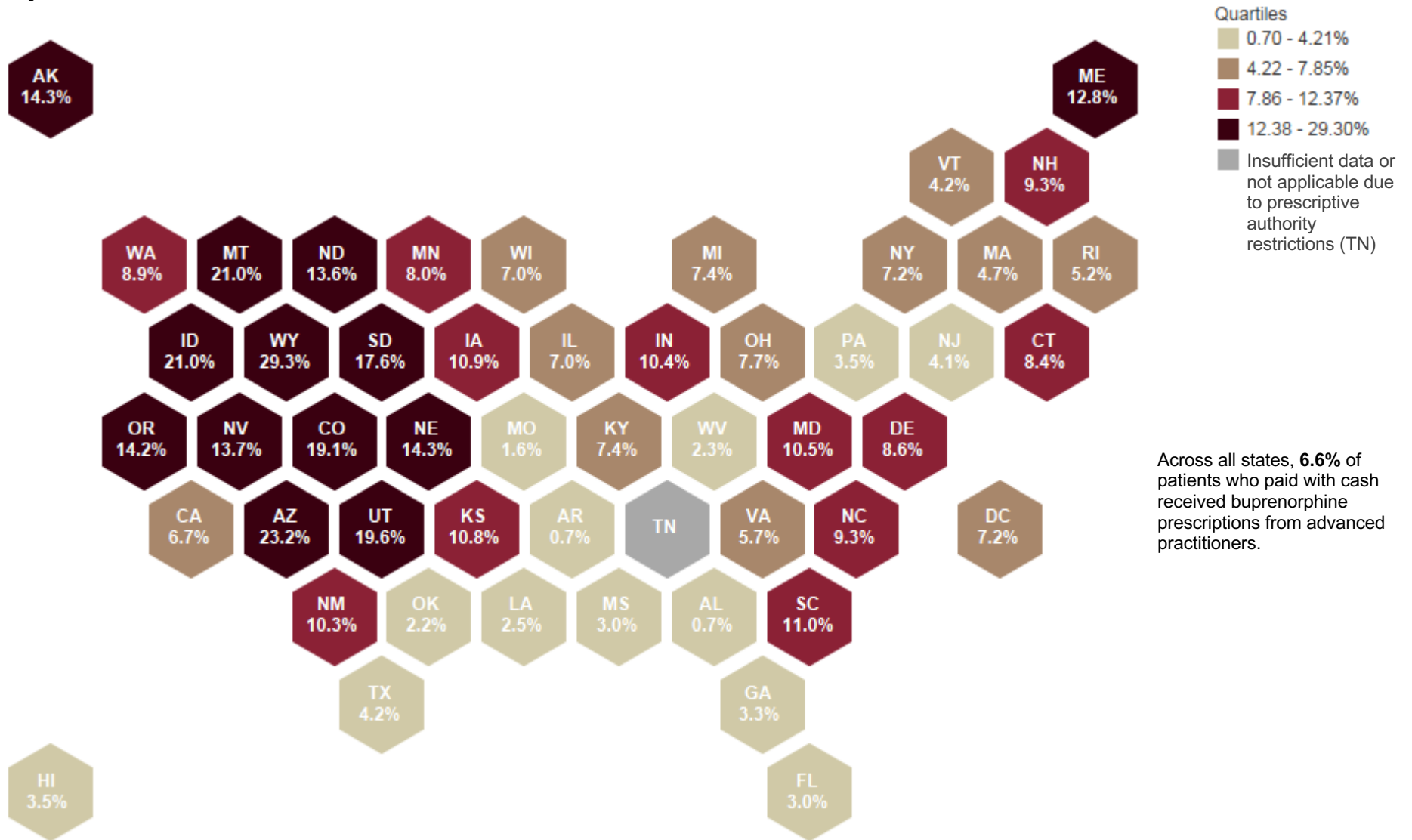


**Exhibit F-10. Proportion of Patients Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners (Payment Type Medicaid), July 2017 – June 2018**



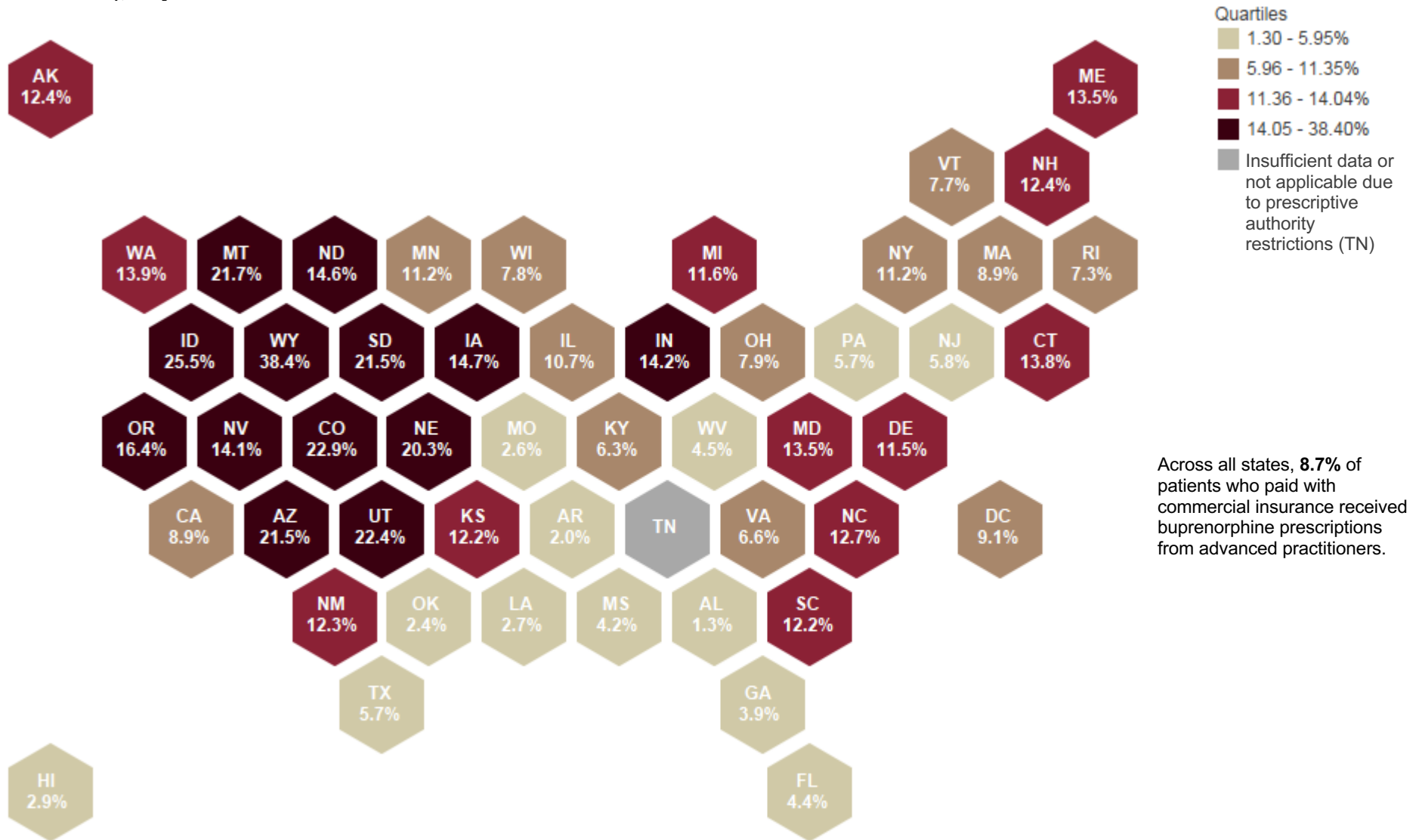


**Exhibit F-11. Proportion of Patients Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners (Payment Type Cash), July 2017 – June 2018**

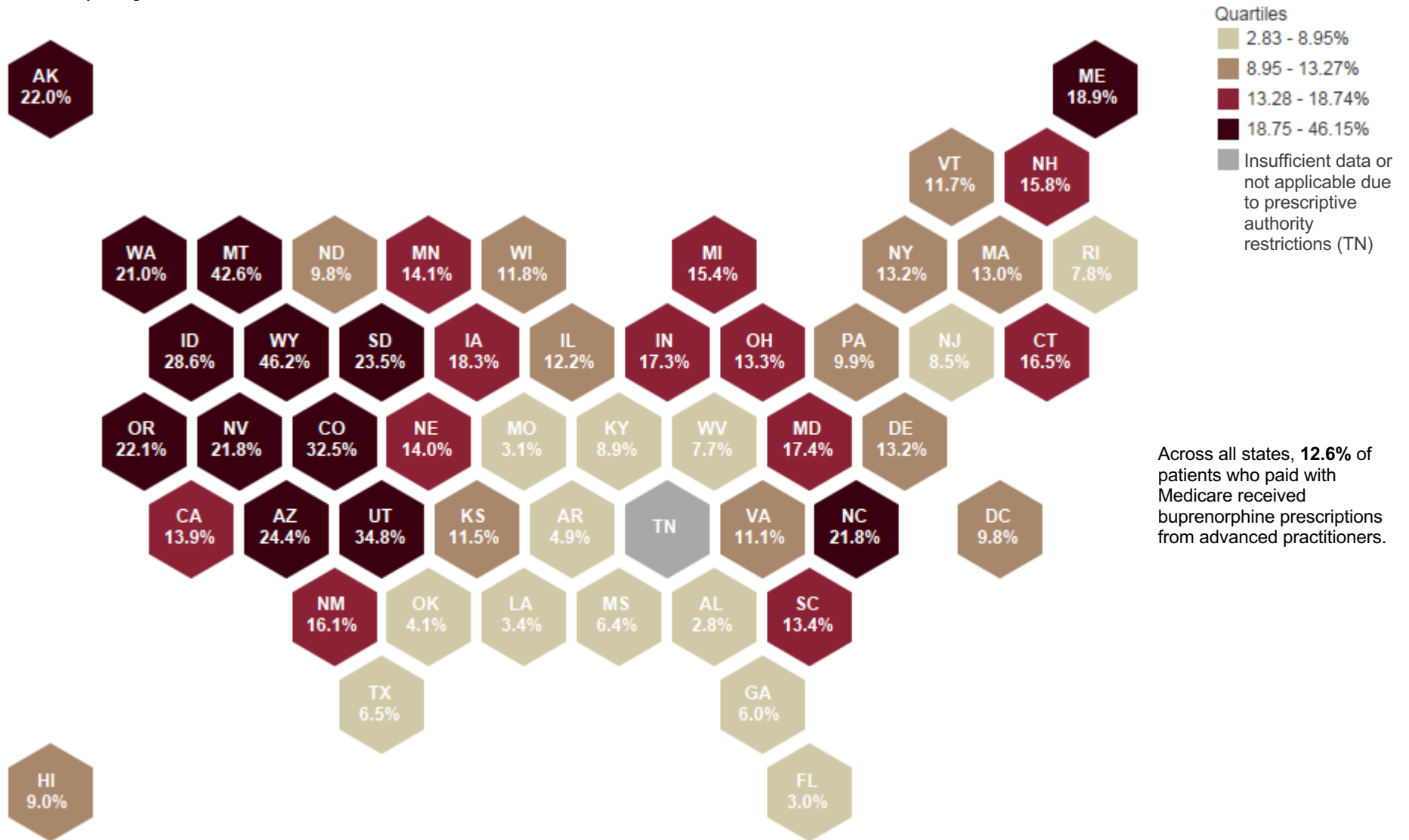




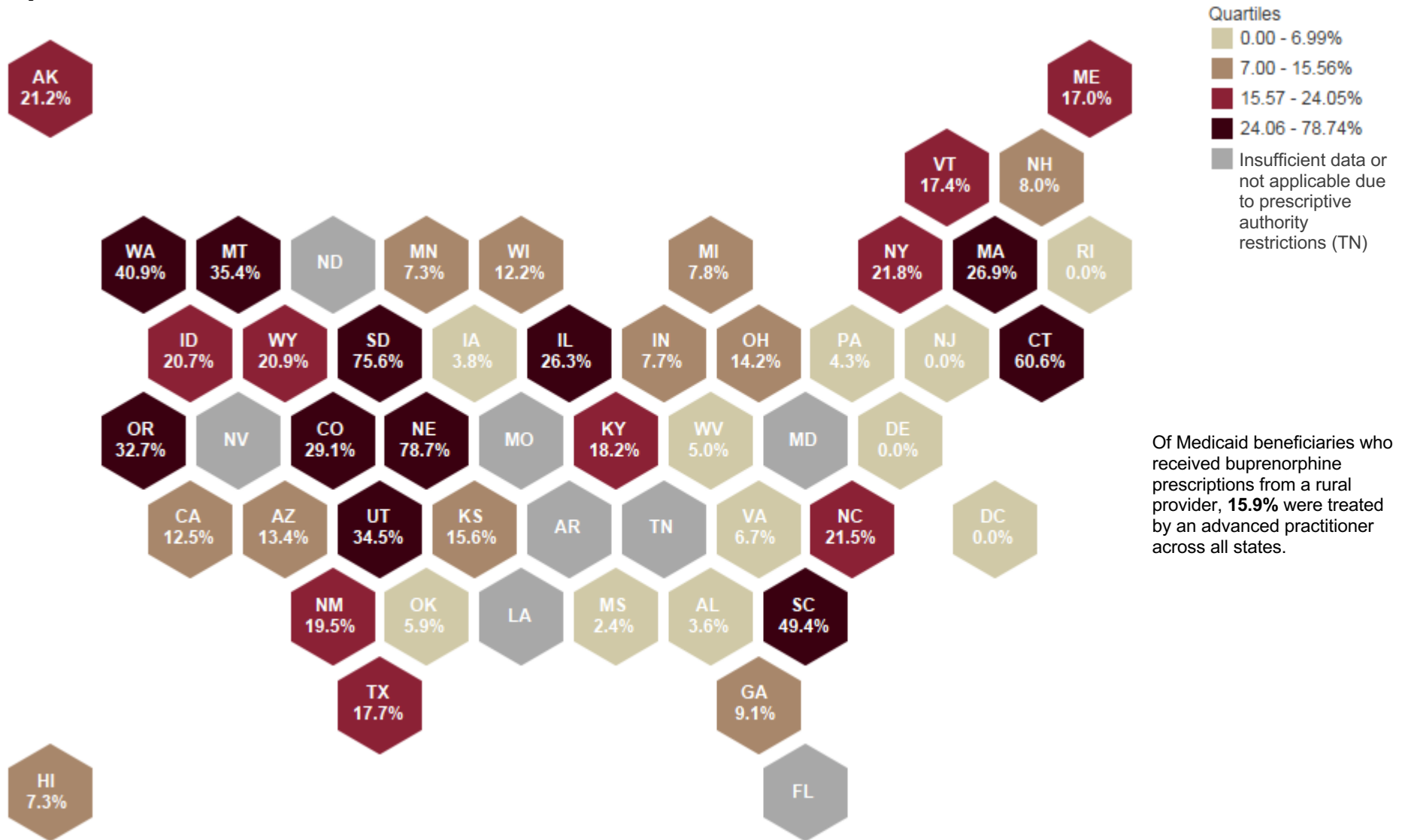
**Exhibit F-12. Proportion of Patients Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners (Payment Type Commercial), July 2017 – June 2018**



**Exhibit F-13. Proportion of Patients Receiving Buprenorphine Prescriptions for OUD from Advanced Practitioners (Payment Type Medicare), July 2017 – June 2018**



**Exhibit F-14. Proportion of Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD from Rural Advanced Practitioners, July 2017 – June 2018**



**Exhibit F-15. Proportion of Medicaid Beneficiaries Receiving Buprenorphine Prescriptions for OUD from Urban Advanced Practitioners, July 2017 – June 2018**

