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Continuity of Medication Management among Adults with Schizophrenia and Comorbid Cardiometabolic Conditions

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Abstract

Objectives—Adults with schizophrenia and cardiometabolic conditions may be good candidates for co-management by primary care prescribers and specialists. Associated risks for discontinuity in medication management have not been well-studied. This study examines whether medication adherence, inpatient admissions, and emergency department (ED) visits vary by the number and types of prescribers seen by adults with schizophrenia and cardiometabolic conditions.

Methods—This study used a retrospective cohort of 4,223 adult Medicaid enrollees with schizophrenia and hypertension, hyperlipidemia, and/or diabetes from three states in 2009–2010.

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Author Contributions and Disclosures

1. All authors meet the criteria for authorship outlined by the Uniform Requirements for Manuscripts Submitted to Biomedical Journals.
2. IRB approval for this study was obtained from the authors' respective institutions.
3. In the past 3 years, an author has provided expert testimony for Boehringer Ingelheim and Daiichi Sankyo on unrelated matters. An author owns stock in Amgen through his spouse's employment. An author is currently a Worldwide Health Economics and Outcomes Research Pre-doctoral Fellow at Bristol-Myers Squibb. Previously, she provided advisory services to public and private sector clients while employed at Avalere Health, an Inovalon Company as well as completed an internship at Genentech, a member of the Roche Group in the past three years.
4. No other authors have financial or non-financial conflicts of interest to disclose.

Logistic regression models were run on outcome variables reflecting medication adherence, ED utilization, and inpatient admissions as a function of the number and types of prescribers.

Key findings—Increases in number of psychiatric specialists were associated with better antipsychotic adherence, but decreasing statin adherence. Increases in number of psychiatric specialists were also associated with a higher probability of inpatient admission and ED visits, while increases in number of primary care prescribers were associated with increases in the probability of ED visits.

Conclusion—Greater antipsychotic adherence for adults receiving prescriptions from multiple psychiatric specialists was counteracted by lower statin adherence and greater risk of ED and inpatient utilization. This may help inform optimal care models for these complex individuals.

Keywords

Care coordination; schizophrenia; chronic conditions; health services outcome

Introduction

Schizophrenia is a serious condition that cost the U.S. approximately \$38 billion in direct healthcare costs in 2013 alone.¹ The mental health symptoms of schizophrenia are a treatment priority for prescribers managing individuals with this condition. In addition, comorbid physical conditions, including cardiometabolic conditions (CMCs) like diabetes, hypertension, and hyperlipidemia present a significant burden to individuals with schizophrenia and are often under-looked as a treatment priority.^{2–6}

A likely contributor to the under-treatment of CMCs in individuals with serious mental illness is a lack of care coordination.^{3,7} Adults with multiple chronic conditions (MCCs) see an array of different prescribers over the course of many outpatient visits in a given year.^{8,9} The potential for involvement by multiple prescribers increases even further for patients with serious mental illness (e.g., schizophrenia)¹⁰ because they often require referral and treatment by psychiatric specialists.³ While specialty involvement may improve the care of individuals with MCCs,¹¹ it also introduces opportunities for confusion over the respective roles of prescribers in the management of individual conditions.^{3,7} Adults with multiple discordant chronic conditions (such as CMCs and schizophrenia) may be especially vulnerable to poorly coordinated care compared to other adults with multiple concordant chronic conditions. Indeed, adults with multiple discordant chronic conditions are more likely to report negative care coordination experiences compared to adults with multiple concordant chronic conditions.¹²

One recent definition of continuity of care looks at consistency in prescribing by a single prescriber over time.¹³ Continuity of prescribing is an important concept in individuals with schizophrenia, as prescription antipsychotics serve as a first-line treatment. Similarly, comorbid CMCs common in these individuals are primarily managed with medications. Introducing more than one prescriber into the care management of these complex individuals may impact medication adherence and health service utilization.

Given the medication needs among individuals with schizophrenia and comorbid CMCs, as well as the need for specialty involvement, we examined patterns of prescribing across primary care prescribers, psychiatric specialist prescribers, and combinations of these prescriber types. We also examined the relationship of continuity of prescribing with health service utilization (inpatient and emergency department (ED) visits) and medication outcomes (adherence) in a population of individuals with schizophrenia and one or more CMCs (hypertension, hyperlipidemia, and/or diabetes). Understanding whether medication and service use outcomes differ by the number and types of prescribers may help shape care models to improve management of these individuals with multiple discordant conditions.

Methods

Study Design and Data

We used a retrospective cohort study design to examine medication and service use outcomes associated with different numbers and types of prescribing providers for Medicaid adults with schizophrenia and hypertension, diabetes, and/or hyperlipidemia. We used Medicaid Analytical Extract (MAX) data files from three states (NC, CO, and KY) with low rates of missing provider information.¹⁴ We measured the number and type of prescribers involved in providing medications in 2009 and examined the association with medication and service use outcomes in 2010. The lag in outcome measurement allows time for the effects of prescriber (dis)continuity to materialize.

Inclusion/Exclusion Criteria

The Medicaid data from these 3 states contained an initial sample of 7,771 adults ages 18–64 years with schizophrenia and one or more CMCs (hypertension, hyperlipidemia, and/or diabetes) as identified through ICD-9-CM codes (see Table 1, Appendix 1, for ICD-9 codes). Medicaid enrollees were retained if they had one or more antipsychotic medication fills for schizophrenia and had one or more fills for a medication to treat one of the 3 CMCs in 2009 (see Table 2, Appendix 1, for medication classes).

To ensure full data capture of Medicaid-funded services, adults were included if they were continuously enrolled in Medicaid throughout the entire 24-month period of observation and were not dually enrolled in Medicare, private insurance, or managed care. The final sample included 4,223 continuously enrolled fee-for-service Medicaid adults with schizophrenia and one or more CMCs receiving medications from one or more primary care prescribers (PCPs) or psychiatric specialist prescribers in 2009 (Figure 1).

Prescriber Variable Definition

We used prescription claims data to determine the number and types of prescribers providing prescriptions for antipsychotics and medication classes associated with the three CMCs of interest. Prescriber types of interest included PCPs, who were thought to be best positioned to manage chronic care, and psychiatric specialist prescribers. Cardiometabolic specialists and all other prescriber types were controlled for as covariates. Prescriber type was identified using National Provider Identifier (NPI) taxonomy codes. The number of prescribers of each type was calculated via number of unique NPIs observed in the

prescription claims for each study participant. The majority (68.6%) of prescriptions for medications managing the conditions of interest contained prescriber identifiers in the prescription claim. For the remaining prescription claims, we identified the prescriber of record by matching to the most recent outpatient prescriber encounter preceding the prescription claim. Ultimately, 9.3% of prescriptions (0.6% of all prescription claims) were unable to be matched to a prescriber within 30 days of a prescription and were excluded.

The most common PCPs identified through this process were family medicine physicians (45.7%), internal medicine physicians (27.9%), and family medicine/internal medicine nurse practitioners (7.2%). The most common psychiatric specialist prescribers were psychiatrists (86.9%), generically coded psychiatric/mental health specialists (4.2%), and child & adolescent psychiatrists (3.9%). We examined both the number and type of prescribers involved in prescribing medications to this cohort.

Outcome Variables

Outcome measures included medication adherence, all-cause inpatient hospital admission, and number of all-cause ED visits. Variables were measured in 2010, the subsequent year from our prescriber number and type measures, in order to reduce simultaneity bias. We chose to look at all-cause utilization rather than condition-specific utilization in order to capture the full scope of services needed to manage these discordant conditions. Medication adherence was constructed using proportion of days covered (PDC) for each of the 4 medication classes (antihypertensives, statins, oral antidiabetics, and antipsychotics), which measures the proportion of days on any treatment for each condition over the 1-year period (2010) starting with the first medication fill.¹⁵ Given the chronic nature of each condition, we treated discontinuations in treatment as periods of non-adherence in our PDC measurement. Refill adherence was dichotomized for statistical analysis at the conventional threshold of 80%.¹⁶

Covariates

We captured enrollee characteristics, including age in years, sex, race (white, black, and other/missing), and state of residence. We also constructed several Medicaid enrollment variables that might otherwise confound the prescriber-outcome association, including enrollment in a behavioral health managed care plan, receipt of primary care case management in the Medicaid program, and blind/disabled status in Medicaid, which indicates a more severely ill population. We controlled for the three CMCs of interest and indicators for each additional comorbid mental health condition (depression, anxiety, attention deficit hyperactivity disorder (ADHD), and substance abuse), as well as the enrollee's mean Chronic Illness and Disability Payment System (CDPS) score, which served as an indicator of additional comorbidity and disease severity^{17,18} Finally, prescribing by cardiometabolic specialists and prescribing by all other prescribers were also controlled for in our models.

Analysis

We first examined differences in unadjusted analyses of Medicaid enrollee characteristics between 3 mutually exclusive prescriber subgroups (enrollees receiving antipsychotic and

CMC prescriptions from only PCPs, only psychiatric specialist prescribers, or both types of prescribers) using t-tests for continuous variables and chi-square tests for binary and categorical variables. Next, we used logistic regression to model all outcomes.

Each regression model estimated outcomes (medication adherence for antipsychotics, oral antidiabetics, antihyperlipidemics, and antihypertensives; all-cause inpatient admissions; and all-cause ED visits) as a function of the number of PCPs (0, 1, 2, or 3+) and the number of psychiatric specialist prescribers (0, 1, 2 or 3+), controlling for all covariates described in the preceding section. We set having one of each prescriber type as the referent category to facilitate hypothesis testing. To explore whether outcomes differed by number of PCPs for any number of psychiatric specialist prescribers, we also examined interactions between the PCP and psychiatric prescriber variables. Using the likelihood ratio test, we saw no improvement in model fit from inclusion of interaction terms in any of the models, so we present results from un-interacted models (see Tables 3 and 4, Appendix 1, for full model results).¹⁹ All model results are presented as average marginal effects to show the change in the probability of each outcome across levels of prescriber number in comparison to having either a single PCP or single psychiatric specialist prescriber. Data analysis was conducted using STATA release 14 (StataCorp LP, College Station, TX). This study was approved by the institutional review boards of the authors' respective institutions.

Results

Patient Characteristics

Among the full cohort of 4,223 Medicaid enrollees with schizophrenia and one or more CMCs, most were female (60.2%), white (46.7%) or black race (43.0%), and a mean age of 48.6 years (Table 1). Comorbid diabetes, hypertension, and hyperlipidemia were diagnosed in 51.7%, 77.4%, and 51.5% of the cohort, respectively. Of note, 19.4% of the cohort was diagnosed with all three CMCs. A substantial number (n=1247, 29.5%) of enrollees received all of their prescriptions from a PCP, few (n=170, 4.0%) received prescriptions only from psychiatric specialist prescribers, and most (n=2806, 66.4%) received prescriptions from both a PCP and psychiatric specialist prescriber at some point during the baseline period.

In bivariate analyses, we found that compared to enrollees with prescriptions filled only by a PCP, those with prescriptions from only a psychiatric specialist prescriber or from a psychiatric specialist prescriber and PCP were less likely to be white (55% versus 34% and 44%, respectively) and more likely to have primary care case management (46% versus 78% and 73%, respectively) (Table 1). Compared to enrollees with prescribing only by a PCP and enrollees with prescribing by both a PCP and psychiatric specialist prescriber, enrollees with prescribing by only a psychiatric specialist prescriber were different with regard to several characteristics: having all three CMCs of interest (20% and 20% versus 11%, respectively), having substance abuse disorder (16% and 15% versus 8%, respectively), mean CDPS score (2.10 and 2.03 versus 1.64, respectively), and mean number of therapeutic classes of medication used (10.6 and 10.8 versus 7.1, respectively).

Variation in Medication Refill Adherence by Prescribers

In unadjusted analyses, enrollees had similar refill adherence for antipsychotics and CMC medications regardless of the number of PCPs prescribing medications (Figure 2). Within each category of PCP use, having more psychiatric specialist prescribers was associated with higher unadjusted antipsychotic adherence. For example, in enrollees receiving prescriptions from 3 or more PCPs, unadjusted antipsychotic adherence increases from 65.6% to 74.3% for enrollees receiving prescriptions from one versus 3 or more psychiatric specialist prescribers. Having more psychiatric specialist prescribers was associated with lower unadjusted cardiometabolic medication adherence. In enrollees receiving prescriptions from 3 or more PCPs, unadjusted statin adherence drops from 49.4% to 38.7% when enrollees receive prescriptions from 1 versus 3 or more psychiatric specialist prescribers. This association was also observed in other cardiometabolic medication categories.

The unadjusted patterns we observed appear to persist in multivariate analyses. There was no statistically significant difference in antipsychotic adherence for enrollees receiving prescriptions from 0, 2, or 3+ PCPs compared to a single PCP (Table 2). On the other hand, adherence to antipsychotic medications was 5.0% points (95% CI -8.8% to -1.3%) lower for enrollees receiving prescriptions from no psychiatric specialist prescribers when compared to those receiving prescriptions from a single psychiatric specialist prescriber. Similarly, enrollees receiving prescriptions from multiple psychiatric specialist prescribers had statistically significantly higher antipsychotic adherence compared to those receiving prescriptions from a single psychiatric specialist prescriber (2 psychiatric specialists: 4.1% points, 95% CI 0.4% to 7.9%; 3+ psychiatric specialists: 11.4% points, 95% CI 7.1% to 15.7%).

In multivariate adherence analyses, the association between the number of psychiatric specialist prescribers and adherence to cardiometabolic medications only reached significance for enrollees using statin medications. Compared to enrollees receiving prescriptions from one psychiatric specialist prescriber, enrollees with 2 psychiatric specialist prescribers had a 6.5% point (95% CI -11.4% to -1.6%) lower statin adherence and enrollees with 3 or more psychiatric specialist prescribers had a 7.6% point (95% CI -13.7% to -1.4%) lower statin adherence (see Table 5, Appendix 1, for full model results).

Variation in All-cause Inpatient Admission and ED Visits by Prescribers

There was no association between number of PCPs and probability of all-cause inpatient admission (Table 3), while enrollees receiving prescriptions from 3+ psychiatric specialist prescribers were 9.8% points (95% CI 5.3% to 14.2%) more likely to have an inpatient admission than enrollees receiving prescriptions from a single psychiatric specialist prescriber. ED visits were significantly more likely in enrollees receiving prescriptions from 3+ PCPs (4.2% points, 95% CI 0.5% to 7.9%) or 3+ psychiatric specialist prescribers (7.3% points, 95% CI 2.4% to 12.1%) than from a single prescriber of each type. Additionally, enrollees receiving prescriptions from no psychiatric specialist prescribers were 5.8% points (95% CI -9.5% to -2.2%) less likely to visit the ED compared to those receiving prescriptions from a single psychiatric specialist prescriber (see Table 6, Appendix 1, for full set of results).

Discussion

This is the first study examining the association of prescriber continuity with health outcomes in Medicaid enrollees with multiple discordant conditions (severe mental illness and comorbid CMCs). We found that receiving prescriptions from multiple psychiatric specialist prescribers was associated with higher antipsychotic adherence, lower statin adherence, and greater risk of ED and inpatient utilization.

Receiving prescriptions from more psychiatric specialist prescribers was associated with better refill adherence to antipsychotic medications, consistent with prior work showing that persons with schizophrenia are more likely to be fully-adherent to antipsychotic medications as the number of antipsychotic prescribers increases.²⁰ There may be multiple possible explanations for this observed relationship. It is possible that individuals with medications prescribed by multiple psychiatric specialists are receiving better or more tightly monitored antipsychotic management. In addition, receiving prescriptions from multiple psychiatric specialist prescribers may be an indicator for more severe illness which requires more careful attention and more involvement from specialists, which in turn leads to greater antipsychotic adherence. Our study cannot differentiate whether one or both of these factors are involved, but we believe that study design decisions such as lagging the outcome model and controlling for measureable comorbidity and disease severity indicators minimized impact of confounders on the results.

The association between receiving prescriptions from more psychiatric specialist prescribers and better antipsychotic adherence did not correspond with parallel improvements in cardiometabolic medication adherence. In fact, receiving prescriptions from more psychiatric specialist prescribers was associated with lower statin adherence, suggesting a tradeoff in adherence between medications of primary responsibility for these psychiatric specialist prescribers and medications usually managed by PCPs. This finding is interesting in the context of prior research showing that as antipsychotic adherence increases, adherence to cardiometabolic medications also increases.²¹ Following the hypothesis that having more psychiatric specialist prescribers may be indicative of greater attention to the mental health needs of Medicaid enrollees and greater antipsychotic adherence, it may also be possible that this attention comes at the expense of attention being paid to cardiometabolic medications. However, as noted above, a greater number of psychiatric specialist prescribers may indicate greater severity of schizophrenia, which may be a risk factor for reduced statin adherence.

We also observed a higher probability of having an ED visit when 3+ PCPs or 3+ psychiatric specialists were prescribing medications and a higher probability of inpatient admissions with 3+ psychiatric specialist prescribers. These results are consistent with a prior study of veterans with concordant conditions²² and prior work with Delaware Medicaid patients in the 1990s.^{23,24} It is unclear if these results are driven by unobserved severity of schizophrenia, fragmentation in care from having multiple prescribers, or both. These results may also highlight additional tools that can be used to improve care coordination, including use of pharmacist case managers or the medical home model, which has shown success in improving care in persons with severe mental illness.^{25–28} For example, having adults with

multiple discordant chronic conditions (such as CMCs and schizophrenia) who receive prescriptions from multiple providers designate a pharmacist case manager or establishing a PCP-based medical home may be associated with reductions in the potential for drug interactions, duplicate drug therapies or laboratory tests, and provider role confusion (although not explicitly modeled in this study) that may occur when multiple, uncoordinated prescribers are involved in care.

The finding that there is no difference in medication adherence or inpatient admissions by number of PCPs among enrollees with schizophrenia and comorbid CMCs is surprising considering findings from other studies examining prescriber continuity. In a prior study assessing medication adherence to oral antidiabetics, antihypertensives, and antidyslipidemics in a sample of 7,933 Veterans Administration (VA) patients with multiple concordant chronic conditions, receiving prescriptions from 4+ prescribers was associated with a significant decrease in the odds of medication adherence to antihypertensive medications, and receiving prescriptions from 3 or more prescribers also decreased odds of adherence to medications for dyslipidemia.²⁹ The population examined in these VA studies was limited to adults with multiple cardiometabolic conditions (without schizophrenia), who may not be as prone to use specialists compared to the current study's population with schizophrenia. The insignificant association between number of PCPs and medication adherence and inpatient admissions in our current study may suggest that adults with multiple discordant chronic conditions may require a different prescriber mix for care coordination compared to adults with multiple concordant conditions. Future studies should investigate the optimal number and specialty of prescribers involved in the care of adults with different types of discordant conditions, including both somatic and mental chronic conditions.

There are limitations to acknowledge. Generalizability of the current study is increased by inclusion of 3 diverse states; however, experiences of these Medicaid enrollees may not generalize to Medicaid enrollees in other states or non-Medicaid populations. The included states are also diverse in their populations and Medicaid program administration, which could influence our results. Additionally, refill adherence measured by PDC may not equate to medication consumption. Future research may use additional adherence measures to confirm results of the current study. Further, counting the number and types of prescribers may not necessarily account for appropriate hand-offs and informal coordination between prescribers. The interplay of additional factors, such as the interface of cardiometabolic specialist prescribers, other provider specialties, technological improvements in care coordination like common electronic health records, and severity of conditions on the number and type of prescribers needed for optimal care coordination for adults with discordant chronic conditions should be further investigated.

Conclusion

Among Medicaid enrollees with schizophrenia and one or more comorbid CMCs, the mix of PCPs prescribing medications appears to be less important than the number of psychiatric specialist prescribers in understanding the relationship between provider number and type and medication adherence, ED visits, and inpatient admissions. Having multiple psychiatric

specialist prescribers involved in care was related to better antipsychotic adherence, but also related to poorer cardiometabolic medication adherence and an increased risk of ED visits and inpatient admissions. This finding can help inform optimal care models and coordination strategies between psychiatric specialists and other provider types.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1. Consort Diagram for Medicaid Adults enrolled 2009–2010

¹ Criteria applied only in 2009 data

² 1 IP or 2 OP claims with a schizophrenia ICD-9-CM code listed in Table 1, Appendix 1

³ 1 IP or 2 OP claims with a cardiometabolic condition ICD-9-CM code listed in Table 1, Appendix 1

⁴ Prescription drugs for schizophrenia included in Table 2, Appendix 1

⁵ Prescription drugs for cardiometabolic drugs included in Table 2, Appendix 1

Figure 2. Unadjusted Proportion of Medicaid Enrollees Adherent to Medications by Medication Type (2010)

Table 1

Baseline (2009) Summary of Medicaid Enrollee Characteristics

	<i>Schizophrenia Enrollees with 1+ Comorbid CMCs</i>	<i>Enrollees in PCP group¹</i>	<i>Enrollees in Psychiatric Specialist group²</i>	<i>Enrollees in PCP + Psychiatric Specialist group³</i>
	N = 4,223	N=1,247	N=170	N=2,806
Demographic Variables				
Age (Mean, SD)	48.6 (10.0)	50.4 (9.3)	46.9 (10.0)	48.1 (10.3)
Female (N, %)	2543 (60.2%)	735 (58.9%)	82 (48.2%)	1726 (61.5%)
White race (N, %)	1974 (46.7%)	683 (54.8%)	57 (33.5%)	1234 (44.0%)
Black race (N, %)	1816 (43.0%)	370 (29.7%)	101 (59.4%)	1345 (47.9%)
Other race (N, %)	433 (10.3%)	194 (15.6%)	12 (7.1%)	227 (8.1%)
Medicaid Enrollment Characteristics				
Managed Care (N, %)	2952 (69.9%)	681 (54.6%)	140 (82.4%)	2131 (75.9%)
Behavioral Health Managed Care (N, %)	348 (8.2%)	169 (13.6%)	14 (8.2%)	165 (5.9%)
Primary Care Case Management (N, %)	2754 (65.2%)	578 (46.4%)	133 (78.2%)	2043 (72.8%)
Presence of Comorbid Condition				
Diabetes (N, %)	2184 (51.7%)	653 (52.4%)	70 (41.2%)	1461 (52.1%)
Hypertension (HTN) (N, %)	3269 (77.4%)	930 (74.6%)	123 (72.4%)	2216 (79.0%)
Hyperlipidemia (HLP) (N, %)	2173 (51.5%)	682 (54.7%)	68 (40.0%)	1423 (50.7%)
Diabetes + HTN (N, %)	1588 (37.6%)	456 (36.6%)	43 (25.3%)	1089 (38.8%)
Diabetes + HLP (N, %)	1122 (26.6%)	346 (27.8%)	27 (15.9%)	749 (26.7%)
HTN + HLP (N, %)	1511 (35.8%)	461 (37.0%)	40 (23.5%)	1010 (36.0%)
Diabetes + HTN + HLP (N, %)	818 (19.4%)	245 (19.7%)	19 (11.2%)	554 (19.7%)
Mental Health Comorbidities				
Depression (N, %)	1416 (33.5%)	334 (26.8%)	41 (24.1%)	1041 (37.1%)
Anxiety (N, %)	837 (19.8%)	216 (17.3%)	27 (15.9%)	594 (21.2%)
ADHD (N, %)	45 (1.1%)	8 (0.6%)	1 (0.6%)	36 (1.3%)
Substance Abuse (N, %)	633 (15.0%)	196 (15.7%)	14 (8.2%)	423 (15.1%)
Provider Type				
Primary Care Prescriber (N, %)	4053 (95.9%)	1247 (100%)	---	2806 (100%)
Psychiatric Specialist (N, %)	2976 (70.5%)	---	170 (100%)	2806 (100%)
Cardiometabolic Specialist (N, %)	473 (11.3%)	137 (11.0)	19 (11.2%)	317 (11.3%)
Other Provider Type (N, %)	3600 (85.3%)	1020 (81.8%)	159 (93.5%)	2421 (86.3%)
Clinical Variables				
CDPS risk score (Mean, SD)	2.04 (0.9)	2.10 (1.0)	1.64 (0.6)	2.03 (0.9)
Unique therapeutic classes (Mean, SD)	10.6 (4.7)	10.6 (4.7)	7.1 (3.5)	10.8 (4.6)
State of Residence				

	<i>Schizophrenia Enrollees with 1+ Comorbid CMCs</i>	<i>Enrollees in PCP group¹</i>	<i>Enrollees in Psychiatric Specialist group²</i>	<i>Enrollees in PCP + Psychiatric Specialist group³</i>
	N = 4,223	N=1,247	N=170	N=2,806
Colorado (N, %)	282 (6.7%)	156 (12.5%)	12 (7.1%)	114 (4.1%)
Kentucky (N, %)	1108 (26.3%)	649 (52.0%)	14 (8.2%)	445 (15.9%)
North Carolina (N, %)	2833 (67.0%)	442 (35.5%)	144 (84.7%)	2247 (80.1%)

CMCs: Cardiometabolic conditions; CDPS: Chronic Illness & Disability Payment System

¹PCP group: Medicaid enrollees receiving prescriptions from only primary care prescribers

²Psychiatric Specialist group: Medicaid enrollees receiving prescriptions from only psychiatric specialist prescribers

³PCP + Psychiatric Specialist group: Medicaid enrollees receiving prescriptions from both primary care prescribers and psychiatric specialist prescribers. PCP group, Psychiatric Specialist group, and PCP + Psychiatric Specialist group are mutually exclusive.

Table 2

Average Marginal Effects of Number of Prescribers on Medication Refill Adherence *

	<i>Antipsychotic Adherence</i> N = 4,223	<i>Antihypertensive Adherence</i> N = 3,725	<i>Oral Antidiabetic Adherence</i> N = 2,305	<i>Statin Adherence</i> N = 2,902
Multivariable Adjusted Average Marginal Effect of PCP and Psychiatric Specialist Prescribing without Interactions				
Number of PCPs				
0	0.044 (−0.028, 0.117)	−0.030 (−0.113, 0.053)	−0.064 (−0.183, 0.054)	0.022 (−0.085, 0.129)
1	Ref	Ref	Ref	Ref
2	−0.015 (−0.051, 0.021)	0.016 (−0.024, 0.055)	−0.024 (−0.076, 0.029)	0.025 (−0.025, 0.066)
3+	−0.009 (−0.046, 0.028)	−0.013 (−0.055, 0.028)	−0.015 (−0.068, 0.039)	−0.002 (−0.050, 0.046)
Number of Psychiatric Specialist Prescribers				
0	−0.050 ** (−0.088, −0.013)	0.019 (−0.021, 0.060)	−0.010 (−0.063, 0.044)	0.006 (−0.041, 0.054)
1	Ref	Ref	Ref	Ref
2	0.041 * (0.004, 0.079)	−0.003 (−0.045, 0.038)	−0.022 (−0.075, 0.032)	−0.065 ** (−0.114, −0.016)
3+	0.114 *** (0.071, 0.157)	0.026 (−0.025, 0.076)	0.009 (−0.058, 0.075)	−0.076 ** (−0.137, −0.014)

Models control for age, gender, race, Chronic Illness & Disability Payment System as a measure of comorbidity, number of therapeutic classes of medication used, managed care enrollment, receipt of behavior health management, receipt of case management, state of residence, comorbid anxiety, depression, ADHD, and substance abuse, additional cardiometabolic conditions (hypertension, hyperlipidemia, and/or diabetes), and use of other providers or cardiometabolic specialists.

Note:

p<0.001,

**
p<0.01,

*
p<0.05

Table 3

Average Marginal Effects of Number of Prescribers on Inpatient and Emergency Department Use

	<i>Probability of ED Visit (95% CI)</i>	<i>Probability of Inpatient Admission (95% CI)</i>
	N = 4,223	N = 4,223
Multivariable Independent Average Marginal Effect of PCP and Psychiatric Specialist Prescribing		
Number of PCPs		
0	−0.021 (−0.094,0.053)	0.036 (−0.039,0.110)
1	Ref	Ref
2	0.017 (−0.019,0.052)	0.009 (−0.024,0.042)
3+	0.042 * (0.005,0.079)	0.009 (−0.025,0.042)
Number of Psychiatric Specialist Prescribers		
0	−0.058 ** (−0.095,−0.022)	−0.006 (−0.038,0.026)
1	Ref	Ref
2	−0.008 (−0.046,0.029)	0.020 (−0.014,0.054)
3+	0.073 ** (0.024,0.121)	0.098 *** (0.053,0.142)

Models control for age, gender, race, Chronic Illness & Disability Payment System as a measure of comorbidity, number of therapeutic classes of medication used, managed care enrollment, receipt of behavior health management, receipt of case management, state of residence, comorbid anxiety, depression, ADHD, and substance abuse, additional cardiometabolic conditions (hypertension, hyperlipidemia, and/or diabetes), and use of other providers or cardiometabolic specialists.

Note:

p<0.001,

**
p<0.01,

*
p<0.05