Published in final edited form as:

Gen Hosp Psychiatry. 2017 ; 45: 25–31. doi:10.1016/j.genhosppsych.2016.12.001.

Continuity of Medication Management in Medicaid Patients with Chronic Comorbid Conditions: An Examination by Mental Health Status

Joel F. Farley^{a,*}, Richard A. Hansen^b, Marisa E. Domino^c, Mrudula Borse^a, Nirosha Mahendraratnam^a, Neepa Ray^d, and Matthew L. Maciejewski^{e,f}

^aUNC Eshelman School of Pharmacy, University of North Carolina at Chapel Hill, USA

^bHarrison School of Pharmacy, Auburn University, USA

^cGillings School of Global Public Health, University of North Carolina at Chapel Hill, USA

^dCenter for Medication Optimization through Practice and Policy, University of North Carolina at Chapel Hill, USA

^eCenter for Health Services Research in Primary Care, Durham Veterans Affairs Medical Center, USA

^fDivision of General Internal Medicine, Department of Medicine, Duke University Medical Center, USA

Abstract

Objective—Patients with serious mental illness (SMI) often have comorbid cardiometabolic conditions (CMCs) that may increase the number of prescribers involved in treatment. This study examined whether patients with SMI (depression and schizophrenia) and comorbid CMCs experience greater discontinuity of prescribing than patients with CMCs alone.

Methods—2009 Medicaid data were used to compare number and types of prescribers (primary care, cardiometabolic, psychiatric, other) in individuals with 1-3 CMCs (diabetes, hypertension, dyslipidemia) alone (n=76,451); with CMC and schizophrenia (n=6,507); and with CMC and depression (n=23,510) and the degree of prescribing within a provider's area of specialty.

Results—44%, 61%, and 71% of individuals with CMCs only, with CMCs and schizophrenia, and with CMCs and depression had medications from these classes prescribed by 5 or more providers respectively. More than 35% of patients with CMCs alone or CMCs and schizophrenia had prescriptions provided by 3 or more PCP providers, which increased to 49.1% for patients with CMCs and depression. In the schizophrenia cohort, 29% of antipsychotics were PCP-prescribed while psychiatrists prescribed 10%, 9%, and 9% of antihypertensive, antihyperlipidemic, and antidiabetic medications respectively.

*Corresponding author: Joel F. Farley, UNC Eshelman School of Pharmacy, 2205 Kerr Hall, Campus, Box 7573, Chapel Hill, NC 27599, USA. jffarley@unc.edu.

Conclusions—The presence of SMI increases the number of prescribers treating individuals with CMCs. The impact of this fragmentation in medication management on health outcomes is unknown.

Suggested Keywords

Continuity of care; mental health; chronic disease; diabetes; hypertension

Introduction

Patients with multiple comorbid conditions (MCCs) have been shown to have an increased risk of adverse health outcomes, both because of the compounding risk of the conditions themselves and the complexity of healthcare required to manage multiple conditions (1). However, the ways in which health systems compound or mitigate the MCC-outcome association is poorly understood. Adults with MCCs often see different providers, including primary care and multiple specialists (2). As a result, their medical care is highly fragmented (3). Lacking a usual source of care is associated with higher rates of medication-related problems, emergency department (ED) visits and hospitalizations (4–11).

Most continuity of care studies in MCC populations focus on continuity with providers and not continuity with prescribers. Continuity of care is a complex construct that involves longitudinal continuity, informational continuity and management continuity(3). For this study, we define continuity of prescribing as a measure of longitudinal continuity in which a patient fills prescriptions from the same provider over time, which is operationally distinct from informational continuity (the availability of accurate and current patient information) or management continuity (care plan agreed upon by all providers and the patient). Conceptually, continuous prescribing by a single physician is thought to result in better health outcomes through more appropriate medication use, reductions in drug duplications, fewer drug-drug interactions, and better medication adherence (12). In addition, it is operationally distinct from measures that look at office visits to different physicians over time in that it directly assesses the provision of a medical intervention in the form of a prescription. Prior studies have demonstrated better medication adherence (13) and lower emergency department visits and inpatient hospitalizations (14) in patients receiving prescriptions from a single provider than patients with multiple prescribers. However, these studies are limited to a single Veterans Affairs Medical Center (VAMC) and only looked at patients with one or more of four cardiometabolic conditions (hypertension, hyperlipidemia, diabetes, and congestive heart failure). These studies did not look at prescriber specialty and did not examine the extent to which providers prescribed within their specialty. Although the involvement of specialists in medication management may be clinically appropriate in certain situations, continuity of care may also be compromised when more than one provider is involved in the prescribing process (15).

Continuity of care may be a particular challenge in individuals with severe mental illness (SMI) given high rates of comorbidity with cardiometabolic health conditions. Baseline rates of diabetes, hypertension, and hyperlipidemia in patients with schizophrenia entering the Clinical Antipsychotic Trials of Intervention Effectiveness were 11%, 33%, and 47%

respectively (16). Despite their prevalence, the cardiometabolic health conditions of patients with SMI have been shown to be inadequately treated (17). Among the reasons cited for this under-treatment includes issues of care coordination, particularly between primary care and psychiatric providers (18).

Prescriber continuity is an important concept in the management of patients with MCCs who typically see multiple providers (19, 20) and take multiple medications (21, 22), which puts them at higher risk of adverse drug events (23). Of the few studies examining continuity of prescribing in patients with MCC only one study to our knowledge has examined this issue in patients with SMI and this study limited its analysis to the effect of prescriber continuity on antipsychotic treatments (24). Continuity of prescribing takes on even greater importance in patients with SMI given prior evidence that better care continuity in this population has been associated with better quality of life, better community functioning, lower severity of symptoms, and greater service satisfaction (27). A patient-centered understanding of continuity of care in the context of medication management in patients with serious mental illness requires consideration of prescribers of medications to manage SMI and the discordant conditions that are highly prevalent and often are managed by non-psychiatric specialists (16).

The objective of this study is to describe patient characteristics and continuity in the prescribing process by measuring patterns in the number and type of prescribers providing prescriptions to Medicaid beneficiaries with cardiometabolic health conditions with and without comorbid schizophrenia or depression. In addition to continuity of prescribing by the same prescriber over time, this analysis also examines the scope of prescribing within and outside of providers' area of specialty, which is an important first step in identifying prescribing scenarios that may minimize the risk for adverse drug events and poor health outcomes.

Methods

Study Design and Data

This study used a retrospective cross-sectional study design to examine patterns of prescribing among patients with 1–3 cardiometabolic health conditions (diabetes, hypertension, and/or hyperlipidemia). We stratified the cohort of Medicaid enrollees into three groups: 1) enrollees with claims diagnoses for one or more of the three cardiometabolic conditions alone (no schizophrenia or depression), 2) enrollees with claims diagnoses for one or more cardiometabolic conditions and comorbid schizophrenia, and 3) enrollees with claims diagnoses for one or more cardiometabolic condition and comorbid depression without a diagnosis of schizophrenia. These comparison groups were established to test the hypothesis that having a discordant condition, such as a serious mental illness, would increase the number of prescribers in individuals with cardiometabolic conditions. That is, patients without an SMI would have little need for medications from a psychiatrist, while patients with depression or schizophrenia might require ongoing medication management by a psychiatrist. As a result, clinically appropriate referral to a psychiatrist could result in unintended fragmentation in these patients' overall medication management. Examination of these three cohorts allowed us to examine if prescribing patterns differed for

patients with and without comorbid SMI and whether prescribing patterns differed by comorbid depression or schizophrenia. We used 2009 Medicaid Analytical Extract (MAX) claims from NC, CO, VT and KY. These states represent diverse geographical regions of the U.S. and were identified as having low rates of missing provider information by the Centers for Medicare & Medicaid Services (CMS).

Inclusion/Exclusion Criteria

From an initial data pull of 515,466 individuals across the 4 state Medicaid programs, we included 244,973 individuals aged 18 to 64 with one or more inpatient or two or more outpatient claims with ICD-9-CM codes for diabetes, hypertension, hyperlipidemia, depression, or schizophrenia (Supplemental Appendix A). Of these patients, 177,774 patients had continuous enrollment during calendar year 2009. We then excluded 15,394 individuals dually enrolled in Medicare or private insurance to ensure data capture given that claims not reimbursed through Medicaid are missing in this population. We restricted our sample to 137,177 patients using one or more medications to manage each individual condition (Supplemental Appendix B). Of these patients, 233 who have unidentified providers and subsequently, 30,476 who do not have a CMC were also excluded. The final cohort included 76,451 patients with one or more cardiometabolic health conditions without schizophrenia or depression, which we define as the cardiometabolic only cohort (Supplemental Appendix C). In addition, 6,507 patients had one or more cardiometabolic conditions and comorbid schizophrenia (schizophrenia cohort) and 23,510 had one or more cardiometabolic conditions and comorbid depression (depression cohort).

Prescriber Variable Definition

We defined both the annual count and types of prescribers for the three cardiometabolic conditions and two mental health conditions. Prescribers of medications used to manage conditions beyond these 5 conditions of interest were not considered. Prescription claims were used to identify the prescriber of record for each medication. For the 31.4% of claims missing prescriber identifiers, the outpatient record most recent to the new prescription fill was used to identify the prescriber. Among the new prescriptions without a prescriber identifier, 57.0% matched an office visit within 1 day of the prescription, 74.3% matched within 7 days, and 90.7% matched within 30 days. 9.3% of prescriptions did not match to a prescriber within 30 days and were excluded in our final analysis.

Provider specialty was identified using National Provider Identifier (NPI) taxonomy codes. Specifically, prescribers were grouped into four specialty categories: (1) primary care (e.g., family medicine provider, internal medicine provider, or nurse practitioner), (2) cardiometabolic (e.g., cardiologist, endocrinologist, or diabetes & metabolism specialist), (3) psychiatric (e.g., psychiatrist or other psychiatric/mental/health specialist), or "other" area of practice (e.g., general acute care hospital provider, emergency medicine, unspecified specialist, and home health). Specialty taxonomy information was missing from 6.5% of claims and these claims were not included in our final analysis.

Descriptive Variables

We examined differences in enrollee demographic information across each of the cohorts of interest. Enrollee demographic variables included continuous age, sex, and race (white, black, and other/missing). The other racial category was created given the infrequency of reporting races other than white or black. We also examined Medicaid enrollment variables including enrollment in behavioral health managed care plans, receipt of primary care case management in the Medicaid program, and blind/disabled versus other enrollment status in Medicaid. To examine the full scope of comorbid conditions an individual may have, we also calculated the Chronic Disease Payment Score for each person (25) (26).

Analysis

First, differences in characteristics between enrollees in the depression and schizophrenia cohorts were compared to individuals in the cardiometabolic only cohort using two-sided t-tests and chi-squared tests. Second, we describe the number and types of providers prescribing medications across each cohort. Third, we examined the combination of prescriber specialties of Medicaid enrollees to examine the proportion of patients seeing one, two, three, or all four specialty types. Finally, we examined the scope of prescribing by area of specialty by categorizing the proportion of new prescriptions across the 5 conditions of interest (antihyperlipidemics, antidiabetics, antihypertensives, antidepressants, and antipsychotics) written by a PCP, psychiatric specialist, cardiometabolic specialist, or other specialty prescriber. The purpose of this analysis was to examine the proportion of prescriptions written within or outside of a prescriber's area of specialty. For example, we expected that psychiatric providers might commonly be prescribing anti-psychotics and antidepressants for patients with comorbid schizophrenia or depression, but would be less likely to prescribe medications to manage diabetes, hypertension or dyslipidemia.

This study was approved by the Institutional Review Boards of each author's corresponding institution.

Results

Patient Characteristics

Table 1 presents demographic comparisons between the schizophrenia and depression cohorts relative to the cardiometabolic only cohort. Where noted, comparisons between the depression and schizophrenia cohorts not presented in Table 1 are also highlighted with corresponding p-values herein. Compared to the cardiometabolic only cohort, the depression cohort had more (64.6 vs 77.1%) ($p<0.001$) and the schizophrenia cohort had fewer female Medicaid enrollees (64.6 vs 58.7%) ($p<0.001$). In addition, the depression cohort had more white (66.8%) ($p<0.001$) and the schizophrenia cohort had fewer white (47.4%) ($p<0.001$) enrollees than the cardiometabolic only cohort (56.2%). There was also a higher rate of individuals with blind/disabled Medicaid enrollment in the schizophrenia cohort (97.3%) than in either the cardiometabolic only (72.5%) ($p<0.001$) or depression (73.9%) cohorts ($p<0.001$). Among adults in the cardiometabolic only cohort, 45.5% had one, 38.1% had two, and 16.4% had all three cardiometabolic conditions. Among the cohort with schizophrenia, 34.8% of individuals had comorbid depression; 47.8% had only one

cardiometabolic condition, 36.0% had two and 16.1% had all three cardiometabolic conditions. Among the depression cohort, 50.6% of patients had only one comorbid cardiometabolic condition, 34.0% had 2 conditions and 15.5% had all three cardiometabolic comorbidities.

Number of Prescribers by Specialty Seen by Medicaid Enrollees with Multiple Chronic Conditions

Table 2 provides a description of the number of prescribers from whom patients are receiving medications. Prescribing by a single provider over a one year period was uncommon in all cohorts, ranging from 9.6%, 4.3%, and 2.7%, respectively. On the other hand, prescribing by 5 or more prescribers ranged from 44.4%, 61.0%, and 70.7% in these same patients, respectively. In all three cohorts, most patients had a prescription written by at least one primary care provider (94% in the cardiometabolic only cohort, 93% in the schizophrenia cohort and 96% in the depression cohort). Additionally, compared to 49.1% of patients in the depression cohort having prescriptions written by 3 or more PCPs, only 36.5% of patients in the cardiometabolic only cohort ($p < 0.001$) and 35.4% of patients in the schizophrenia cohorts ($p < 0.001$) had prescriptions written by 3 or more PCPs.

Interestingly, few patients in any cohort were prescribed medication by a cardiometabolic specialist, with a lower proportion in the schizophrenia cohort (10.3%) than in the cardiometabolic only (16.1%) ($p < 0.001$) or depression cohorts (17.1%) ($p < 0.001$). Not surprisingly, patients in the schizophrenia and depression cohorts were more likely to have a prescription written by a psychiatric specialist (66.9% ($p < 0.001$) and 38.9% ($p < 0.001$), respectively) than patients in the cardiometabolic only cohort (5.4%). Among patients in the depression cohort with a prescribing psychiatrist, 66.8% had a prescription written by only one psychiatric prescriber, while 24.3% and 8.9% had a prescription written by 2 or 3 or more psychiatric specialty providers respectively. In contrast, among patients in the schizophrenia cohort with a prescribing psychiatrist, 51.5% had a prescription written by a single psychiatric provider while 31.1% and 17.5% of patients had prescriptions written by 2 or 3 or more providers, respectively.

Combinations of Prescriber Specialty Prescribing to Medicaid Enrollees with Multiple Chronic Conditions

Table 3 examines further the types of providers from whom individuals in each of the three cohorts received prescriptions. Patients with cardiometabolic conditions alone were the most likely cohort to receive prescriptions from only one type of provider (24.4% of patients) with the most common type of provider being a PCP. In contrast, 8.9% ($p < 0.001$) and 8.7% ($p < 0.001$) of patients in the schizophrenia and depression cohorts, respectively, received prescriptions from saw only one type of provider. In all cohorts, among the subgroup of patients receiving prescriptions from only one type of provider, the most common provider type to prescribe medications was a PCP (81.2% of the cardiometabolic only cohort, 70.1% of the schizophrenia cohort, and 78.9% of the depression cohort). Most patients in the cardiometabolic only cohort received prescriptions from two provider types (59.6%) during 2009, with the most common combination of provider types being a PCP and "other" specialty (92.9% of patients seeing two provider types). Similarly, 47.5% of

patients in the depression cohort received prescriptions from two or more provider types with the most common combination (88.7%) being a PCP and “other” specialist. In the schizophrenia cohort, 50.6% of patients received prescriptions from three or more provider types with the most common combination being a PCP, psychiatric specialist, and other specialist (93.0% of patients receiving prescriptions from three or more provider types).

Scope of Prescribing by Provider Specialty

Table 4 presents the prescription level analysis of prescribing by provider specialty for each class of medication across the three cohorts. In each cohort, the most common prescriber of cardiometabolic medications was a PCP. Interestingly, prescribing of cardiometabolic medications by a cardiometabolic specialist was slightly higher in the cardiometabolic only cohort (5.5–6.3%) and depression cohort (5.4–6.2%) than in the schizophrenia cohort (2.8 - 3.3%). In addition, cardiometabolic medication prescribing by a psychiatrist was higher in patients with schizophrenia (8.5 - 10.3%) than among patients with depression (2.3 - 2.9%). In the schizophrenia cohort, medications for hypertension, hyperlipidemia, and diabetes were prescribed by a psychiatrist 10.3%, 8.5%, and 9.2% of the time, respectively. Antipsychotics and antidepressants in patients with schizophrenia were most frequently prescribed by psychiatrists (46.6% and 44.1%, respectively) but were also prescribed by PCPs (28.8% and 30.5%, respectively). In patients with depression, the percentage of antipsychotics and antidepressants prescribed by a psychiatrist also was common (42.5% and 30.2%, respectively) as was prescribing of these medications by PCPs (31.2% and 43.6%, respectively).

Discussion

This study examined continuity of care in the context of medication management for patients with SMI and cardiometabolic conditions. Our results show that having a single provider manage medications in patients with multiple chronic conditions is the exception and not the rule. While nearly all individual patients in each cohort had at least one prescription written by a PCP over the one-year study period, the majority of patients received prescriptions by 2 or more PCPs. In addition, specialty prescribing was common, particularly for Medicaid enrollees with comorbid schizophrenia or depression.

This study extends prior work that examined the types of prescribers involved in the treatment of patients across different cohorts (13, 14, 24). Expectedly, the presence of schizophrenia or depression yielded a higher probability that an individual had a prescription written by a psychiatrist. However, prescribing by a cardiometabolic specialist was lower in patients with cardiometabolic conditions schizophrenia (10%) than in patients with cardiometabolic conditions alone (16%) or patients with depression and cardiometabolic conditions (17%). Although continuity of care is associated with better health outcomes, it has also been argued that perfect continuity of care by one single provider may not be ideal and many patients may benefit from care provided by a specialist (28, 29). Given the lower rates of cardiometabolic specialty prescribing in the cohort of patients with schizophrenia, further studies may wish to elaborate on whether this is appropriate in this population.

Prescribing outside of a provider's area of specialty was common in each of the cohorts and appeared more common in patients with SMI. In the schizophrenia cohort specifically, 28.8% of antipsychotic prescriptions were written by a PCP, and psychiatric specialists prescribed medications for hypertension, hyperlipidemia, and diabetes 10.3%, 8.5%, and 9.2% of the time, respectively. Similarly, in patients with depression, 43.6% of antidepressants were provided by PCPs, while psychiatric specialists prescribed fewer than 3% of each of the medications for cardiometabolic conditions in this cohort. Few studies have examined the issue of prescribing medications outside of an area of specialty, so it is unclear whether such prescribing puts Medicaid enrollees at risk for adverse events. A study by Mark, Levit and Buck showed that 49% of antipsychotic medications and 21% of antidepressants dispensed in the U.S. were provided by a psychiatrist, while general practitioners provided 22% and 62% of these medications, respectively (30). To our knowledge, this is the first study to examine prescribing across areas of specialty in patients using medications for both SMI and cardiometabolic health conditions. These findings suggest a potential benefit to providing additional training to PCPs in the management of mental health conditions and to psychiatric specialists in the management of cardiometabolic conditions and the medications used to manage them. Future research should examine whether such prescribing impacts patient outcomes.

A number of limitations should be highlighted. Given the cross-sectional nature of this study, no causal inferences between appropriateness of prescribing and the number of prescribers can be made. In addition, there was missing information related to prescriber type for some prescriptions that we imputed, which may have been misattributed. Our results are limited to prescribing among the specific subset of chronic CMCs examined and may not reflect the full number of conditions or prescribers involved in the care of these individuals. Finally, these results can only be generalized to conditions we studied in the context of four state Medicaid programs and may not generalize to individuals outside of the Medicaid program or to individuals enrolled in managed care Medicaid programs or dually enrolled in Medicare.

This study also has a number of strengths. To our knowledge, this is first study to examine prescriber continuity in patients with cardiometabolic conditions with and without SMI. In addition, this study examines continuity of prescribing across multiple states' Medicaid programs and conditions. In summary, the results of this study suggest that few patients receive all of their prescriptions from a single prescriber, many patients receive prescriptions from specialty providers, and providers are likely to prescribe medications outside of their area of specialty. Although additional research is needed to better understand health outcomes from discordant prescribing observed in this study, the results have implications to a number of different groups. In particular, clinicians should be cognizant of the potential for prescribing by other providers to reduce the risk of medication interactions, therapeutic duplications, and other adverse drug events. This may also argue for care management and the involvement of clinical pharmacist support to monitor and address adverse drug events should they arise (31).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

References

1. Vogeli C, Shields AE, Lee TA, Gibson TB, Marder WD, Weiss KB, et al. Multiple chronic conditions: prevalence, health consequences, and implications for quality, care management, and costs. *J Gen Intern Med*. 2007; 22(Suppl 3):391–5. DOI: 10.1007/s11606-007-0322-1 [PubMed: 18026807]
2. Pham HH, Schrag D, O'Malley AS, Wu B, Bach PB. Care patterns in Medicare and their implications for pay for performance. *The New England journal of medicine*. 2007; 356(11):1130–9. DOI: 10.1056/NEJMsa063979 [PubMed: 17360991]
3. Saultz JW, Albedaiwi W. Interpersonal continuity of care and patient satisfaction: a critical review. *Ann Fam Med*. 2004; 2(5):445–51. [PubMed: 15506579]
4. Mainous AG 3rd, Koopman RJ, Gill JM, Baker R, Pearson WS. Relationship between continuity of care and diabetes control: evidence from the Third National Health and Nutrition Examination Survey. *Am J Public Health*. 2004; 94(1):66–70. [PubMed: 14713700]
5. Parchman ML, Pugh JA, Noel PH, Larme AC. Continuity of care, Self-management behaviors, and glucose control in patients with type 2 diabetes. *Medical Care*. 2002; 40(2):137–44. [PubMed: 11802086]
6. Koopman RJ, Mainous AG 3rd, Baker R, Gill JM, Gilbert GE. Continuity of care and recognition of diabetes, hypertension, and hypercholesterolemia. *Archives of internal medicine*. 2003; 163(11):1357–61. [PubMed: 12796073]
7. Konrad TR, Howard DL, Edwards LJ, Ivanova A, Carey TS. Physician-patient racial concordance, continuity of care, and patterns of care for hypertension. *Am J Public Health*. 2005; 95(12):2186–90. [PubMed: 16257949]
8. Brookhart MA, Patrick AR, Schneeweiss S, Avorn J, Dormuth C, Shrank W, et al. Physician follow-up and provider continuity are associated with long-term medication adherence: a study of the dynamics of statin use. *Archives of internal medicine*. 2007; 167(8):847–52. [PubMed: 17452550]
9. Kerse N, Buetow S, Mainous AG 3rd, Young G, Coster G, Arroll B. Physician-patient relationship and medication compliance: a primary care investigation. *Ann Fam Med*. 2004; 2(5):455–61. [PubMed: 15506581]
10. Piette JD, Heisler M, Krein S, Kerr EA. The role of patient-physician trust in moderating medication nonadherence due to cost pressures. *Arch Intern Med*. 2005; 165(15):1749–55. [PubMed: 16087823]
11. Angell SY, Garg RK, Gwynn RC, Bash L, Thorpe LE, Frieden TR. Prevalence, awareness, treatment, and predictors of control of hypertension in New York City. *Circ Cardiovasc Qual Outcomes*. 2008; 1(1):46–53. [PubMed: 20031787]
12. Beadles CA, Voils CI, Crowley MJ, Farley JF, Maciejewski ML. Continuity of medication management and continuity of care: Conceptual and operational considerations. *SAGE Open Medicine*. 2014; 2doi: 10.1177/2050312114559261
13. Hansen RA, Voils CI, Farley JF, Powers BJ, Sanders LL, Sleath B, et al. Prescriber continuity and medication adherence for complex patients. *Ann Pharmacother*. 2015; 49(3):293–302. DOI: 10.1177/1060028014563266 [PubMed: 25549627]
14. Maciejewski ML, Powers BJ, Sanders LL, Farley JF, Hansen RA, Sleath B, et al. The intersection of patient complexity, prescriber continuity and acute care utilization. *J Gen Intern Med*. 2014; 29(4):594–601. DOI: 10.1007/s11606-013-2746-0 [PubMed: 24408277]
15. Forrest CB. A typology of specialists' clinical roles. *Archives of internal medicine*. 2009; 169(11):1062–8. DOI: 10.1001/archinternmed.2009.114 [PubMed: 19506176]
16. Nasrallah HA, Meyer JM, Goff DC, McEvoy JP, Davis SM, Stroup TS, et al. Low rates of treatment for hypertension, dyslipidemia and diabetes in schizophrenia: data from the CATIE schizophrenia trial sample at baseline. *Schizophr Res*. 2006; 86(1–3):15–22. [PubMed: 16884895]

17. Salsberry PJ, Chipps E, Kennedy C. Use of general medical services among Medicaid patients with severe and persistent mental illness. *Psychiatric services (Washington, D.C.)*. 2005; 56(4):458–62.
18. Lambert TJR, Newcomer JW. Are the cardiometabolic complications of schizophrenia still neglected? Barriers to care. *Med J Aust*. 2009; 190(4 Suppl):S39–42. [PubMed: 19220173]
19. Starfield B, Lemke KW, Herbert R, Pavlovich WD, Anderson G. Comorbidity and the use of primary care and specialist care in the elderly. *Ann Fam Med*. 2005; 3(3):215–22. DOI: 10.1370/afm.307 [PubMed: 15928224]
20. Anderson G, Knickman JR. Changing the chronic care system to meet people's needs. *Health affairs (Project Hope)*. 2001; 20(6):146–60.
21. Boyd CM, Darer J, Boulton C, Fried LP, Boulton L, Wu AW. Clinical practice guidelines and quality of care for older patients with multiple comorbid diseases: implications for pay for performance. *JAMA*. 2005; 294(6):716–24. DOI: 10.1001/jama.294.6.716 [PubMed: 16091574]
22. Garfinkel D, Mangin D. Feasibility study of a systematic approach for discontinuation of multiple medications in older adults: addressing polypharmacy. *Archives of internal medicine*. 2010; 170(18):1648–54. DOI: 10.1001/archinternmed.2010.355 [PubMed: 20937924]
23. Gandhi TK, Weingart SN, Borus J, Seger AC, Peterson J, Burdick E, et al. Adverse drug events in ambulatory care. *The New England journal of medicine*. 2003; 348(16):1556–64. DOI: 10.1056/NEJMsa020703 [PubMed: 12700376]
24. Farley JF, Wang CC, Hansen RA, Voils CI, Maciejewski ML. Continuity of antipsychotic medication management for Medicaid patients with schizophrenia. *Psychiatric services (Washington, D.C.)*. 2011; 62(7):747–52. DOI: 10.1176/appi.ps.62.7.747
25. Kronick R, Gilmer T, Dreyfus T, Lee L. Improving health-based payment for Medicaid beneficiaries: CDPS. *Health Care Financ Rev*. 2000; 21(3):29–64. [PubMed: 11481767]
26. University of California San Diego. Chronic Illness and Disability Payment System (CDPS). 2012. <http://cdps.ucsd.edu/>
27. Adair CE, McDougall GM, Mitton CR, Joyce AS, Wild TC, Gordon A, et al. Continuity of care and health outcomes among persons with severe mental illness. *Psychiatric services (Washington, D.C.)*. 2005; 56(9):1061–9. DOI: 10.1176/appi.ps.56.9.1061
28. Chen LM, Ayanian JZ. Care continuity and care coordination: what counts? *JAMA internal medicine*. 2014; 174(5):749–50. DOI: 10.1001/jamainternmed.2013.14331 [PubMed: 24638199]
29. Salisbury C, Sampson F, Ridd M, Montgomery AA. How should continuity of care in primary health care be assessed? *The British journal of general practice : the journal of the Royal College of General Practitioners*. 2009; 59(561):e134–41. DOI: 10.3399/bjgp09X420257 [PubMed: 19341548]
30. Mark TL, Levit KR, Buck JA. Datapoints: psychotropic drug prescriptions by medical specialty. *Psychiatric services (Washington, D.C.)*. 2009; 60(9):1167. doi: 10.1176/appi.ps.60.9.1167
31. Smith M, Bates DW, Bodenheimer T, Cleary PD. Why pharmacists belong in the medical home. *Health affairs (Project Hope)*. 2010; 29(5):906–13. DOI: 10.1377/hlthaff.2010.0209 [PubMed: 20439879]

Table 1

Baseline (2009) Summary of Patient Characteristics¹

	Patients with 1 CMC ³ N = 76,451 (A)	Schizophrenia Patients with 1 CMC ³ N = 6,507 (B)	P-value ⁷ (A vs B)	Depression Patients with 1 CMC ³ N = 23,510 (C)	P-value ⁷ (A vs C)
Demographics					
Age ²	48.5 (11.3)	47.8 (10.9)	<0.001	46.4 (10.9)	<0.001
Female	49423 (64.6%)	3822 (58.7%)	<0.001	18122 (77.1%)	<0.001
White	42953 (56.2%)	3085 (47.4%)	<0.001	15692 (66.8%)	<0.001
Black	20923 (27.4%)	2707 (41.6%)		4790 (20.4%)	
Other	12575 (16.5%)	715 (11.0%)		3028 (12.9%)	
Medicaid Enrollment Characteristics					
Behavioral health managed care	9592 (12.6%)	559 (8.6%)	<0.001	1796 (7.6%)	<0.001
Primary care case management	52691 (68.9%)	4216 (64.8%)	<0.001	16158 (68.7%)	0.576
Blind, disabled	55402 (72.5%)	6330 (97.3%)	<0.001	17377 (73.9%)	<0.001
Presence of Comorbid Condition					
Schizophrenia	---	100%		---	
Depression	---	2267 (34.8%)		100%	
Diabetes only	6715 (8.8%)	586 (9.0%)	0.544	1928 (8.2%)	0.005
Hypertension only	22779 (29.8%)	1610 (24.7%)	<0.001	6720 (28.6%)	<0.001
Hyperlipidemia only	5284 (6.9%)	916 (14.1%)	<0.001	3244 (13.8%)	<0.001
Diabetes + HTN	10453 (13.7%)	997 (15.3%)	<0.001	2766 (11.8%)	<0.001
Diabetes + HLP	4440 (5.8%)	411 (6.3%)	0.093	1210 (5.2%)	<0.001
HTN + HLP	14222 (18.6%)	936 (14.4%)	<0.001	4006 (17.0%)	<0.001
Diabetes + HTN + HLP	12558 (16.4%)	1051 (16.1%)	0.566	3636 (15.5%)	0.001
Clinical Variables					
CDPS risk score ²	1.2 (1.0)	2.0 (1.0)	<0.001	1.6 (1.1)	<0.001
Unique therapeutic classes ^{2,4}	9.6 (4.7)	10.0 (4.8)	<0.001	11.9 (4.8)	<0.001
Annual prescription fills ^{2,5}	59.0 (46.1)	84.6 (56.9)	<0.001	78.5 (52.5)	<0.001
Monthly prescription fills ^{2,5}	4.9 (3.8)	7.1 (4.7)	<0.001	6.5(4.4)	<0.001

	Patients with 1 CMC ³ N = 76,451 (A)	Schizophrenia Patients with 1 CMC ³ N = 6,507 (B)	P-value ⁷ (A vs B)	Depression Patients with 1 CMC ³ N = 23,510 (C)	P-value ⁷ (A vs C)
State of Residence					
Colorado	6883 (9.0 %)	460 (7.1 %)	<0.001	1265 (5.4%)	<0.001
Kentucky	26739 (35.0%)	1704 (26.2%)	<0.001	8949 (38.1 %)	<0.001
North Carolina	39204 (51.3%)	4321 (66.4%)	<0.001	12337 (52.5 %)	0.001
Vermont	3625 (4.7%)	22 (0.3%)	<0.001	959 (4.1%)	<0.001

¹ Unless noted, rows represent percentage by condition. Rounding may result in percentages not equal to 100.

² Row represents mean and standard deviation.

³ Cardiometabolic conditions include HTN, HLP, and diabetes.

⁴ Missing broad therapeutic class is counted as a unique category.

⁵ Includes both new fills and refills.

⁶ Identified through the Other Services Files as Physicians, Other Practitioners, Outpatient Hospital, Clinic, Nurse Midwife services, and Nurse Practitioner Services.

⁷ For continuous variables such as age and the clinical variables, the P-value from the t-test is provided. For categorical variables, the p-value from the chi-square test is provided.

CMC: Cardiometabolic Condition; HTN: Hypertension; HLP: Hyperlipidemia; CDPS: Chronic Illness & Disability Payment System; ED: Emergency Department

Table 2

Description of Prescribing by Type of Provider¹

	Patients with 1 CMC ³ N = 76,451 (A)	Schizophrenia Patients with 1 CMC ³ N = 6,507 (B)	P-value ⁴ (A vs B)	Depression Patients with 1 CMC ³ N = 23,510 (C)	P-value ⁴ (A vs C)
Total Number of Prescribers					
One prescriber	7332 (9.6%)	279 (4.3%)	<0.001	642 (2.7%)	<0.001
Two prescribers	11685 (15.3%)	589 (9.1%)		1446 (6.2%)	
Three prescribers	12389 (16.2%)	787 (12.1%)		2201 (9.4%)	
Four prescribers	11123 (14.6%)	882 (13.6%)		2589 (11.0%)	
Five or more prescribers	33922 (44.4%)	3970 (61.0%)		16632 (70.7%)	
PCP Prescriber					
Any prescribing by PCP	72107 (94.3%)	6024 (92.6%)	<0.001	22620 (96.2%)	<0.001
Number of prescribers ²					
1	22889 (31.7%)	1971 (32.7%)	0.145	5087 (22.5%)	<0.001
2	22870 (31.7%)	1923 (31.9%)		6437 (28.5%)	
3+	26348 (36.5%)	2130 (35.4%)		11096 (49.1%)	
Number of PCPs seen by patient ⁵	2.2 (1.49)	2.2 (1.56)	0.050	2.7 (1.77)	<0.001
CMC Specialty Prescriber					
Any prescribing by CMC	12267 (16.1%)	668 (10.3%)	<0.001	4015 (17.1%)	<0.001
Number of prescribers ²					
1	9415 (76.8%)	555 (83.1%)	0.001	3084 (76.8%)	0.856
2	2197 (17.9%)	90 (13.5%)		709 (17.7%)	
3+	655 (5.3%)	23 (3.4%)		222 (5.5%)	
Number of CMC specialists seen by patient ⁵	0.2 (0.54)	(0.40)	<0.001	0.2 (0.56)	0.001
Psychiatric Specialty Provider					
Any prescribing by psychiatrist	4146 (5.4%)	4356 (66.9%)	<0.001	9133 (38.9%)	<0.001
Number of prescribers ²					
1	3304 (79.7%)	2243 (51.5%)	<0.001	6103 (66.8%)	<0.001
2	681 (16.4%)	1353 (31.1%)		2216 (24.3%)	

	Patients with 1 CMC ³ N = 76,451 (A)	Schizophrenia Patients with 1 CMC ³ N = 6,507 (B)	P-value ⁴ (A vs B)	Depression Patients with 1 CMC ³ N = 23,510 (C)	P-value ⁴ (A vs C)
3+	161 (3.9%)	760 (17.5%)		814 (8.9%)	
Number of psychiatric specialists seen by patient ⁵	(0.31)	1.2 (1.16)	<0.001	0.6 (0.85)	<0.001
Other Specialty Prescriber					
Any prescribing by other specialty prescriber	58636 (76.7%)	5470 (84.1%)	<0.001	20925 (89.0%)	<0.001
Number of prescribers²					
1	17839 (30.4%)	1468 (26.8%)	<0.001	3832 (18.3%)	<0.001
2	13777 (23.5%)	1274 (23.4%)		3940 (18.8%)	
3+	27020 (46.1%)	2728 (49.9%)		13153 (62.9%)	
Number of other specialists seen by patient ⁵	2.3 (2.3)	2.6 (2.4)	<0.001	3.5 (2.9)	<0.001

¹Unless noted, rows represent percentage by condition. Rounding may result in percentages not equal to 100.

²The denominator is the number of patients who saw the specific type of provider. For example, the denominator for seeing one, two, or three plus PCPs is the number of people who saw any PCP.

³Cardiometabolic conditions include HTN, HLP, and diabetes.

⁴The p-value from the t-test is provided for the number of specialists for each type of specialist. The p-value from the chi-square test is provided for the remaining rows.

⁵Row represents mean and standard deviation.

CMC: Cardiometabolic Condition; HTN: Hypertension; HLP: Hyperlipidemia; PCP: Primary Care

Description of Type of Prescriber by Provider Type for Patients with One or More CMCs or Severe Mental Illness and One or More CMCs^{1,2}

	Patients with 1 CMC N = 76,451 (A)	Schizophrenia Patients with 1 CMC N = 6,507 (B)	p-value ⁴ (A vs B)	Depression Patients with 1 CMC N = 23,510 (C)	p-value ⁴ (A vs C)
Patient Sees One Provider Type³					
PCP	18632 (24.4%)	579 (8.9%)	<0.001	2048 (8.7%)	<0.001
CMC specialist	15133 (81.2%)	406 (70.1%)		1615 (78.9%)	
Psychiatric specialist	210 (1.1%)	2 (0.4%)	<0.001	13 (0.6%)	<0.001
Other specialist	20 (0.1%)	60 (10.4%)		21 (1.0%)	
	3269 (17.6%)	111 (19.2%)		399 (19.5%)	
Patient Sees Two Provider Types³	45523 (59.6%)	2240 (34.4%)	<0.001	11175 (47.5%)	<0.001
PCP + CMC specialist	1875 (4.1%)	19 (0.9%)		206 (1.8%)	
PCP + psychiatric specialist	522 (1.6%)	515 (23.0%)		657 (5.9%)	
PCP + other specialist	42310 (92.9%)	1414 (63.1%)	<0.001	9916 (88.7%)	<0.001
CMC specialist + psychiatric specialist	3 (0.01%)	5 (0.2%)		8 (0.1%)	
Psychiatric specialist + other specialist	143 (0.3%)	272 (12.1%)		295 (2.6%)	
CMC specialist + other specialist	670 (1.5%)	15 (0.7%)		93 (0.8%)	
Patient Sees Three Provider Types³	11706 (15.3%)	3293 (50.6%)	<0.001	8853 (37.7%)	<0.001
PCP + CMC specialist + psychiatric specialist	52 (0.4%)	30 (0.9%)		65 (0.7%)	
PCP + CMC specialist + other specialist	8838 (75.5%)	184 (5.6%)	<0.001	2135 (24.1%)	<0.001
CMC specialist+ psychiatric specialist + Other specialist	29 (0.3%)	18 (0.6%)		61 (0.7%)	
PCP + psychiatric specialist + other specialist	2787 (23.8%)	3061 (93.0%)		6592 (74.5%)	
Patient Sees All Provider Types³					
PCP + CMC specialist + psychiatric specialist + other specialist	590 (0.8%)	395 (6.1%)	<0.001	1434 (6.1%)	<0.001

²Cardiometabolic conditions include HTN, HLP, and diabetes.

⁴The p-value from the chi-square test is provided.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

CMC: Cardiometabolic Condition; HTN: Hypertension; HLP: Hyperlipidemia; PCP: Primary Care Physician

Table 4

Frequency of Prescribing within Area of Specialty among Medication Using Patients with Serious Mental Illness and Comorbid Cardiometabolic Conditions^{1,2,3}

	HTN medications	HLP medications	Diabetes medications	Antipsychotic medications	Antidepressant medications
CMC Sample					
Number of unique new prescription fills by provider type	268491	78402	137576	22824	90245
PCP	204514 (76.2%)	62249 (79.4%)	107278 (78.0%)	11137 (48.8%)	62809 (69.6%)
CMC specialist	16620 (6.2%)	4916 (6.3%)	7603 (5.5%)	178 (0.8%)	1199 (1.3%)
Psychiatric specialist	1045 (0.4%)	269 (0.3%)	397 (0.3%)	5656 (24.8%)	7790 (8.6%)
Other	46312 (17.3%)	10968 (14.0%)	22298 (16.2%)	5853 (25.6%)	18447 (20.4%)
Schizophrenia Sample					
Number of unique new prescription fills by provider type	23386	8512	14386	45019	23261
PCP	15056 (64.4%)	5983 (70.3%)	9859 (68.5%)	12975 (28.8%)	7104 (30.5%)
CMC specialist	761 (3.3%)	242 (2.8%)	440 (3.1%)	194 (0.4%)	177 (0.8%)
Psychiatric specialist	2410 (10.3%)	726 (8.5%)	1322 (9.2%)	20415 (45.4%)	9789 (42.1%)
Other	5159 (22.1%)	1561 (18.3%)	2765 (19.2%)	11435 (25.4%)	6191 (26.6%)
Depression Sample					
Number of unique new prescription fills by provider type	73388	22558	38105	32958	99066
PCP	53723 (73.2%)	17385 (77.1%)	28698 (75.3%)	10278 (31.2%)	43219 (43.6%)
CMC specialist	4400 (6.0%)	1390 (6.2%)	2064 (5.4%)	225 (0.7%)	948 (1.0%)
Psychiatric specialist	2102 (2.9%)	516 (2.3%)	876 (2.3%)	14011 (42.5%)	29911 (30.2%)
Other	13163 (17.9%)	3267 (14.5%)	6467 (17.0%)	8444 (25.6%)	24988 (25.2%)

¹ Unless noted, rows represent percentage by medication type. Rounding may result in percentages not equal to 100.

² Cardiometabolic conditions include HTN, HLP, and diabetes.

³ Columns are not mutually exclusive in regards to participants. For example, a participant can have a new prescription for an antihypertensive medication and a new prescription for an antidiabetic medication.

CMC: Cardiometabolic Condition; HTN: Hypertension; HLP: Hyperlipidemia; PCP: Primary Care Physician