Medicaid Managed Care Penetration and Drug Utilization for Patients With Serious Mental Illness

Aaron L. Schwartz, PhD; Jacqueline Pesa, PhD, MPH; Dilesh Doshi, PharmD; John Fastenau, PhD, MPH; Seth A. Seabury, PhD; Eric T. Roberts, PhD; and David C. Grabowski, PhD

ABSTRACT

Objectives: State Medicaid programs are under increasing pressure to contain pharmaceutical spending. Many states have attempted to limit spending through greater Medicaid managed care penetration, which rose nationally from 54.5% in 1999 to 74.9% in 2011. It is not clear how this expansion has affected beneficiaries with serious mental illness (SMI)—a vulnerable population that often has their drug spending "carved out" from their managed care benefit. We sought to assess the association between managed care penetration and pharmaceutical spending on drugs for SMIs in these states.

Study Design: Retrospective cohort study.

Methods: State-year observations were constructed to study the relationship between managed care penetration and pharmaceutical spending on drugs for SMIs over the period 1999 to 2011. We analyzed the relationship using both cross-sectional and panel-data methods.

Results: Our cross-sectional analyses suggested that carve-out states with greater managed care penetration spend significantly less per enrollee on pharmaceuticals for the treatment of mental disorders: our panel data analyses did not generate statistically meaningful results.

Conclusions: Future studies should address whether any effects of managed care on mental health prescription utilization and spending reflect improved care coordination or worsening access to valuable care for the population with SMI.

Am J Manag Care. 2016;22(5):346-353

Medicaid is the nation's largest source of financing for behavioral health services.[1] It serves many beneficiaries with serious mental illness (SMI), including schizophrenia, bipolar disorder, and major depressive disorder.[2] Although many dually eligible beneficiaries with SMI receive their drug coverage through Medicare under the Part D program, drugs treating SMI still account for almost 20% of Medicaid pharmacy spending.[3] In 2009, approximately 5 million individuals (11.9% of all Medicaid beneficiaries) received antipsychotics or antidepressant medications through Medicaid.[4]

One of the major provisions of the Affordable Care Act (ACA) is a sweeping increase in Medicaid eligibility for those states choosing to opt in. The Congressional Budget Office estimates that Medicaid expansion will increase the number of nonelderly enrollees in Medicaid and the Children's Health Insurance Program (CHIP) by 10 million in 2016.[5] The costs of this expansion initially will be fully financed by the federal government and, by 2020, the federal share of Medicaid expansion funding will decline to 90%, which will require states to pay for the balance of new enrollees' costs.[6] Increased enrollment in Medicaid, coupled with states' growing obligation to finance the program's costs, will likely impose new pressures on states to curb Medicaid spending—for both newly and previously eligible populations.

Historically, states have attempted to control Medicaid fee-for-service (FFS) prescription drug spending with tools such as formulary restrictions, step therapies, and prior authorization; however, these have sometimes produced unintended consequences in the FFS setting. In the case of drug treatments for SMI, prior research has demonstrated that the use of formulary restrictions may have significant adverse effects for patients—especially those who may benefit from atypical antipsychotics or other novel therapies.[7-9] Furthermore, in many cases, these poor outcomes were significant enough to eliminate any potential cost savings from the policies.[10] Similarly,

the use of prior authorization for atypical antipsychotics by the Maine Medicaid program was found to increase medication discontinuations without lowering spending.[11]

Increasingly, states have turned to contracts with Medicaid managed care plans in order to better control costs and reduce budgetary uncertainty. However, in many states, prescription drug spending is "carved out" (ie, not included) in the managed care benefit. Under a carve-out arrangement, prescription drug benefits are managed on an FFS basis, which excludes them from the set of services for which a managed care plan has oversight and direct financial liability. Conceptually, this suggests that carve-out reduces both the ability of and incentives for managed care plans to coordinate pharmaceutical use with spending on other health services, potentially leading to "cost spillovers" elsewhere in the system.[12]

This issue is particularly relevant in the treatment of SMI, where poor adherence and discontinuation may have serious consequences, including emergency department (ED) visits, inpatient hospitalization, homelessness, incarceration, or even suicide.[13-15] Indeed, a simple change in drug coverage may result in unintended consequences. For example, following the implementation of Medicare Part D, many dually eligible beneficiaries had difficulty accessing psychiatric medications, leading to increased psychiatric ED visits.[16,17] On the other hand, in light of growing evidence that prescription drug adherence might result in lower spending on services that are carved into most Medicaid managed care programs (eg, nondrug inpatient and urgent care), these plans might still have an incentive to promote pharmaceutical adherence among carved-out beneficiaries with SMI.[18]

New research is needed to understand the implications of Medicaid managed care for the treatment of SMI. In this study, we examined the relationship between the expansion of managed care in Medicaid programs and Medicaid spending on pharmaceuticals for the SMI population in carve-out states.

Take-Away Points

Our findings suggest that states with higher Medicaid managed care penetration have lower spending on serious mental illness (SMI) drugs. We cannot conclude that the relationship is causal, but the finding does raise a number of interesting issues for health policy.

- If managed care is associated with less use of ineffective drugs, then this lower utilization can be viewed as cost-effective, with state Medicaid programs achieving similar outcomes at a lower cost.
- However, if managed care is also associated with less use of effective drugs, then this decreased utilization may not be cost-effective due to the increased likelihood of negative health outcomes, such emergency department visits, hospitalizations, homelessness, incarcerations, and death.
- Most states carve out some or all behavioral health services from managed care benefits. A potential downside of such arrangements is fragmentation of care, particularly for vulnerable beneficiaries with SMI, who are likely consumers of other medical services.

METHODS

We collected historical Medicaid managed care penetration rates, SMI prescription utilization data, and additional state-level information for all states and the District of Columbia from 1999 to 2011 (inclusive). These data were used to analyze whether states' levels of Medicaid managed care penetration were associated with their level of prescription use for the SMI population.

Data

Medicaid managed care penetration rates were derived from annual enrollment reports published by CMS and its predecessor, the Health Care Financing Administration.[19] These reports document enrollment in both comprehensive and limited benefit managed care plans and include the proportion of each state's Medicaid beneficiaries enrolled in managed care plans (ie, the penetration rate). Several states administered Medicaid programs on an exclusively FFS basis: New Hampshire in 2004, 2010, and 2011; Mississippi in 2002, 2003, and 2007; and Alaska and Wyoming from 1999 to 2011. We retained these observations in our analyses, coding these states as having no Medicaid managed care penetration in the applicable years.

Drug utilization data were collected from CMS annual Medicaid State Drug Utilization Data files. Each file contains information for covered outpatient drugs that were paid for by a state Medicaid agency. Specifically, the files include information on the number of prescriptions and the amount of reimbursement for those prescriptions by National Drug Code (NDC). Notably, the files do not include prescriptions paid by Medicare Part D plans on behalf of dual eligible beneficiaries. The CMS database of State Drug Utilization files is relatively complete, missing files for only 6 of the 323 (1.9%) state-year observations in which states were eligible to report prescription drug spending data (ie, states that carved out the managed care prescription drug benefit, or for which the managed care penetration rate was 0, in a particular year).

Because the CMS annual Medicaid State Drug Utilization Data only record prescriptions that were paid for via FFS (either due to a carve-out of the drug benefit or

through a traditional FFS model), we used the Medicaid Analytic Extract (MAX) Prescription Drug Tables, published by CMS for the years 1999 to 2011, to identify each state's carve-out status by year.[20] We treated a state as operating under a carve-out arrangement in a given year if it carved out the prescription drug benefit from all of its managed care plans—or prepaid health plans—for at least three-fourths of that year. The MAX Prescription Drug Tables did not provide information about carve-out arrangements for 2000 and 2010, so we imputed data for these years by conservatively coding a state as carving out the drug benefit only if it did so in both adjacent years (ie, 1999 and 2001 for the missing 2000 data, and 2009 and 2011 for the missing 2010 data). States whose carve-out status could not be determined (Louisiana and Vermont) were dropped from our analyses, as were the 2 states (Maryland and Minnesota) that did not carve out the prescription drug benefit from their Medicaid managed care plans in any year of our study period.

Other state-year–level data were derived from 2 main sources. First, various resident sociodemographic characteristics and insurance coverage rates were calculated from the Annual Social and Economic Supplement to the Current Population Survey (CPS), a large national survey of households by the Census Bureau.[21] Second, information on states' healthcare provider counts were collected from the Area Health Resource File (AHRF) Access System, a compendium of geocoded data compiled by the Health Resources and Services Administration. Rates of providers per capita were calculated using AHRF state provider totals and CPS state population estimates. Because provider counts are not available for every year, missing data were imputed by modeling state-specific quadratic time trends.

Drug Utilization Outcomes

Our primary outcomes were annual rates of SMI prescription use and spending for the Medicaid SMI population in states and years in which the Medicaid prescription drug benefit was carved out of managed care or that ran a traditional FFS Medicaid program. We designated drugs as SMI prescriptions on the basis of their pharmacologic class (eg, atypical antipsychotics)[22] or specific SMI indications. In order to check the robustness of our results, we chose to construct 2 alternate definitions of SMI prescriptions: a narrow definition including only antipsychotic medications and a broader definition including additional drugs with primary psychiatric indications, like antidepressants. Although all our psychiatric prescriptions consist of psychiatric drugs without major nonpsychiatric uses, these 2 measures allow us to isolate our findings for antipsychotics relative to the broader class of SMI drugs. A full list of classes included in each definition is provided in the **eAppendix** (available at **www.ajmc.com**).

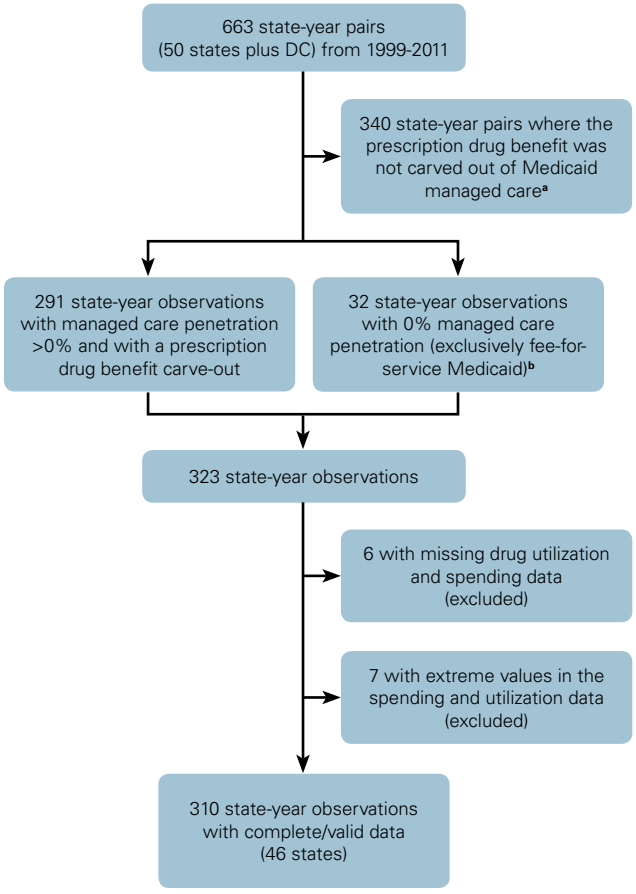
The construction of the outcome variables involved the following steps. For each state and year, we tabulated the total annual Medicaid spending and number of prescriptions for each NDC falling within our SMI definitions. We excluded a small number of drug utilization outliers (0.1% of annual drug observations) because their prescription totals were larger than 100 times the state median for that drug. We then calculated the total state SMI prescription utilization and spending among all drugs within our SMI definitions. We further excluded 7 state-year observations that exhibited very high SMI prescription spending relative to the state trend: Washington (2006), South Dakota (2007), and Tennessee (2003-2007). After applying this restriction, we obtained a final analytic sample of 310 observations from 46 managed care carve-out and Medicaid FFS states that had valid SMI prescription spending and utilization data (**Figure 1**). Total spending and utilization amounts were divided by the size of each state's Medicaid SMI population, which was estimated using the annual count of Medicaid beneficiaries in the CPS and 2011-2012 survey estimates of the rates of adult SMI by state.[23]

Analyses

We employed 2 alternate modeling approaches to assess the association between managed care penetration and SMI prescription outcomes. The first, a pooled cross-sectional approach, tested for whether the levels of a state's prescription outcomes in a given year were associated with the level of its managed care penetration rate, controlling for time-varying state characteristics and shared time trends in prescription outcomes across all states. This analysis consisted of linear regression models of state prescription outcomes on the state Medicaid managed care penetration rate (the variable of interest), year indicators, and state characteristics.

The second modeling approach, a panel data method, tested for whether changes in a state's managed care penetration rate over time were associated with changes in prescription outcomes. These regressions included 2 additional sets of terms: state indicators and interactions between these indicators and a linear time trend (ie, state-specific time trends). These additional terms control for unobserved but fixed state characteristics that contribute to the level and linear growth rate of the outcome variable. In other words, one can interpret the panel models as controlling for states' baseline differences in outcomes

■ **Figure 1.** Sample Inclusion Criteria



[a]We dropped 1999 to 2011 observations for Vermont and Louisiana, whose carve-out status we were unable to ascertain. We also excluded observations from Maryland and Minnesota, which did not carve out the prescription drug benefit from Medicaid managed care plans in any year of our study period.
[b]These states (and corresponding years) are: Alaska and Wyoming (13 years each, from 1999-2011), Mississippi (2002, 2003, and 2007), and New Hampshire (2004, 2010, and 2011).

as well as their outcomes' linear trend. All models were run on state-year observations for which a prescription drug carve-out arrangement was in effect or where a state only operated a traditional FFS Medicaid program.

The regression models also included controls for the following time-varying state covariates: the proportion of residents by age group (aged 0 to 25, 26 to 50, and 51 to 75 years), the proportion of white residents, the labor force participation rate, the unemployment rate, the proportion of residents below 100% of the federal poverty level, the proportion of residents who are uninsured, Medicare beneficiaries, Medicaid beneficiaries, dual eligibles, the number of active nonfederal medical doctors per resident, the number of psychiatrists per resident, and the number of short-term general hospital beds per resident.

All models also included an additional term to account for the effect of Medicare Part D on Medicaid drug claims. Although year indicators account for the average effect of the policy, we also included a term allowing that effect to vary according to the size of a state's dual eligible population. This term is an interaction between the proportions of Medicaid beneficiaries who are also Medicare beneficiaries, calculated from the CPS, and an indicator for years 2006 and later, when dual eligibles no longer received Medicaid pharmacy benefits for drugs covered by Part D.

All regression analyses were weighted by state population and standard errors were clustered at the state level.[24]

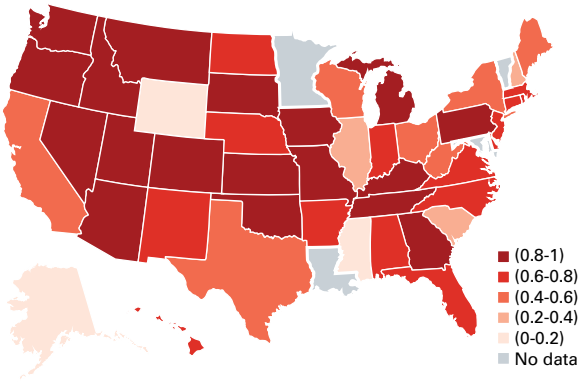
RESULTS

Our sample consisted of 310 state-year observations for prescription drug utilization and spending from 46 states that provided valid spending and utilization data, and that either carved out the prescription drug benefit for Medicaid managed care enrollees or operated FFS Medicaid programs (Figure 1). Across these states and years, the average Medicaid managed care penetration rate was 63.2%. This varied substantially across states: for example, Alaska and Wyoming had no managed care penetration, whereas all of Tennessee's Medicaid beneficiaries were enrolled in managed care (**Figure 2**).

Over the study period, Medicaid managed care penetration increased from 54.5% nationally in 1999 to 74.9% nationally in 2011 (**Figure 3**). Considerable heterogeneity was found in managed care growth across states. For example, managed care penetration increased by 56 percentage points in Illinois and by 51 percentage points in Texas, from 1999 to 2011. In Mississippi and New Hampshire, managed care penetration varied from 0% to over 70% when these states alternately expanded and reduced the use of managed care contracts in their Medicaid programs. Managed care penetration was more stable in states such as Massachusetts, Wisconsin, and Iowa over our study period.

Medicaid SMI prescription spending also varied substantially across carve-out states (**Figure 4**). When using the broad definition of SMI drugs, annual prescription spending averaged $3730 per beneficiary with SMI, ranging from an average of $111 in New Mexico to $7701 in New Hampshire, from our sample of 310 state-year observations. The corresponding average for our narrow definition of drugs for SMI was $2344, ranging from $68 in New Mexico to $4938 in New Hampshire. Annual counts of prescriptions per beneficiary averaged 25.3 and 8.8 for our broad and narrow definitions of SMI prescriptions, respectively. Summary statistics for additional state characteristics are present in the eAppendix.

Figure 2. Average Managed Care Penetration, 1999-2011[a,b]



[a]Averages reflect state-year observations where a carve-out arrangement was in effect or where a state only operated a fee-for-service Medicaid program (N = 310). Arizona contributed spending data only in years in which the state did not carve out the prescription drug benefit, and is also excluded from our analyses.
[b]The units shown in this figure are percentages.
Source: Authors' analysis of Medicaid Managed Care Enrollment Reports.

We found cross-sectional, negative associations between the managed care penetration rate and each measure of SMI prescription utilization, although not all estimates were statistically significant (Table). In particular, a 10 percentage point increase in Medicaid beneficiaries enrolled in managed care was associated with 0.87 fewer SMI prescriptions per beneficiary with SMI (using the broad definition of SMI prescriptions) and with 0.34 fewer prescriptions (using the narrow definition of prescriptions). Similarly, a 10 percentage point increase in managed care penetration was associated with $103 lower SMI drug spending per beneficiary using the broad definition. These estimates grew closer to 0, and were no longer statistically significant, when panel data models were employed.

DISCUSSION

Managed care has become the dominant form of care delivery in Medicaid, and it continues to grow in use in the current era of Medicaid expansion. Our findings suggest that even when prescriptions are carved out of managed care, states with higher Medicaid managed care penetration have lower spending on SMI drugs. We cannot conclude that the relationship is causal, but the finding does raise a number of interesting issues for health policy.

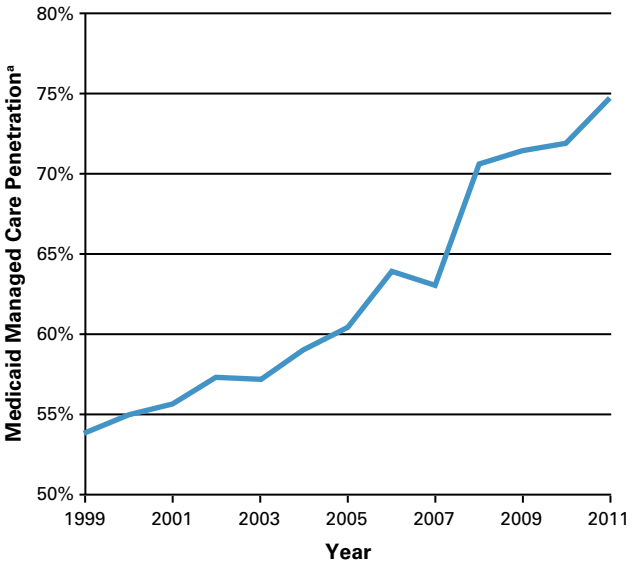
Implications

A key question is why we observed different findings across the cross-sectional and panel data models. Each analysis has some advantages and disadvantages: the cross-sectional analysis generates more precise estimates (ie, smaller standard errors), but the results cannot be interpreted as causal because states with more managed care penetration may differ from other states in ways we are unable to model. The panel data estimates have the advantage of allowing for more valid causal inference, but the estimates are imprecise. Although there was a substantial expansion of Medicaid managed care across the nation during our study period, not all states experienced large changes in managed care penetration over time.

Some states, like New Hampshire and Mississippi, did have wide variation in managed care penetration over time, whereas others had little or no changes in managed care penetration over our study period, which effectively reduced the number of states contributing to the panel data analysis. Moreover, our study period was only from 1999 to 2011, which did not allow us to harnesssome states' early introduction of managed care programs—covering more rapid ramp-ups of managed care penetration—for statistical identification. Ultimately, the large standard errors for our panel data results suggest that increasing Medicaid managed care penetration was not strongly associated with changes in SMI use and spending. Thus, the 2 sets of findings are consistent with one another.

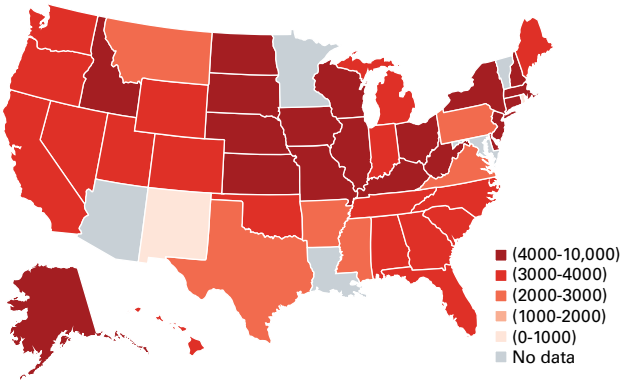
A key question for policy makers will be identifying the underlying mechanism by which managed care is associated with lower utilization. Many of the levers used

Figure 3. Medicaid Managed Care Penetration Over Time



[a]The penetration rate includes data from all states, regardless of carve-out status.
Source: Authors' analysis of Medicaid Managed Care Enrollment Reports.

■ **Figure 4.** Average Spending on SMI Prescriptions per Beneficiary, 1999-2011[a,b]



[a]Averages reflect state-year observations where a carve-out arrangement was in effect, or where a state only operated a fee-for-service Medicaid program (N = 310). Arizona contributed spending data only in years in which the state did not carve out the prescription drug benefit, and is also excluded from our analyses.
[b]The units shown in this figure are average dollars from 1999-2011.
Source: Authors' calculations.

by managed care to control utilization—prior authorization, limits on medication number/dosing, step therapy, and utilization review—are also used in Medicaid FFS programs. Although restrictive provider networks might play a role in limiting utilization, this mechanism is limited by federal requirements regarding network adequacy. Our results cannot be explained by favorable selection of healthier patients by managed care organizations (MCOs), because we measured state-level use of SMI drugs for both FFS and managed care enrollees.

From a policy perspective, the implications of lower Medicaid drug utilization and spending for SMI beneficiaries are unclear without knowing the corresponding impact on healthcare outcomes. On the one hand, if managed care is associated with less use of ineffective drugs, then this lower utilization can be viewed as cost-effective, with state Medicaid programs achieving similar outcomes at a lower cost. However, if managed care is associated with less use of effective drugs, then this decreased utilization may not be cost-effective due to the increased likelihood of negative health outcomes, such as ED visits, hospitalizations, homelessness, incarcerations, and death.[18]

A large amount of the health economics literature has worried about cost spillovers across different services; that is, reducing costs in one service area may be like squeezing a balloon, causing costs to rise in other areas.[12,25] In the case of Medicaid coverage of SMI drugs, the concern is that lower Medicaid spending on drugs will be offset by higher Medicaid spending for other services, such as hospitalizations. The incentive for payers to avoid cost-spillovers depends on the financing structure, which can involve carve-outs for mental health, pharmaceuticals, or both. Most states carve out some or all behavioral health services and pharmaceuticals from managed care benefits and finance them through separate reimbursement contracts.[26,27]

In addition to the potential for increased cost shifting across services that are carved in and out, another potential downside of such arrangements is fragmentation of care, particularly for vulnerable beneficiaries with SMI who are likely consumers of other medical services. Some evidence suggests that the behavioral health carve-outs have restricted necessary care for patients with SMI.[28]

Recently, some states have moved to carve in behavioral health into an integrated Medicaid managed care benefit. This shift has the potential for states to better integrate mental health with other healthcare services by making a

■ **Table.** Association Between a 10-Percentage Point Change in Medicaid Managed Care Penetration and Serious Mental Illness Prescriptions[a,b]

Dependent Variable	(1) Number of SMI Prescriptions (broadly defined)	(2) Number of SMI Prescriptions (narrowly defined)	(3) SMI Prescription Spending (broadly defined)	(4) SMI Prescription Spending (narrowly defined)
Pooled cross-sectional models (N = 310 state-year combinations and 46 states)	–0.87[c]	–0.34[c]	–102.99[c]	–56.88
	(0.51)	(0.17)	(61.32)	(38.12)
Panel data models (N = 235 state-year combinations and 24 states)	–0.20	0.06	10.00	18.15
	(0.51)	(0.18)	(61.72)	(37.57)

SMI indicates serious mental illness.
[a]Estimates represent the difference in outcomes associated with a 10% increase in the coverage of Medicaid beneficiaries by managed care. Models are estimated on state-year observations in which all Medicaid managed care plans in a state carved out the prescription drug benefit for Medicaid beneficiaries and for states in which all Medicaid beneficiaries were in fee-for-service programs in a given year.
[b]Calculations are weighted by state population. Standard errors, which are clustered by state, are presented in parentheses.
[c]P <.1.
Source: Authors' calculations.

single organization accountable for all of a beneficiary's medical care. Various models of integrated plans have emerged. Some states limit plans from at-risk subcontracting of behavioral health services, and others have created integrated plans specifically catered to individuals with serious mental health issues.[26] In light of these structural changes aimed at care coordination, the costs and quality of SMI treatment in Medicaid managed care may be changing.

Many states elected to carve out the prescription drug benefit because Congress, prior to 2010, did not allow Medicaid MCOs to capture manufacturer rebates for pharmaceuticals, which states were allowed to receive in their traditional FFS Medicaid programs (this policy was instituted in the 1991 Medicaid Drug Rebate Program). Thus, state decisions to carve out prescription benefits were often financial because carve-out enabled states to capture the rebates directly. The ACA required manufacturers to grant these rebates to Medicaid MCOs, which now reduces the incentives for states to carve out the benefit.[27]

In the context of our study, we found some cross-sectional evidence that Medicaid managed care penetration is associated with lower spending on SMI drugs, despite the fact that manufacturer discounts on prescription drugs were not directly available to carved-in managed care plans before 2010. The ACA allows Medicaid MCOs to capture manufacturer rebates for drugs, which is expected to lead to greater carve-in of prescription drug benefits in Medicaid managed care plans.Because carve-in plans are at risk for other healthcare spending, they should have less incentive to restrict SMI drugs if that causes cost spillovers with respect to hospitalizations.

Future Research

This paper raises a number of other issues that merit further research attention. First, the implications of changes in Medicaid SMI drug spending on healthcare outcomes and broader healthcare utilization should be considered. The role of SMI drug spending and outcomes in state Medicaid programs that carve in and carve out behavioral spending—especially in the context of the new rules under the ACA. Finally, given our finding that spending was lower in states with greater Medicaid managed care penetration, it will be important to identify the exact mechanism underlying this result.

Limitations

The standard assumptions of cross-sectional and panel data methods apply to our analyses. Specifically, our cross-sectional associations may be biased if the results are confounded by state attributes not included in the models. Our panel data analysis attempts to control for stable state attributes through the inclusion of state fixed effects and linear time trends. Thus, causal interpretation of the panel data results requires weaker assumptions. However, the results may still be biased due to omitted time-varying state confounders. Although we have included many state covariates in our models, one potentially important time-varying confounder—the state prevalence of SMI—could not be included because it has only been consistently measured during recent years of our study period. In addition, whereas our data contain multiple state-year observations and the universe of Medicaid drug use, the statistical power of our analyses is limited by the number of state-year pairs with available data. This limitation can result in wide confidence intervals around our effect estimates.

Another limitation of our study design is that our measures of managed care penetration reflect penetration for the entire state Medicaid population rather than for only Medicaid beneficiaries with SMI. Substantial heterogeneity exists in how states provide mental health coverage within managed care (eg, carve-outs, subcontracted plans, integrated plans). Also, individuals with SMI may differ from other beneficiaries in choosing managed care. Thus, our measures of managed care penetration may not reflect managed care penetration in the SMI population.

CONCLUSIONS

The ACA has expanded Medicaid eligibility at a time when Medicaid managed care penetration is at an all-time high. This expansion also comes at a time of increased experimentation regarding the role of private plans in providing mental health benefits. Our findings emphasize the need for researchers and policy makers to examine what the private provision of mental health benefits means for vulnerable patient populations as these reforms play out.

Author Affiliations: Harvard Medical School (ALS, ETR, DCG), Boston, MA; Janssen Pharmaceuticals, Inc (JP, DD, JF), Titusville, NJ; University of Southern California (SAS), Los Angeles, CA.

Source of Funding: This study was funded by Janssen Pharmaceuticals, Inc.

Author Disclosures: Drs Pesa, Doshi, and Fastenau are Johnson & Johnson stockholders and all full-time employees at Janssen Pharmaceuticals, which sponsored this study and makes medications for mental health. Precision Health Economics (PHE) was a paid consultant to Janssen in connection with the conduct of this study and the development of this article. In addition to their academic affiliations, Drs Grabowski and Seabury are consultants/academic affiliates at PHE. Dr Schwartz was a paid consultant for PHE, who hired him to perform this research; he also reports fellowship support from the National Institute on Aging F30 AG044106-01A1. Dr Roberts' time on this project was supported by the Marshall J. Seidman Center for Studies in Health Economics and Health Care Policy at Harvard Medical School.

Authorship Information: Concept and design (DCG, ALS, DD, SAS, JF, JP); acquisition of data (DCG, ALS); analysis and interpretation of data

(DCG, ALS, DD, SAS, JF, JP, ETR); drafting of the manuscript (DCG, ALS, ETR); critical revision of the manuscript for important intellectual content (DCG, ALS, DD, SAS, JF, JP, ETR); statistical analysis (DCG, ALS, SAS); obtaining funding (DD, JF, JP); and supervision (DCG, JP).

Address correspondence to: David C. Grabowski, PhD, Professor, Department of Health Care Policy, Harvard Medical School, 180 Longwood Ave, Boston, MA 02115. E-mail: grabowski@med.harvard.edu.

REFERENCES

1. Levit KR, Kassed CA, Coffey RM, et al. Projections of national expenditures for mental health services and substance abuse treatment 2004-2014. Substance Abuse and Mental Health Services Administration website. https://store.samhsa.gov/shin/content/SMA08-4326/SMA08-4326.pdf. Published 2008. Accessed April 28, 2016.

2. Frank RG, Goldman HH, Hogan M. Medicaid and mental health: be careful what you ask for. *Health Aff (Millwood)*. 2003;22(1):101-113.

3. Medicare Payment Advisory Commission. A data book: health care spending and the Medicare program. American Health Lawyers Association website https://www.healthlawyers.org/Events/Programs/Materials/Documents/LTC13/papers/pp_hasselman_data_book.pdf. Published June 2011. Accessed April 28, 2016.

4. Statistical compendium: Medicaid pharmacy benefit use and reimbursement in 2009: United States 2009 [2009AllBenes_UD.xls]. CMS website. www.cms.gov/Research-Statistics-Data-and-Systems/Computer-Data-and-Systems/MedicaidDataSourcesGenInfo/Downloads/2009Rx_US.zip. Accessed April 29, 2016.

5. Estimates for the insurance coverage provisions of the Affordable Care Act updated for the recent Supreme Court decision. Congressional Budget Office website. http://www.cbo.gov/sites/default/files/cbofiles/attachments/43472-07-24-2012-CoverageEstimates.pdf. Published July 2012. Accessed October 23, 2014.

6. Kaiser Commission on Medicaid and the Uninsured. Medicaid and its role in state/federal budgets & health reform. Kaiser Family Foundation website. https://kaiserfamilyfoundation.files.wordpress.com/2013/04/8162-03.pdf Published April 2013. Accessed April 28, 2016.

7. Goldman D, Fastenau J, Dirani R, et al. Medicaid prior authorization policies and imprisonment among patients with schizophrenia. *Am J Manag Care*. 2014;20(7):577-586.

8. Goldman DP, Dirani R, Fastenau J, Conrad RM. Do strict formularies replicate failure for patients with schizophrenia? *Am J Manag Care*. 2014;20(3):219-228.

9. Seabury SA, Goldman DP, Kalsekar I, Sheehan JJ, Laubmeier K, Lakdawalla DN. Formulary restrictions on atypical antipsychotics: impact on costs for patients with schizophrenia and bipolar disorder in Medicaid. *Am J Manag Care*. 2014;20(2):e52-e60.

10. Soumerai SB, McLaughlin TJ, Ross-Degnan D, Casteris CS, Bollini P. Effects of a limit on Medicaid drug-reimbursement benefits on the use of psychotropic agents and acute mental health services by patients with schizophrenia. *N Engl J Med*. 1994;331(10):650-655.

11. Soumerai SB, Zhang F, Ross-Degnan D, et al. Use of atypical antipsychotic drugs for schizophrenia in Maine Medicaid following a policy change. *Health Aff (Millwood)*. 2008;27(3):w185-w195. doi: 10.1377/hlthaff.27.3.w185.

12. Chandra A, Gruber J, McKnight R. Patient cost-sharing and hospitalization offsets in the elderly. *Amer Econ Rev*. 2010;100(1):193-213.

13. Svarstad BL, Shireman TI, Sweeney JK. Using drug claims data to assess the relationship of medication adherence with hospitalization and costs. *Psychiatr Serv*. 2001;52(6):805-811.

14. Swanson JW, Swartz MS, Borum R, Hiday VA, Wagner HR, Burns BJ. Involuntary out-patient commitment and reduction of violent behaviour in persons with severe mental illness. *Br J Psychiatry*. 2000;176:324-331.

15. Weiden PJ, Kozma C, Grogg A, Locklear J. Partial compliance and risk of rehospitalization among California Medicaid patients with schizophrenia. *Psychiatr Serv*. 2004;55(8):886-891.

16. Huskamp HA, West JC, Rae DS, Rubio-Stipec M, Regier DA, Frank RG. Part D and dually eligible patients with mental illness: medication access problems and use of intensive services. *Psychiatr Serv*. 2009;60(9):1169-1174. doi: 10.1176/appi.ps.60.9.1169.

17. West JC, Wilk JE, Rae DS, et al. First-year Medicare Part D prescription drug benefits: medication access and continuity among dual eligible psychiatric patients. *J Clin Psychiatry*. 2010;71(4):400-410. doi: 10.4088/JCP.08m04608whi.

18. Roebuck MC, Dougherty JS, Kaestner R, Miller LM. Increased use of prescription drugs reduces medical costs in Medicaid populations. *Health Aff (Millwood)*. 2015;34(9):1586-1593. doi: 10.1377/hlthaff.2015.0335.

19. Medicaid managed care enrollment reports [1996-2011]. Medicaid.gov website. https://www.medicaid.gov/medicaid-chip-program-information/by-topics/data-and-systems/medicaid-managed-care/medicaid-managed-care-enrollment-report.html. Accessed April 28, 2016.

20. Zuckerman S, Williams AF, Stockley KE. Trends in Medicaid physician fees, 2003-2008. *Health Aff (Millwood)*. 2009;28(3):w510-w519. doi: 10.1377/hlthaff.28.3.w510.

21. King M, Ruggles S, Alexander T, et al. Integrated Public Use Microdata Series, Current Population Survey version 3.0 [machine-readable database]. University of Minnesota, Minnesota Population Center website. https://cps.ipums.org/cps/. Accessed June 27, 2014.

22. National Drug Code Directory. FDA website. http://www.fda.gov/Drugs/InformationOnDrugs/ucm142438.htm. Updated May 14, 2014. Accessed May 18, 2014.

23. State estimates of adult mental illness from the 2011 and 2012 National Surveys on Drug Use and Health. Substance Abuse and Mental Health Services Administration website. http://www.samhsa.gov/data/sites/default/files/sr170-mental-illness-state-estimates-2014/sr170-mental-illness-state-estimates-2014/sr170-mental-illness-state-estimates-2014.pdf. Published February 28, 2014. Accessed October 23, 2014.

24. Moulton BR. An illustration of a pitfall in estimating the effects of aggregate variables on micro units. *Rev Econ Stat*. 1990;72(2):334-338. doi: 10.2307/2109724.

25. McWilliams JM, Zaslavsky AM, Huskamp HA. Implementation of Medicare Part D and nondrug medical spending for elderly adults with limited prior drug coverage. *JAMA*. 2011;306(4):402-409. doi: 10.1001/jama.2011.1026.

26. Bachrach D, Anthony S, Detty A. State strategies for integrating physical and behavioral health services in a changing Medicaid environment. The Commonwealth Fund website. http://www.commonwealthfund.org/~/media/files/publications/fund-report/2014/aug/1767_bachrach_state_strategies_integrating_phys_behavioral_hlt_827.pdf. Published August 2014. Accessed October 23, 2014.

27. Bruen B, Young K. What drives spending and utilization on Medicaid drug benefits in states?: Kaiser Family Foundation website. http://files.kff.org/attachment/brief-what-drives-spending-and-utilization-on-medicaid-drug-benefits. Published December 2014. Accessed April 28, 2016

28. Busch AB, Frank RG, Lehman AF. The effect of a managed behavioral health carve-out on quality of care for Medicaid patients diagnosed as having schizophrenia. *Arch Gen Psychiatry*. 2004;61(5):442-448. ■

www.ajmc.com Full text and PDF

eAppendix

Psychiatric Prescription Drug Selection

Our broad set of psychiatric prescriptions consists of psychiatric drugs without major non-psychiatric uses. Based on the FDA NDC database, pharmacists on the research team selected several drug classes for inclusion as well as several additional substances that did not fall into the major classes. These classes are defined by established pharmacologic class (EPC), chemical/ingredient and mechanism of action (MoA). 7716 NDC were selected that belonged to the following classes or additional substances. Note that the class names are written as they appeared in the FDA NDC database.

Classes (broad measure)

- Atypical Antipsychotic (EPC)
- Atypical Antipsychotic (EPC), Serotonin Reuptake Inhibitor (EPC) ,Serotonin Uptake Inhibitors (MoA)
- Benzodiazepine (EPC), Benzodiazepines [Chemical/Ingredient], Tricyclic Antidepressant (EPC)
- Mood Stabilizer (EPC)
- Norepinephrine Uptake Inhibitors (MoA), Serotonin and Norepinephrine Reuptake Inhibitor (EPC), Serotonin Uptake Inhibitors (MoA)
- Serotonin Reuptake Inhibitor (EPC)
- Serotonin Reuptake Inhibitor (EPC),Serotonin Uptake Inhibitors (MoA)
- Tricyclic Antidepressant (EPC)

Additional substances (broad measure)

- Buspirone
- Amoxapine
- Maprotiline
- Mirtazapine
- Carbamazepine
- Divalproex
- Lamotrigine
- Valproic Acid

Our narrow set of psychiatric prescriptions consisted of the 2236 NDC codes within the following classes:

Classes (narrow measure)

- Atypical Antipsychotic (EPC)
- Atypical Antipsychotic (EPC), Serotonin Reuptake Inhibitor (EPC), Serotonin Uptake Inhibitors (MoA)
- Benzodiazepine (EPC), Benzodiazepines [Chemical/Ingredient], Tricyclic Antidepressant (EPC)

State Characteristics

The following table contains characteristics of the states in our sample.

EXHIBIT A1: State Summary Characteristics (1999-2011)

Characteristic	*Mean*	*Standard Deviation*
Medicaid managed care penetration	63.2%	22.2%
Outcomes		
No. SMI prescriptions per beneficiary (broadly defined)	25.3	10.6
No. SMI prescriptions per beneficiary (narrowly defined)	8.8	3.6
SMI prescription spending per beneficiary (broadly defined)	3730	1294
SMI prescription spending per beneficiary (narrowly defined)	2344	943
Covariates		
% aged 0-25	36.6%	2.6%
% aged 26-50	36.2%	1.7%
% aged 51-75	20.7%	2.5%
% white	80.8%	7.5%
Labor force participation rate	27.8%	2.7%
Unemployment rate	3.0%	0.9%
% below Federal Poverty Level	12.8%	2.5%
% uninsured	15.2%	4.6%
% Medicare beneficiaries	13.5%	2.4%
% Medicaid beneficiaries	12.6%	3.1%
% Dual eligibles	12.9%	3.7%
No. active MDs, non-federal, per resident	$2.6*10^{-3}$	$6.5*10^{-4}$
No. psychiatrists per resident	$1.3*10^{-4}$	$7.1*10^{-5}$
No. short term general hospital beds per resident	$3.4*10^{-3}$	$7.5*10^{-4}$
Number of State-Year Observations	310	

SOURCES: CMS Medicaid Managed Care Enrollment Reports, Medicaid State Drug Utilization Data, Current Population Survey Annual Social and Economic Supplement, Area Health Resource File

NOTES: Each observation is a state-year combination. Calculations are weighted by state population.