RESEARCH

Impact of Monthly Prescription Cap on Medication Persistence Among Patients with Hypertension, Hyperlipidemia, or Diabetes

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ABSTRACT

BACKGROUND: Hypertension, hyperlipidemia, and diabetes are among the most prevalent and costly chronic health conditions affecting the U.S. population. Prescription treatments for these conditions are of critical importance to the health of patients, yet suboptimal adherence to prescription treatments for these conditions is not uncommon. While monthly prescription restriction has become a commonly used mechanism to reduce medication utilization, little is known about the effect of this policy on patients with hypertension, hyperlipidemia, or diabetes.

OBJECTIVES: To evaluate the effect of a reimbursement limit implemented in the Louisiana Medicaid program that restricted patients receiving 8 prescriptions per month without prior authorization on continuation (persistence) of medications for hypertension, hyperlipidemia, or diabetes.

METHODS: A pre-post design was applied using Medicaid claims data from 2001-2003 to compare medication persistence among patients in Louisiana (LA) to patients in Indiana (IN), a nonequivalent comparator state. *Medication persistence* was defined as time from treatment initiation to a treatment gap of 30 days or longer. To capture pre-intervention trends in medication persistence, we compared historical "pre-policy" cohorts in LA and IN followed for 10 months prior to policy adoption (March 3, 2002, to December 31, 2002) to "post-policy" cohorts followed for 10 months after policy adoption (March 3, 2003, to December 31, 2003). All incident cohorts were identified using a 6-month washout period. We used Cox-proportional hazard models to compare discontinuation rates in LA and IN across the pre-policy and policy period cohorts.

RESULTS: The adjusted results showed no differences in persistence during the pre-policy period between LA and IN for any of the 3 chronic conditions. In the post-policy period, patients with hyperlipidemia in LA were 1.13 (95% CI = 1.02-1.25; $P < 0.05$) times more likely to discontinue their treatment as their IN counterparts, while no significant differences were observed in the hypertension or diabetes cohorts.

CONCLUSION: Our study suggests there is inconclusive evidence that the monthly prescription restriction disrupts the continuation of medications for common chronic health conditions in patients. More research is needed to identify which patients are most vulnerable to the effect of monthly prescription limits and how this policy could potentially affect additional treatment outcomes such as medication adherence, health outcomes, and Medicaid expenditures.

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What is already known about this subject

- Hypertension, hyperlipidemia, and diabetes are among the most prevalent and costly chronic health conditions affecting the U.S. population. Approximately one-third of U.S. adults aged 20 years or older have hypertension, one-sixth have hyperlipidemia, and one-tenth have diabetes. However, it was reported that 30% of patients with hypertension, 52% of patients with hyperlipidemia, and 16% of patients with diabetes receive no treatment for their conditions.
- Low adherence to prescription treatments for these conditions has been shown to be associated with adverse outcomes, including higher risk of cardiovascular events and mortality, higher rate of inpatient admissions and emergency room visits, and higher total treatment costs.
- Evaluations of a prescription limit in 1982 in the New Hampshire Medicaid program showed a significant drop in medication use immediately after policy implementation as well as a statistically significant increase in nursing home and hospital admissions among the mentally ill and elderly Medicaid populations.

What this study adds

- This retrospective study examines whether the implementation of a prescription cap affects medication persistence among patients in Louisiana (LA, policy state) in comparison with Indiana (IN, comparison state that did not implement a cap on prescriptions) for treatments for hypertension, hyperlipidemia, or diabetes using Medicaid claims data from 2001-2003.
- No differences in persistence were found before the policy implementation between LA and IN for any of the 3 chronic conditions. After policy implementation, patients with hyperlipidemia in LA were 1.13 (95% CI = 1.02-1.25; $P < 0.05$) times more likely to discontinue their treatments as their IN counterparts, while no significant differences were observed in the hypertension or diabetes cohorts ($P > 0.05$ for all other groups).
- Although inconclusive, this study suggests a potential for disruptions in medication persistency resulting from these policies. Policy makers implementing restrictive policies should monitor closely for potential disruptions in patient care that might result following policy adoption.

Hypertension, hyperlipidemia, and diabetes are among the most prevalent and costly chronic health conditions affecting the U.S. population. Approximately one-third of U.S. adults aged 20 years or older have hypertension, one-sixth have hyperlipidemia, and one-tenth have diabetes.[1-3] The total treatment costs for hypertension and diabetes have been estimated at $76.6 billion (2010) and $174 billion (2007), respectively.[3,4] Depending on the population, the average costs per patient for hyperlipidemia ranged from $6,376 to $10,654 in 2007 and 2008.[5,6] Prescription treatments for these conditions are critically important in the management of these conditions. However, studies suggest that approximately 30% of patients with hypertension, 52% of patients with hyperlipidemia, and 16% of patients with diabetes receive no pharmacological treatment for their conditions.[1-3] Adherence to medications for these conditions has been shown to be suboptimal, which reduces their potential for effectiveness. Rates of medication adherence have been estimated at 72%, 55%, and 65% for patients with hypertension, hyperlipidemia, and diabetes, respectively.[7-9]

Low adherence to prescription treatments for these conditions has significant consequences for patient outcomes. Adherence to cardioprotective medications has been shown to be associated with a 48% reduction in all-cause mortality,[10] as well as lower total medical costs and hospitalization rates.[11] In addition, studies have shown that patients with medication possession ratio (MPR) or proportion of days covered (PDC) ≥ 0.8 using antihypertensive drugs had lower risk of cardiovascular events, hospitalization, and emergency room visits as well as lower health care costs.[12-15] Compared with patients whose MPR or PDC < 0.8, patients who were more adherent to statins had a 19% to 26% reduction in the risk of cardiovascular events[16,17] and a 25% reduction in the risk of mortality.[18] Better adherence, defined as PDC ≥ 0.8, to antidiabetic drugs was similarly found to be associated with fewer emergency room visits (incidence rate ratio [IRR]:0.679-0.80; $P < 0.05$), a 2.7%-4.0% lower rate of complications, and 18 fewer short-term disability days.[19]

Predictors of nonadherence, which have been cited in the clinical literature, include the cost of treatment, increasing copayments for prescriptions, and administrative barriers to adherence.[20-21] However, few studies have examined the effect of a monthly prescription limit on medication use,[21-28] which has become an increasingly common cost reduction mechanism in state Medicaid programs.[29] Evaluations of a prescription limit in 1982 that restricted the number of drugs reimbursable to patients in the New Hampshire Medicaid program to 3 prescriptions per month showed a significant drop in medication use immediately after policy implementation.[23,25,26] Similar results were found in another study, which showed that New Hampshire's 3-drug monthly limit was associated with a decrease in cardiovascular medication use.[23] In addition, an increase in nursing home admissions (hazard ratio [HR] = 1.8, 95% confidence interval [CI] = 1.2-2.6) among chronically ill Medicaid beneficiaries who were aged 60 or older and a significant increase in hospital admissions (relative risk [RR] = 1.2, 95% CI = 0.8-1.6) were observed among patients who took 3 or more prescriptions at baseline.[24,27] In a related study, restricting patients in the Mississippi Medicaid program to 5 prescriptions per month without prior authorization in 2002 resulted in lower adherence to antipsychotic medications.[22] However, this policy was enacted alongside increased copayments and other policies that made it difficult to isolate the effect of the monthly prescription cap policy.[22]

The current study examines a monthly prescription limit implemented in the Louisiana Medicaid program. The policy began on March 3, 2003, and limited patients to 8 prescription fills per month.[30] Patients who were younger than 21 years of age, who lived in a long-term care facility, or who were pregnant were exempted from this policy. Patients using more than 8 prescriptions could be exempted from the policy if they had a "medically necessary" condition and completed a prior authorization (PA) process. Physicians were required to provide evidence of a medically necessary exemption including the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) diagnosis codes for medications exceeding the 8-prescription limit. After receiving the PA requirement, a pharmacist could then dispense the medications required.

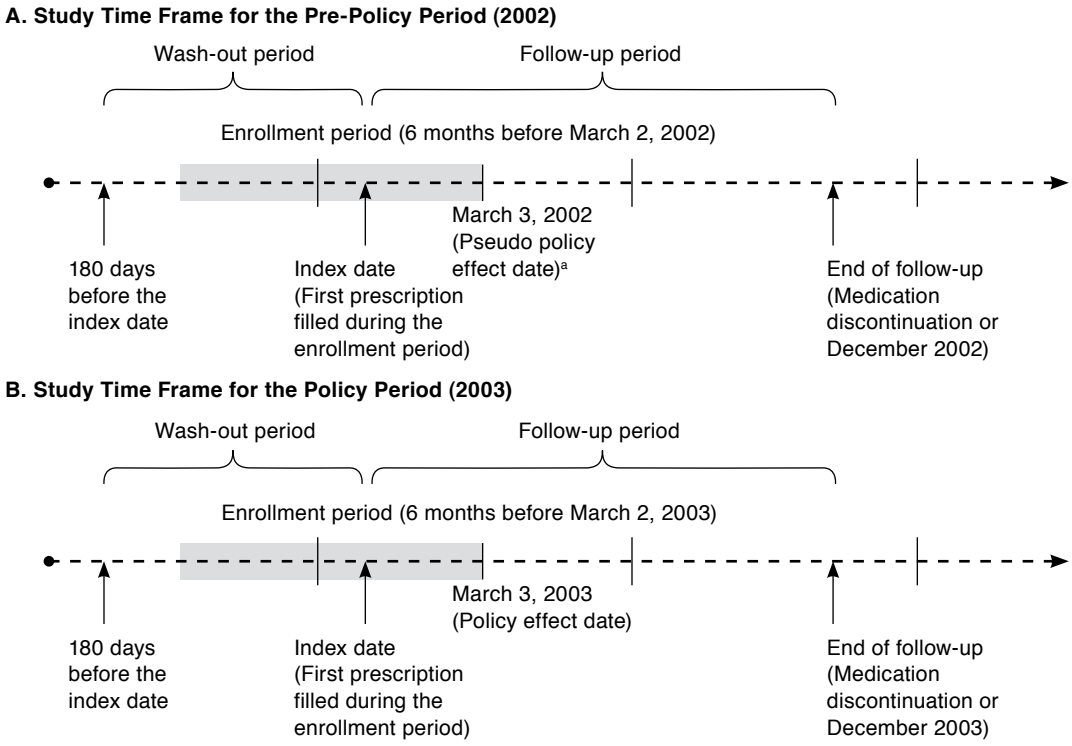
Despite the increasing use of prescription caps in state Medicaid programs, there exists limited information about the effect of caps on health outcomes and medication adherence. This study examined whether the implementation of a prescription cap affected medication persistence of treatments for hypertension, hyperlipidemia, and diabetes. Understanding whether patients with chronic conditions may be adversely affected by the policy will help decision makers better design health policies under Medicaid or managed care settings.

Methods

Data Source

Data were obtained from 2001-2003 Medicaid Analytic Extract (MAX) files for Louisiana (LA) and Indiana (IN), which are maintained by the Centers for Medicare & Medicaid Services. The MAX files contain patient-level information submitted by the state Medicaid programs, including enrollment, patient demographic information (e.g., date of birth, gender, race, resident state, and zip code), inpatient, outpatient, long-term care claims, and Medicaid pharmacy claims. IN was chosen as a nonequivalent comparison state because it had the same level of copayments as LA ($0.50 for generic medications and $3.00 for brand name drugs) but did not enforce a monthly prescription limit policy. In addition, based on our search on National Pharmaceutical Council website and the websites

FIGURE 1 *Study Design and Time Frame*



[a]*Pseudo policy effect date is the date that was 1 year before the policy implemented. This date was assigned in the pre-policy period (2002) to mimic the policy effect date in the policy period (2003) and to create the enrollment period.*

for LA and IN Medicaid programs, IN did not appear to have any significant changes to its prescription policies during the period observed.

Study Design and Samples

This study employed a nonequivalent comparator group cohort study design with 2003 as the intervention (policy period) year and 2002 as the comparison (pre-policy period) year. Three study cohorts (patients with hypertension, hyperlipidemia, or diabetes) were constructed separately in 2002 and 2003 in each state. To be included, a patient had to be continuously enrolled in Medicaid from 2001 to 2003 and aged 21 years or older on March 3, 2003. Patients were included if they had at least 1 inpatient or 2 outpatient diagnoses of any of the 3 major conditions (ICD-9-CM diagnosis codes for essential hypertension: 401, disorders of lipoid metabolism: 272, or diabetes mellitus: 250) at any time during the 3-year study period. The 3 chronic condition groups were not mutually exclusive, and patients with more than 1 condition could be included in more than 1 cohort. In addition, patients were required to have at least 1 prescription claim for the 3 major conditions:

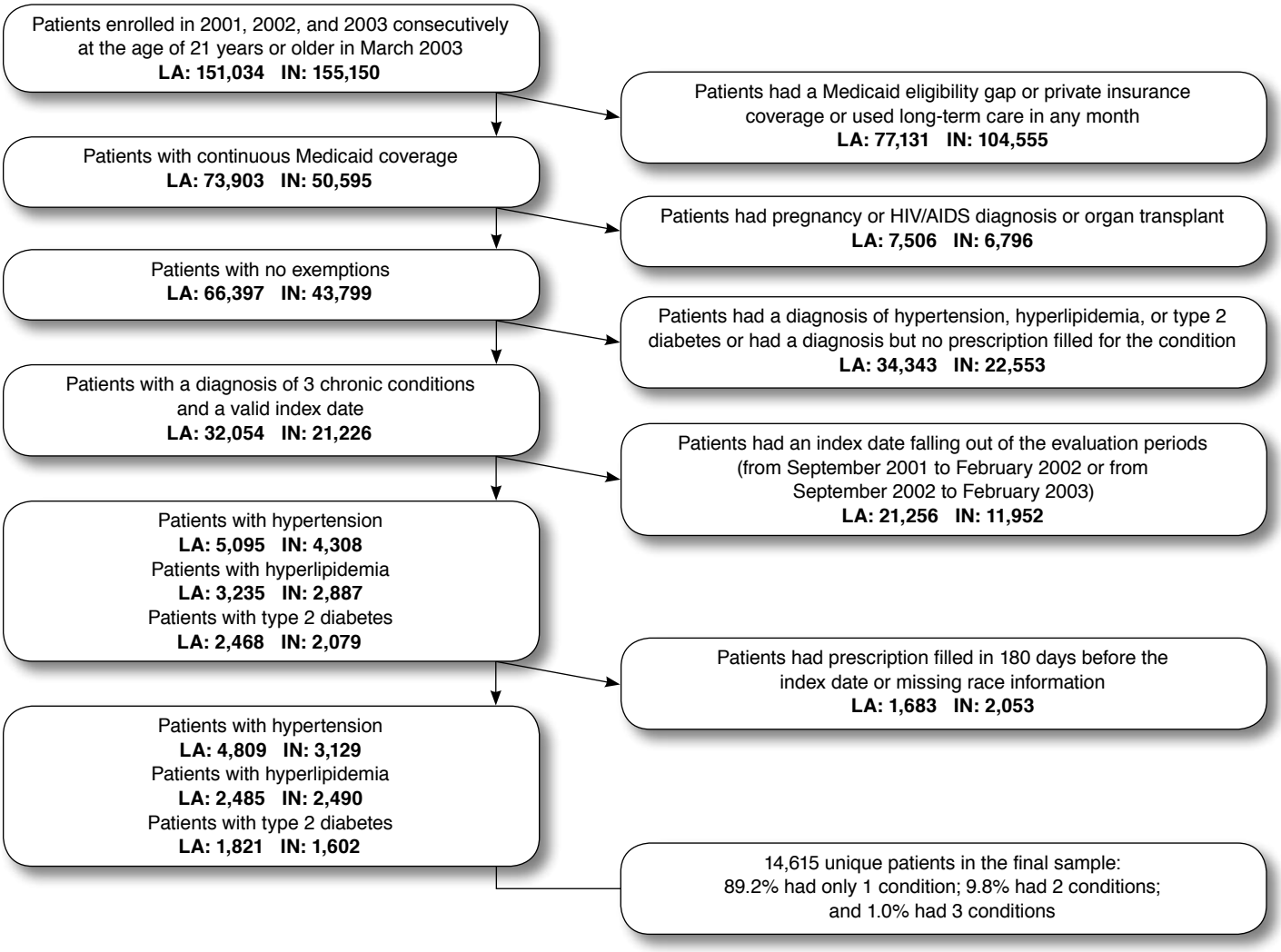
- *Hypertension:* calcium channel blocker, angiotensin-converting enzyme inhibitors, beta blockers, alpha-beta blockers, and diuretics
- *Hyperlipidemia:* antihyperlipidemic drugs
- *Diabetes:* oral antidiabetic agents and insulins.

Combination treatments were not included in this study, since no combination drugs were available during the study period (2001-2003).

To fully capture patients' medication utilization records, we excluded patients who did not have full Medicaid benefits, had private insurance coverage during 2001 to 2003 (i.e., number of months covered by private insurance > 0), had a long-term care claim, or had missing race information. Patients who had organ transplantation (ICD-9-CM: V42.x), pregnancy (ICD-9-CM: V22.x, V23.x), or human immunodeficiency virus (HIV; ICD-9-CM: 42.x) were excluded because they could be exempted from the prescription-limit policy.

We next identified incident cohorts (i.e., new users) representing pre-policy and policy period cohorts using a design described in Figure 1. An enrollment period was defined as 6 months prior to both the pre-policy (March 2002) and policy period (March 2003) of observation, and each patient was

FIGURE 2 Sample Size Flow Chart



AIDS = acquired immune deficiency syndrome; HIV = human immunodeficiency virus; IN = Indiana; LA = Louisiana.

assigned an index date as the first prescription filled of an oral agent during the enrollment period. To be qualified as a new user, a patient was required to be free of the specified drug classes for at least 180 days before the index date. For example, a patient with diabetes who received metformin during follow-up was required to have no claims for antidiabetic drugs during the pre-index period. Although insulin was classified as one of the antidiabetic treatments in the inclusion criteria to capture patients with diabetes comprehensively, patients who were on insulin only (without any use of oral antidiabetic drugs during the follow-up period) were excluded from the sample due to the difficulty of capturing medication persistence of injectable agents in claims data.

All patients were followed from the policy effective date (March 3, 2003) or 1 year before the policy was implemented (March 3, 2002) until medication discontinuation or the end of the pre-policy or policy period year (year of 2002 for the pre-policy group and year of 2003 for the policy group). A total of 6 incident cohorts were constructed from patients with each of the 3 chronic conditions in 2 states (LA and IN; Figure 1). IN served as a control group to compare the effect of the policy in LA and did not use a prescription cap during the observation period in this study.

After applying the inclusion/exclusion criteria, we identified 4,809 and 3,129 patients with hypertension; 2,485 and 2,490 patients with hyperlipidemia; and 1,821 and 1,602 patients

TABLE 1 Patient Characteristics for the Pre- and Post-Policy Cohorts

Pre-Policy Cohorts									
	Hypertension			Hyperlipidemia			Diabetes		
	IN (%)	LA (%)	*P* Value	IN (%)	LA (%)	*P* Value	IN (%)	LA (%)	*P* Value
N	1,700	2,525		1,309	1,244		833	957	
Age group			0.242			0.030			0.537
19-35	13.65	15.21		9.01	7.32		11.88	11.81	
36-50	43.71	44.24		42.17	37.22		43.82	41.38	
51-64	42.65	40.55		48.82	55.47		44.30	46.81	
Female	68.71	66.18	0.086	68.45	71.54	0.088	68.19	69.17	0.653
Nonwhite	27.24	74.46	<0.001	12.38	60.53	<0.001	23.77	69.07	<0.001
Non-MSA	43.59	33.15	<0.001	42.63	36.58	0.002	43.46	36.47	0.003
CCIS (mean)	2.09	1.92	0.003	2.45	2.45	0.960	3.00	2.92	0.419
Post-Policy Cohorts									
	Hypertension			Hyperlipidemia			Diabetes		
	IN (%)	LA (%)	*P* Value	IN (%)	LA (%)	*P* Value	IN (%)	LA (%)	*P* Value
N	1,429	2,284		1,181	1,241		769	864	
Age group			0.082			0.102			0.271
19-35	14.35	17.08		8.47	8.30		11.44	14.12	
36-50	46.05	44.05		43.95	39.89		42.26	40.74	
51-64	39.61	38.88		47.59	51.81		46.29	45.14	
Female	67.95	65.50	0.124	66.20	68.90	0.159	69.05	67.94	0.630
Nonwhite	25.96	74.91	<0.001	15.16	63.98	<0.001	25.10	72.69	<0.001
Non-MSA	43.81	33.63	<0.001	43.18	38.20	0.013	43.43	33.45	<0.001
CCIS (mean)	2.02	1.81	0.002	2.43	2.26	0.047	2.95	2.92	0.775

CCIS = Charlson Comorbidity Index Score; IN = Indiana; LA = Louisiana; MSA = metropolitan statistical area.

with diabetes in LA and IN, respectively (Figure 2). There were 14,615 unique patients in the final sample, and 13,041 (89.2%) of them had only 1 condition; 1,427 (9.8%) of them had 2 conditions; and 147 (1.0%) of them had all 3 conditions.

Dependent and Independent Variables

The outcome of this study, medication persistence, was defined as a gap greater than 30 days in treatment. Using prescription fill date and days' supply, we checked whether a patient had medications on hand for a specified treatment class (i.e., antihypertensive, antihyperlipidemia, or antidiabetic drugs) for each day during the follow-up period. Patients without medication available for more than 30 consecutive days were considered as having discontinuation of therapy. A gap was defined as a period when patients discontinued all of their medications for the study condition. For example, patients who used 2 separate hypertension drugs needed to stop both hypertension drugs for more than 30 days to be considered as having a gap.

Because of the complexity of insulin regimens, insulin was not taken into consideration for the persistence measure due to difficulty in measuring persistence of insulin accurately. Patients who were on insulin treatment only were excluded from the study sample, and patients who switched from an oral antidiabetic agent to insulin were censored at the date of switch.

The key independent variable was a state indicator (LA vs. IN) where LA was the policy state and IN was the comparison state. Other control variables were age in 2001, gender (male vs. female), race (white vs. nonwhite), and whether a patient lived in a metropolitan statistical area (MSA). According to the U.S. Census Bureau, an MSA is defined as a region containing 50,000 or more population, which was used to define an urban area in this study.[31] MSA was included as a covariate because patients living in an urban area may have better access to health care and therefore be more likely to continue their medication treatments. Patients' state and county codes were used to construct Federal Information Processing Standard (FIPS) codes. The constructed FIPS codes were then linked to the 2003 Rural-Urban Continuum Codes provided by the U.S. Department of Agriculture, Economic Research Services, to identify MSA. Charlson Comorbidity Index (Quan's version)[32] was used to calculate the weighted Charlson comorbidity scores to adjust for patients' overall health status.

TABLE 2 Results from Cox Models for Patients with Hypertension, Hyperlipidemia, or Diabetes

	Pre-Policy Period		Post-Policy Period	
	Hypertension			
Unadjusted HR (95% CI)	1.18	(1.10-1.27)[a]	1.20	(1.12-1.30)[a]
Adjusted HR (95% CI)	0.99	(0.91-1.07)	0.95	(0.87-1.04)
	Hyperlipidemia			
Unadjusted HR (95% CI)	1.22	(1.11-1.33)[a]	1.30	(1.20-1.42)[a]
Adjusted HR (95% CI)	1.05	(0.95-1.16)	1.13	(1.02-1.25)[b]
	Diabetes			
Unadjusted HR (95% CI)	1.12	(1.00-1.26)	1.20	(1.07-1.34)[b]
Adjusted HR (95% CI)	0.97	(0.86-1.01)	1.12	(0.90-1.17)

[a]*P* < 0.01.
[b]*P* < 0.05.
CI = confidence interval; HR = hazard ratio.

TABLE 3 Results from the Sensitivity Analysis for Patients Using 8 Prescriptions or More During the Pre-Policy Period

	Pre-Policy Period		Policy Period	
	Hypertension[a]			
Unadjusted HR (95% CI)	0.95	(0.76-1.89)	1.27	(1.00-1.62)
Adjusted HR (95% CI)	0.97	(0.76-1.23)	1.05	(0.80-1.38)
	Hyperlipidemia			
Unadjusted HR (95% CI)	1.20	(0.97-1.49)	1.23	(0.97-1.56)
Adjusted HR (95% CI)	1.19	(0.95-1.50)	1.12	(0.86-1.46)
	Diabetes			
Unadjusted HR (95% CI)	1.02	(0.77-1.36)	1.12	(0.82-1.49)
Adjusted HR (95% CI)	0.95	(0.69-1.30)	1.00	(0.71-1.40)

[a]*Sample size: 559 and 923 patients with hypertension, 445 and 783 patients with hyperlipidemia, and 418 and 665 patients with diabetes in Louisiana and Indiana, respectively.*
CI = confidence interval; HR = hazard ratio.

Statistical Analysis

We began with descriptive statistics to summarize patient characteristics. T-tests and chi-square tests were used to compare continuous and categorical variables, respectively. Cox proportional hazard models were used to analyze the discontinuation rate in different disease cohorts between LA and IN, controlling for other covariates. In addition, a sensitivity analysis was conducted to evaluate the effect of the monthly restriction policy on medication persistence among patients using 8 or more prescriptions in any month during the pre-index period. All analyses were stratified by the post-policy (2003) and pre-policy (2002) periods. SAS version 9.2 (Cary, NC) was used to perform the analyses. Statistical significance was determined *a priori* as $P < 0.05$ for 2-sided tests.

Results

Patient characteristics for both the pre- and post-policy cohorts are reported in Table 1. There were a number of differences between patients in LA and IN when examining the study cohorts, such as race, rural versus urban area residency, and comorbidity burden. Most notably, the LA population was consistently more likely to be nonwhite (61%-75% in LA vs. 12%-27% in IN; $P < 0.05$) across each of the conditions examined and less likely to live in rural areas (33%-38% in LA vs. 43%-44% in IN; $P < 0.05$).

Table 2 presents the results from the Cox proportional hazard models. The unadjusted results showed that patients in LA had lower persistence than patients in IN for hypertension (HR = 1.18, 95% CI = 1.10-1.27; $P < 0.01$) and hyperlipidemia (HR = 1.22, 95% CI = 1.11-1.33; $P < 0.01$) in the pre-policy period and for all 3 conditions in the post-policy period (HR = 1.20, 95% CI = 1.12-1.30; $P < 0.01$ for the hypertension group; HR = 1.30, 95% CI = 1.20-1.42; $P < 0.01$ for the hyperlipidemia group; HR = 1.20, 95% CI = 1.07-1.34; $P < 0.05$ for the diabetes group). However, the differences in medication persistence during the pre-policy period became insignificant after adjusting for covariates. During the post-policy period, the adjusted results indicated that patients with hyperlipidemia in LA were 1.13 times more likely to discontinue their medication treatment than patients in IN (HR = 1.13, 95% CI = 1.02-1.25; $P = 0.024$). No significant difference was found for patients with hypertension or diabetes between the 2 states in the post-policy period adjusted results. Complete outputs from the regression models for hypertension, hyperlipidemia, and diabetes cohorts are shown in appendices A-1, A-2, and A-3.

Table 3 shows the results of the sensitivity analysis for patients who used 8 or more prescriptions during the pre-policy period. The sample for the sensitivity analysis included 559 and 923 patients with hypertension, 445 and 783 patients with hyperlipidemia, and 418 and 665 patients with diabetes in LA and IN, respectively.

Similar to our main analysis, the adjusted results of the sensitivity analysis did not show any effect of the monthly prescription restriction policy on patients' persistence for antihypertensive and antidiabetic drugs ($P > 0.05$ for both groups in the pre- and post-policy periods). However, unlike the main analysis, the effect of the monthly prescription restriction policy on patients' persistence for hyperlipidemia treatment was insignificant in the sensitivity analysis (adjusted HR = 1.12, 95% CI = 0.86-1.46; $P > 0.05$). Sample attrition and baseline characteristics for the sensitivity analysis are presented in Appendix B.

Discussion

This study evaluates the effect of a monthly prescription restriction policy on medication persistence in patients with diabetes, hypertension, or hyperlipidemia. After adjusting for all of the

covariates, we did not find significant differences in medication persistence for patients with hypertension, hyperlipidemia, or diabetes during the pre-policy period. The adjusted results also suggested that the monthly prescription limit had no significant effect on medication persistence among patients with hypertension or diabetes, while a significantly lower persistence for antihyperlipidemia medications was observed during the post-policy period.

The null effect we observed among patients with hypertension or diabetes could be due to the multiple therapeutic classes used to treat hypertension or diabetes, which may make it easier for physicians and patients to find alternative regimens for their conditions. For example, patients with hypertension or diabetes could be on multiple drugs before the policy. They may discontinue 1 or 2 of their medications or reduce the frequency of dosing after the implementation of the policy to meet the 8 prescription restriction.[25,33]

Unlike patients with hypertension or diabetes, we found patients with hyperlipidemia were 13% more likely to discontinue their treatment after the implementation of the policy. Given that hyperlipidemia is an asymptomatic condition, patients may not feel the need for treatment and thus discontinue the therapy to meet the monthly prescription limit.[23] However, this is not a guarantee of policy effect because the confidence interval surrounding the hazard ratio for the post-policy period is inclusive of the confidence interval surrounding the hazard ratio for the pre-policy period, which may be reflected by the fact that we did not observe a significant effect in the sensitivity analysis. On the other hand, the null finding in the sensitivity analysis may be the result of the relatively small sample size.

Limitations

There are several limitations of this study that should be considered when interpreting these results. First, our study results may not be generalizable to privately insured or uninsured populations. In addition, medication persistence was measured based on pharmacy claims, and it was assumed that prescriptions filled are actually taken. Moreover, information on medications obtained by self-payment or physician samples was not available in claims data. Although potential confounders were adjusted in this study, there could still be unmeasurable differences between LA and IN given the nonequivalent comparison group design. For example, a prior study has demonstrated that missing prescriptions paid out of pocket may lead to overestimation of the effect of the monthly prescription restriction policy.[30] Finally, it should be noted that this is a repeated cross-sectional study, and we did not follow a single cohort over time. Time-to-event analysis was performed because the outcome of interest in this study was time to discontinuation. A time series approach would require following patients from the pre-policy to the post-policy period, while patients who "survived" to the post-policy period could be different from patients who discontinued their treatment before the policy implementation. Caution is needed when making causal inferences from this study. In addition to persistence, future research may further assess the effect of the monthly prescription restriction policy on health care costs.

Conclusion

As Medicaid programs continue to struggle with controlling prescription spending, policies such as a monthly prescription limit may be used with greater frequency. Although inconclusive, this study suggests a potential for disruption in medication persistency resulting from these policies. Policy makers implementing restrictive policies should monitor closely for potential disruptions in patient care that might result following policy adoption.

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DISCLOSURES

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Concept and design, data collection and interpretation, and writing and revision of the manuscript were performed by all authors.

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APPENDIX A-1 Regression Outputs for Hypertension Cohorts

	Pre-Policy Period		Post-Policy Period	
	HR	95% CI	HR	95% CI
State				
IN	Reference	-	Reference	-
LA	0.99	(0.91-1.07)	0.95	(0.87-1.04)
Age				
19-35	Reference	-	Reference	-
36-50	0.82*	(0.74-0.91)	0.85*	(0.77-0.94)
51-64	0.71*	(0.64-0.79)	0.78*	(0.70-0.87)
Gender				
Male	Reference	-	Reference	-
Female	1.09	(1.00-1.16)	1.14*	(1.05-1.23)
Race				
White	Reference	-	Reference	-
Nonwhite	1.50*	(1.39-1.62)	1.62*	(1.49-1.76)
MSA				
Yes	Reference	-	Reference	-
No	0.96	(0.89-1.03)	0.98	(0.91-1.06)
CCIS	1.00	(0.98-1.02)	1.01	(0.99-1.03)

**P < 0.01.*

CCIS = Charlson Comorbidity Index Score; CI = confidence interval; HR = hazard ratio; IN = Indiana; LA = Louisiana; MSA = metropolitan statistical area.

APPENDIX A-2 Regression Outputs for Hyperlipidemia Cohorts

	Pre-Policy Period		Post-Policy Period	
	HR	95% CI	HR	95% CI
State				
IN	Reference	-	Reference	-
LA	1.05	(0.95-1.16)	1.13*	(1.02-1.25)
Age				
19-35	Reference	-	Reference	-
36-50	0.93	(0.78-1.10)	1.01	(0.85-1.20)
51-64	0.83*	(0.70-0.98)	0.96	(0.81-1.14)
Gender				
Male	Reference	-	Reference	-
Female	1.10	(1.00-1.21)	1.07	(0.97-1.19)
Race				
White	Reference	-	Reference	-
Nonwhite	1.41**	(1.27-1.57)	1.40**	(1.26-1.55)
MSA				
Yes	Reference	-	Reference	-
No	0.88**	(0.80-0.96)	0.95	(0.87-1.05)
CCIS	1.01	(0.99-1.03)	1.02	(1.00-1.04)

**P < 0.05.*

***P < 0.01.*

CCIS = Charlson Comorbidity Index Score; CI = confidence interval; HR = hazard ratio; IN = Indiana; LA = Louisiana; MSA = metropolitan statistical area.

APPENDIX A-3 Regression Outputs for Hyperlipidemia Cohorts

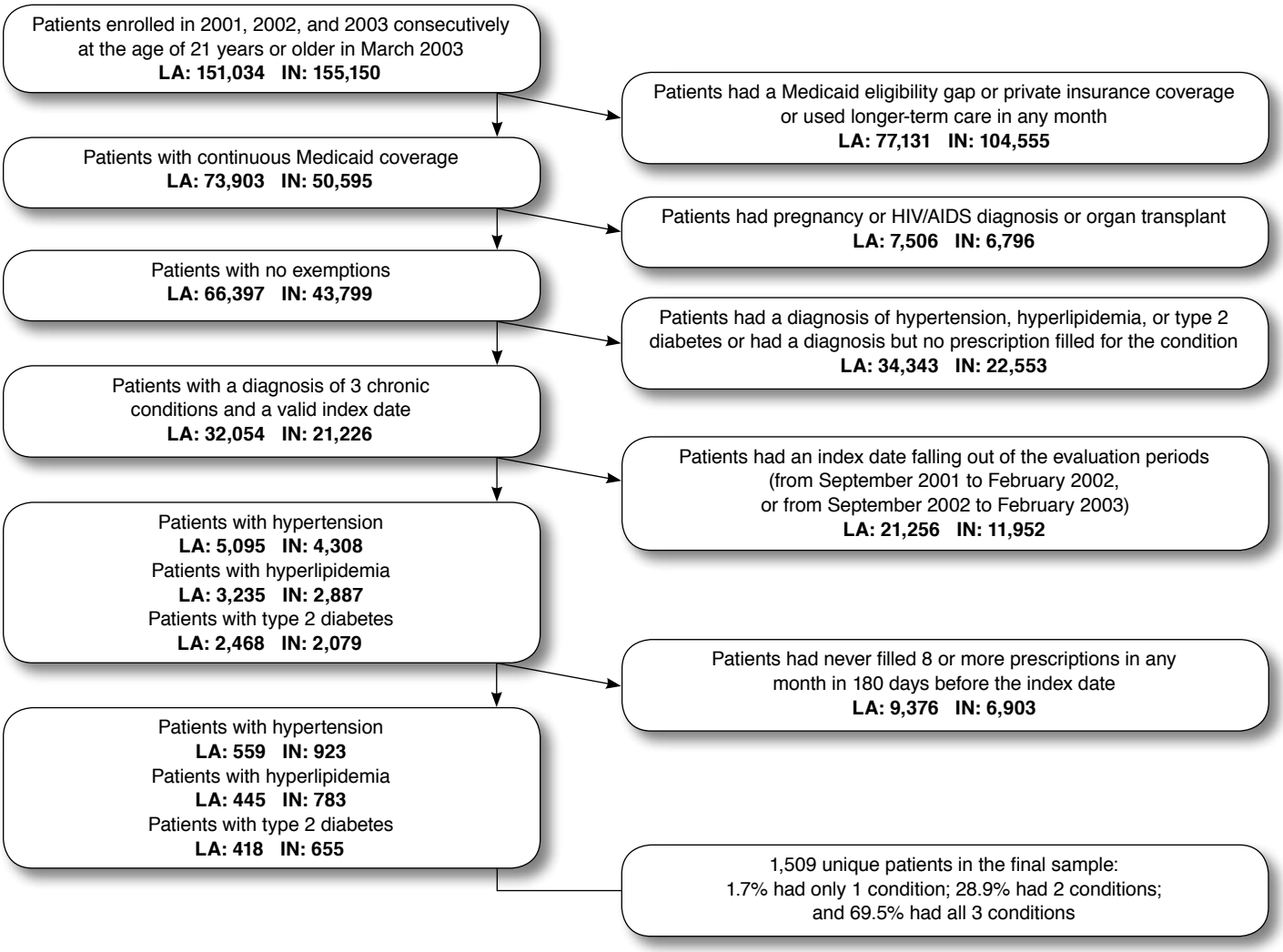
	Pre-Policy Period		Post-Policy Period	
	HR	95% CI	HR	95% CI
State				
IN	Reference	-	Reference	-
LA	0.97	(0.86-1.10)	1.12	(0.90-1.17)
Age				
19-35	Reference	-	Reference	-
36-50	0.95	(0.79-1.13)	0.92	(0.77-1.10)
51-64	0.79**	(0.66-0.94)	0.80*	(0.67-0.96)
Gender				
Male	Reference	-	Reference	-
Female	1.09	(0.96-1.23)	1.06	(0.93-1.94)
Race				
White	Reference	-	Reference	-
Nonwhite	1.39**	(1.23-1.58)	1.40**	(1.23-1.59)
MSA				
Yes	Reference	-	Reference	-
No	0.86*	(0.76-0.96)	0.99	(0.88-1.12)
CCIS	1.04	(1.01-1.07)	1.07**	(1.04-1.09)

**P < 0.05.*

***P < 0.01.*

CCIS = Charlson Comorbidity Index Score; CI = confidence interval; HR = hazard ratio; IN = Indiana; LA = Louisiana; MSA = metropolitan statistical area.

APPENDIX B-1 Sample Size Flow Chart for Sensitivity Analysis



AIDS = acquired immune deficiency syndrome; HIV = human immunodeficiency virus; IN = Indiana; LA = Louisiana.

APPENDIX B-2 Characteristics for Patients Using 8 or More Prescriptions During the Pre-Policy Period

Pre-Policy Cohorts	Hypertension			Hyperlipidemia			Diabetes		
	IN (%)	LA (%)	*P* Value	IN (%)	LA (%)	*P* Value	IN (%)	LA (%)	*P* Value
N	552	363		477	289		389	278	
Age group			0.014			0.042			0.212
19-35	10.7	6.1		10.1	5.5		10.3	7.6	
36-50	47.3	44.4		45.5	43.3		46.3	42.8	
51-64	42.0	49.6		44.4	51.2		43.4	49.6	
Female	71.0	74.7	0.228	71.5	75.4	0.234	71.0	75.5	0.189
Nonwhite	12.7	49.6	<0.001	12.2	45.7	<0.001	14.1	54.3	<0.001
Non-MSA	42.8	39.9	0.399	42.1	40.1	0.586	42.4	39.2	0.407
CCIS (mean)	3.2	3.2	0.759	3.2	3.3	0.395	3.8	3.6	0.505
Post-policy cohorts									
	Hypertension			Hyperlipidemia			Diabetes		
	IN (%)	LA (%)	*P* Value	IN (%)	LA (%)	*P* Value	IN (%)	LA (%)	*P* Value
N	371	196		306	156		266	140	
Age group			0.101			0.026			0.057
19-35	11.1	11.7		10.1	11.5		10.5	13.6	
36-50	48.0	38.8		48.4	35.3		45.1	32.9	
51-64	41.0	49.5		41.5	53.2		44.4	53.6	
Female	75.5	73.0	0.514	74.8	73.7	0.795	76.3	69.3	0.126
Nonwhite	10.0	44.9	<0.001	7.8	42.3	<0.001	10.9	49.3	<0.001
Non-MSA	43.9	40.3	0.406	42.5	44.9	0.625	43.6	41.4	0.673
CCIS (mean)	3.1	3.3	0.317	3.1	3.3	0.516	3.6	23.7	0.582

CCIS = Charlson Comorbidity Index Score; IN = Indiana; LA = Louisiana; MSA = metropolitan statistical area.