The Association Between Pharmacy Closures and Prescription Drug Use: A Retrospective Analysis of Medicaid Prescription Claims in Iowa

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Abstract

Objectives: **The objectives of this study were 2-fold: (1) to examine the association of pharmacy closures with prescription drug use by Medicaid recipients in Iowa; and (2) to evaluate how drug utilization patterns differ between patients whose pharmacies closed and patients whose pharmacies remained open.**

Design: **A 2-group pretest-posttest study of Medicaid enrollees who may have been affected by pharmacy closures. Prescription medication use during the periods preceding and after pharmacy closures was compared. A comparison group was used to account for extraneous factors.**

Patients and Methods: **Sixteen community pharmacies were selected from a pool of pharmacies that closed during 1994; 1092 patients were identified as the main users of these pharmacies, and a comparison group of 3491 patients whose main pharmacies had not closed also was identified. The average number of each patient's prescription claims for the 6 months preceding closing and the 6 months after closing was computed. Multiple regression analysis was conducted to determine whether any association existed between pharmacy closures and the use of prescription drugs.**

Results: **Patients whose pharmacies closed during 1994 had fewer prescription claims after the closings than before the closings. In contrast, patients whose pharmacies remained open had more prescription claims. This difference remains statistically significant after controlling for other factors, such as patient demographics and health status.**

Conclusions: **A decrease in prescription drug use was associated with pharmacy closures. Attention should be directed to patient access to prescription medications in rural areas, as relatively more pharmacies close in rural areas.**

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The growing trend of healthcare system integration defines one of the ways in which healthcare facilities strive to remain financially viable. Some unfortunate ones, however, do not survive. The number of closures of healthcare facilities, primarily hospitals, increased substantially dur-

ing the 1980s, and rural closures continued to occur during the early 1990s.[1] In addition, the number of community pharmacies across the United States decreased sharply throughout the early to middle 1990s.[2] According to the National Community Pharmacists Association, 1363 community pharmacies closed annually during the 6-year period from 1992 through 1997.[2] Most were small, independent pharmacies.[3-7]

The factors underlying these closures are complex, but competition with large regional or national chains has been the major force. Sales of prescription medications constitute the primary revenue source for a typical single-owner community pharmacy. Therefore, when many health insurance companies or managed care organizations offer reimbursement for prescription medications at low rates, margins decline and small, independent pharmacies are driven out of business.[5,6,8] In addition, as some pharmacy benefit managers and insurance plans encourage or force their members to use mail-order pharmacies in an attempt to reduce costs, the customer base of the local pharmacies decreases further.[9]

Traditionally, pharmacies are sites at which patients obtain medications. They comprise the main channel of drug distribution that connects patients with drug therapy. Closure of a local pharmacy is cause for concern, especially when the closure occurs in a rural or frontier area (ie, an even more rural area), where the pharmacy may have been the only source of medical advice and medication. Although no national data on the sites of pharmacy closures are available, Iowa State Board of Pharmacy Data confirms the rural location of many pharmacy closures in Iowa.

To date, the impact of pharmacy closures on patient access and use of prescription medications has been rarely investigated. The goal of the current study is to fill this gap in the literature. The objectives of this study were 2-fold: (1) to examine the association of pharmacy closures with prescription drug use by Medicaid recipients in Iowa; and (2) to evaluate how drug utilization patterns differ between patients whose pharmacies closed and patients whose pharmacies remained open. We hypothesized that pharmacy closures are negatively associated with prescription drug use (ie, after a closure, the use of prescription medications decreases). We also hypothesized that the prescription volume of patients whose pharmacies closed would be relatively larger than that of patients whose pharmacies had not closed.

··· METHODS ···

Study Design

This was a 2-group, pretest-posttest study of Medicaid enrollees in Iowa who may have been affected by pharmacy closures. Study pharmacies were selected from the group of independent community pharmacies that closed during calendar year 1994 in Iowa. Prescription data were collected for the 6 months preceding the study pharmacy's closing month and for the 6 months after closing. To avoid "noise," no prescription data were collected for the month during which closure occurred (ie, prescription volume may not be representative during this transition period). Prescription claims data for the comparison pharmacies were collected for the same time frame as for the corresponding study pharmacies. An average number of prescription claims was computed for each patient of each study pharmacy for the 6 months before and the 6 months after closing. The difference between the 2 periods was taken to indicate the change in prescription quantity.

Sample Selection

Sample selection occurred in 2 stages. First, study and comparison pharmacies were identified. A population of patients for each group was then constructed.

Pharmacy Selection. The sample of study pharmacies was selected so as to permit analysis of 1 pharmacy closure per county in each of the 99 Iowa counties in which a closing occurred. To select the sample, the Iowa State Board of Pharmacy Examiners Licensing records were reviewed to identify pharmacies that had closed during the 1994 calendar year. A total of 33 pharmacies closed in 24 of the 99 counties. In 7 of the 24 counties, more than 1 pharmacy closure occurred. The Medicaid provider file was used to determine which pharmacies in the 7 counties were providers. Five pharmacies that were not Medicaid providers were excluded from the sample. One closed pharmacy in each of the 5 counties that still had more than 1 Medicaid provider was then randomly selected. Similarly, the Medicaid provider file was used to identify which pharmacies in the remaining 17 counties were providers. Six non-Medicaid providers (each in a separate county) were excluded. The final sample of study pharmacies consisted of 16 closures in the 16 counties.

To select comparison pharmacies, the Medicaid prescription claims file was used to identify, by

pharmacy, all patients who patronized each of the 16 study pharmacies within the last 6 months of the closure date. Prescription claims from patients who had at least 1 claim in a study pharmacy were grouped by pharmacy. The Medicaid provider file was analyzed to identify all the pharmacies these patients patronized, including the study pharmacy. A frequency analysis on all the patients' prescription claims was then conducted to determine which pharmacies the patients patronized most frequently, and the most frequently patronized nonstudy pharmacy was selected as the comparison pharmacy. One comparison pharmacy in each of the 16 study counties was selected.

All patients in the study were verified as Medicaid enrollees for the entire 13-month study period. Study patients were defined as individuals having at least 1 claim at the closing pharmacy within the 6 months preceding closure and not receiving other Medicaid prescriptions from other pharmacies. This method identified 1092 patients. The same procedure was used to select the 3491 patients of the comparison pharmacies.

Confounding Factors

In this analysis, which had the goal of determining whether an association existed between pharmacy closures and prescription drug use, patient demographics and health conditions were taken into consideration. To the extent possible, the pharmacy- matching technique was designed to control for population differences between the study group and comparison group. Fifteen of the 16 pairs of pharmacies were in the same county, and most of the comparison pharmacies were only blocks from the corresponding study pharmacy. In addition, because research suggests that drug utilization patterns are associated with differences in demographic characteristics and health status,[10,11] statistical techniques were used to control for within-group variations in these factors.

Statistical Analysis

Multiple regression analysis was used to examine the relationship between pharmacy closures and prescription drug use. Independent variables in the analysis included a pharmacy status indicator (study or closing versus comparison pharmacy); patient demographic characteristics, such as age, sex, and race; and an indicator for patient health condition (change in the number of medical claims). The dependent variable was the change in the number of prescription claims.

The specification of the regression model is as follows:

$$RXCHANGE = \beta_0 + \beta_1 AGE + \beta_2 SEX + \beta_3 RACE + \beta_4 CLOSING + \beta_5 MCCHANGE,$$

where *AGE* is the patient's chronological age at the beginning of the study; *SEX* is a dichotomous variable, with female coded as 1 and male coded as 0; *RACE* is a dichotomous variable indicating racial origin, with white coded as 1 and nonwhite coded as 0; *CLOSING* is an indicator of the status of the pharmacy the patient patronized, with study or closing pharmacy coded as 1 and comparison pharmacy coded as 0; *MCCHANGE* is the change in medical claims, calculated as the pre-post difference in medical claims (ie, the number of medical claims after closing minus the number of medical claims before closing); and the dependent variable, *RXCHANGE,* is the change in prescription claims. *RXCHANGE* was calculated as the pre-post difference in prescription claims (ie, the number of prescription claims after closing minus the number of prescription claims before closing).

··· RESULTS ···

During 1994, 33 pharmacies in Iowa closed. Although no data were available on the volume of prescriptions in these pharmacies, data on the characteristics of the counties in which these closures occurred were obtained (Table 1). The table indicates that 16 of the 33 closures occurred in 8 metropolitan counties in the state, and that the remaining 17 closures took place in 16 nonmetropolitan counties. Almost all the counties in the study experienced 1 or 2 pharmacy closures, but the ratio of closed pharmacies to remaining pharmacies was much higher in the nonmetropolitan counties than in the metropolitan counties (range, 1:2 to 1:13 and 1:18 to 1:37, respectively).

Patient characteristics are shown in Table 2. The study group and comparison group were similar with respect to age and sex, but the racial composition and rurality of the 2 groups' counties of residency differed. In particular, 38% of the patients in the study group and 22% of those in the comparison group were nonwhite. Of these, 97% of the study group patients and 94% of the comparison group were black. In addition, 48% of the study group

Table 1. Pharmacy Closures in Iowa in 1994

County	County Rural–Urban Continuum Code*	No. of Closures	No. of Pharmacies Remaining
Audubon	7	1	2
Chickasaw	7	1	4
Palo Alto	7	1	4
Clay	7	1	5
Buena Vista	7	1	6
Hardin	7	1	8
Kossuth	7	1	8
Delaware	6	2	3
Tama	6	1	4
Bremer	6	1	5
Jackson	6	1	5
Jasper	6	1	9
Wapello	5	1	9
Marshall	5	1	11
Cerro Gordo	5	1	13
Lee	5	1	13
Johnson	3	2	18
Black Hawk	3	2	27
Linn	3	2	45
Woodbury	3	1	18
Dubuque	3	1	23
Scott	2	3	38
Polk	2	3	111
Pottawattamie	2	2	17

*An indicator of the level of rurality of US counties. For metropolitan counties, 0 = central counties of metropolitan areas of 1 million population or more; 1 = fringe counties of metropolitan areas of 1 million population or more; 2 = counties in metropolitan areas of 250,000 to 1 million population; and 3 = counties in metropolitan areas of fewer than 250,000 population. For nonmetropolitan counties, 4 = urban population of 20,000 or more, adjacent to a metropolitan area; 5 = urban population of 20,000 or more, not adjacent to a metropolitan area; 6 = urban population of 2500 to 19,999, adjacent to a metropolitan area; 7 = urban population of 2500 to 19,999, not adjacent to a metropolitan area; 8 = completely rural or fewer than 2500 urban population, adjacent to a metropolitan area; and 9 = completely rural or fewer than 2500 urban population, not adjacent to a metropolitan area.
Adapted from reference 12.

patients and 35% of the comparison group patients resided in nonmetropolitan counties during the study period. Before pharmacy closure, the study group had almost the same mean number of prescriptions filled per patient (10.9) as did the comparison group (11.1).

A model was constructed on the basis of the study population as a whole to determine whether a relationship between pharmacy closure and change in prescription drug use existed after accounting for all important demographic and medical status covariates. As shown in Table 3, after adjustments for the factors listed, the relationship between pharmacy closure and reduction in prescription drug use remained significant. In addition, increasing age, membership in a minority group, and having more medical claims each was associated with increased use of prescription drugs

···DISCUSSION···

Patients whose pharmacies continued to operate used more prescription medications relative to patients whose pharmacies closed, indicating a natural

Table 2. Characteristics of Study Patients and Comparison Patients

	N	Median Age (y)	Percentage Female	Percentage Nonwhite	Percentage Nonmetropolitan Residents	Mean No. of Preclosure Prescriptions Filled per Patient
Study Group	1092	24	67	38	48	10.9
Comparison Group	3491	23	64	22	35	11.1

increase in prescription medication use. In other words, even if no pharmacies had closed, the overall use of prescription medications would have risen over time. However, prescription medication use in the study group actually *decreased*. Given the presence of a comparison group and the application of statistical techniques to control for confounding factors, we are able to conclude that pharmacy closures had an impact on the use of prescription medication. Because the β value in the regression model for pharmacy closure (-.7735) was modest, the magnitude of the clinical/therapeutic effect must be investigated further. A longer study period (eg, 24 months) might describe more comprehensively the relationship between pharmacy closure and prescription drug use.

In addition, use of prescription drugs in the study population tended to increase with age, which is consistent with previous studies,[10,11] and white patients used fewer prescription medications than did minority patients. (Minority was defined as any race other than white.) The literature has described relationships between race and use of prescription drugs. For example, Kotzan et al[13] found that race significantly influences prescription drug use, with white patients receiving more prescriptions for medications than nonwhite patients. Studies by Hahn[14] and by Khandker and Simoni-Wastila,[15] both of which differentiated nonwhites by race (eg, African American, Hispanic, and other), showed that minority patients used fewer prescription drugs relative to white patients. In our study, the majority of minority population was African American (more than 94%). We therefore did not break the minority population down further, which might explain why our results differed from those in the studies we have cited. The Hahn study,[14] however, studied a pediatric population, which could explain the difference. Finally, as in other research,[16] people who had medical claims in this study used fewer prescription medications than did those without medical claims. However, the limitations of using medical claims, rather than severity of illness, as an indicator of health status should be recognized. First, the writing of a prescription does not always result in a medical claim. Second, because a medical claim does not differentiate between acute and chronic medical conditions, counting the number of medical claims also will not make this distinction.

A previous study using the same data examined the possible existence of a relationship between pharmacy closure and days of drug supply per prescription because study pharmacy patients might have purchased more medication with each prescription (ie, their physicians wrote higher days of supply). In other words, the days of supply per prescription might have been higher in the study group than in the comparison group. An examination of the days of supply for both the preclosure and postclosure periods failed to find a difference between the 2 groups. Therefore, using prescription claims as an indicator of the use of prescription drugs was valid.

This study was subject to other limitations. First, we did not investigate the relationship between clinical outcomes and prescription medication use. Second, the lack of data, specifically the lack of information on drug classes, prevented us from considering either disease state or case mix, both of which are important indicators of drug use. As a result, we were unable to use prescription claims as a surrogate for case mix as indepen-

Table 3. Multiple Regression on the Association Between Pharmacy Closing and the Reduction in Prescription Medication Use*

	β	Standard Error†	*t* Statistic	*P*
AGE	0.0078	0.0033	-2.380	.0173
SEX	0.1753	0.1932	-0.907	.3643
RACE	-0.5008	0.2155	2.324	.0202
CLOSING	**-0.7735**	**0.2132**	**3.627**	**.0003**
MCCHANGE	0.2411	0.0174	13.832	.0001

*N = 4537; R^2 = .0453; adjusted R^2 = .0443. Information on race was not available for 46 subjects.
†Significant at the .05 level.

dent variables to calculate a Chronic Disease Score, such as that developed by Von Korff and colleagues.[17] Including data on disease state and case mix in the regression analysis would have better explained changes in prescription drug use and would have improved the R^2 value in this study. Finally, the study used the individual patient as the unit of analysis without testing a clustering effect or intraclass correlation among patients who were using the same pharmacy.

Despite these limitations, the study was significant. Methodologically, it is one of the first to link Medicaid claims data to pharmacy closures, and to explore the relationship between pharmacy closures and the use of prescription medications. Second, the research provides insights into the ways in which patients' health-seeking behaviors change in response to changes in the availability of pharmacy facilities. Finally, the study may shed light on public policy issues that have managed care implications. Medicaid is 1 of 2 large-scale managed care programs sponsored by the federal government. The prescription drug benefit aims to ensure access to drug therapy for millions of Medicaid recipients. If closures of community pharmacies have the effect of cutting off the channels of drug distribution or reducing patient counseling to insufficient degrees, then effective use of prescription medications by this population will be jeopardized. In addition, although we did not observe a statistically significant higher number of pharmacy closures in rural areas than in urban areas, the effect of closures in rural areas would be relatively more severe. Our study findings do imply that the impact of pharmacy closings, whether the result of the impact of managed care systems or of other factors, may create discontinuity in prescription medication use or delay prescription drug acquisition by patients.

··· CONCLUSIONS ···

We observed an association between pharmacy closures and prescription drug use by Medicaid recipients in Iowa. Although analysis of the comparison population predicted that prescription drug use would increase during the 6 months after pharmacy closing, those whose pharmacies closed obtained fewer prescriptions. One might therefore expect patient access to prescription medications will decrease when a pharmacy closes. Both the duration of this period of prescription drug use decrease and the impact of an absence of pharmacotherapy on patient health are important issues for future research.

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