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A Cost Analysis of the Iowa Medicaid Primary Care Case Management Program

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Objective. To determine the cost savings attributable to the implementation and expansion of a primary care case management (PCCM) program on Medicaid costs per member in Iowa from 1989 to 1997.

Data Sources. Medicaid administrative data from Iowa aggregated at the county level.

Study Design. Longitudinal analysis of costs per member per month, analyzed by category of medical expense using weighted least squares. We compared the actual costs with the expected costs (in the absence of the PCCM program) to estimate cost savings attributable to the PCCM program.

Principal Findings. We estimated that the PCCM program was associated with a savings of $66 million to the state of Iowa over the study period. Medicaid expenses were 3.8 percent less than what they would have been in the absence of the PCCM program. Effects of the PCCM program appeared to grow stronger over time. Use of the PCCM program was associated with increases in outpatient care and pharmaceutical expenses, but a decrease in hospital and physician expenses.

Conclusions. Use of a Medicaid PCCM program was associated with substantial aggregate cost savings over an 8-year period, and this effect became stronger over time. Cost reductions appear to have been mediated by substituting outpatient care for inpatient care.

Key Words. Cost, Medicaid, case management, managed care

Caught between rising costs and limited budgets, state Medicaid programs have been turning to managed care (Freund and Hurley 1995; Cagey 2000). A central feature of managed care plans is their use of mechanisms to reduce expenditures. Examples of mechanisms to control costs include primary care case management (PCCM), a form of gatekeeping, to improve the coordination of care and eliminate use of unnecessary services, restrictions on access to services via administrative methods, such as use of prior authorization pro-

grams or limited formularies, and physician risk sharing arrangements, such as capitated payment methods (Eisenberg 1986; Blumenthal 2001). Reliable, accurate information on the relationship between the methods used by Medicaid managed care programs and program costs is critically important to policy makers. However, the cost effect of managed care methods in the Medicaid setting remains an important yet unresolved issue for public policy makers (Provost and Hughes 2000).

The focus of our study is the cost savings attributable to the implementation and expansion of one particular type of managed care intervention, the use of a PCCM program. Although PCCM programs are a common feature of managed care plans, their effect on costs in both Medicaid and private sector settings remains controversial (Lawrence 2001). In theory, PCCM programs might reduce expenses as a result of the gatekeeper's ability to improve the coordination of care and reduce unnecessary health care utilization (Eisenberg 1985). On the other hand, there might be offsetting cost increases if access to (and utilization of) primary care is increased. It is also unknown whether the effects of a PCCM program change over time, as gatekeepers and program administrators become more proficient in their roles.

We hypothesized that an increase in the share of Medicaid patients who were enrolled in a PCCM program would be associated with a decrease in the overall cost per member per month for Medicaid enrollees, and that this cost savings would increase over time, as physicians and program administrators became more experienced in operating the program. Consistent with theoretical predictions concerning the effects of gatekeeping, we expected the PCCM program to shift the locus of care, with a decrease in the cost per member per month for hospital and emergency room services, and an increase in costs for ambulatory and primary care services. To examine our hypotheses, we used longitudinal statewide data from the Iowa Medicaid program.

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THE IOWA EXPERIENCE

The Iowa PCCM program, known as the Medicaid Patient Access Service System (MediPASS), was introduced July 1, 1990 after obtaining a demonstration project waiver from the Health Care Finance Administration (HCFA). MediPASS relied on general practitioners, family practitioners, general internists, obstetrician-gynecologists, and pediatricians to act as primary care case managers. Physician case managers were paid $2 per month per enrollee, with a limit of 1,500 enrollees per case manager. Physician case managers had to approve all visits to the emergency room and referrals to specialists. The intent of the program was to improve the coordination and continuity of care, reduce unnecessary specialty and emergency room care, and shift care from the emergency room and hospital setting to the clinics.

During the study period, each county offered a combination of the traditional fee-for-service program, the MediPASS program, or a health maintenance organization (HMO) option. While the fee-for-service program was available in every county throughout the study period, MediPASS and HMO availability differed across counties, depending on private insurers' ability to establish a network of participating providers in that county to offer an HMO option. MediPASS was initially available in seven counties, but expanded to 82 of the 99 Iowa counties by the end of the study period. Of the 82 counties that participated in MediPASS by the end of the study period, 42 also offered an HMO option (Table 1). Two counties offered an HMO option, but did not participate in MediPASS. Thus, by the end of the study, most counties had

Table 1: Summary of Managed Care Options by County Type and Year

	Fee-for-Service Only		*PCCM Only*		*PCCM and HMO*		*HMO Only*	
Year	*Nonmetro*	*Metro*	*Nonmetro*	*Metro*	*Nonmetro*	*Metro*	*Nonmetro*	*Metro*
1991	77	15	2	4	0	1	0	0
1992	77	15	2	4	0	1	0	0
1993	77	15	2	3	0	2	0	0
1994	21	3	50	8	8	9	0	0
1995	14	2	38	1	26	16	1	1
1996	13	2	39	1	26	16	1	1
1997	13	2	39	1	26	16	1	1
1998	13	2	39	1	26	16	1	1

The designations nonmetro and metro correspond to the USDA Economic Research Service county typology for Iowa.

PCCM, primary care case management; HMO, health maintenance organization; USDA, U.S. Department of Agriculture.

multiple options available to Medicaid enrollees. Enrollees could either select a health plan available in their county, or else they were randomly assigned to a plan. Enrollment in MediPASS or an HMO was limited to participants eligible through what was then called the Aid to Families with Dependent Children (AFDC) program, now referred to as the Temporary Assistance for Needy Families program (TANF).

Because of the changing patterns of availability of the MediPASS and HMO options, each county's mix of patients enrolled in the fee-for-service, PCCM, and HMO options changed over time. As of June 30, 1995, there were 153,098 individuals in the state who were eligible for enrollment in the three plans. Of these, PCCM enrollment was 72,189, HMO enrollment was 26,616, and traditional fee-for service enrollment was 54,293. All three options paid physicians on a fee-for-service basis, with no risk sharing arrangements. The fee schedules were similar across the three types of plans.

METHODS

To estimate the cost effects of the MediPASS program on different categories of medical resources, we used a cross-sectional time series (panel data) analysis using weighted least squares with the county as the unit of analysis (Greene 1997). Our study was restricted to Medicaid enrollees eligible to enroll in MediPASS or HMO plans. We excluded children younger than 1-year old because large differences in aggregate costs can result from even one poor birth outcome, and we felt these cost differences were not related to the subject's Medicaid plan. After defining the eligible population of individuals, we aggregated individual claims to the county level based on the subject's county of residence for each month of the study. This resulted in 9,504 (99 counties $\times$ 96 months) observations over the study period (July 1, 1989 through June 30, 1997).

For each eligible individual, we estimated the direct costs of medical resource utilization in each month. We identified and measured resource use by examining Medicaid claims. We identified the type and quantity of medical resources used in different cost categories. To assign dollar amounts to each resource consumed, we used the Medicaid allowed charge for that item or event. We summed the costs of items in each cost category to obtain the cost per subject per month for MediPASS and FFS enrollees.

The relationship of interest is that between MediPASS activity and health care resource usage. As MediPASS might not be expected to affect use

of all resources uniformly, we divided resource use into the following eight categories:

- inpatient care
- outpatient care
- physician services
- radiology and laboratory services
- pharmaceuticals
- dental care
- special services requiring approval of the physician case manager (e.g., medical supplies, home health care)
- and special services outside the scope of the PCCM program (e.g., optometric, chiropractic, family planning services).

We estimated separate regression models for each category of resources using the same estimating method and model specification. The dependent variable for all but one of the regressions was the cost per non-HMO Medicaid enrolled person for services in the appropriate resource category. The one exception was pharmaceutical costs; payment for medications was not included in the Medicaid HMO contract, so all pharmaceutical claims were made on a fee-for-service basis. Owing to the difficulty of separating HMO from non-HMO enrollees in the Medicaid pharmaceutical claims database, we used the cost per Medicaid enrollee for the pharmaceutical cost analysis.

We estimated the following equation for each of the $j = 1, 2, \ldots, 8$ cost categories:

$$C_j = \alpha_j + \beta_{1j}\text{MediPASS} + \beta_{2j}\text{HMO} + \beta_{3j}\text{Time} + \beta_{4j}\text{Patient} + \beta_{5j}\text{County} + \varepsilon_j$$

Observation subscripts for county and month were omitted for notational convenience. C_i is the per-enrollee cost for resource category j. Right-hand side factors represent categories of explanatory variables and their associated parameter vectors. We hypothesized that five categories of explanatory variables influenced costs. The first category encompassed variables designed to model the direct effect of the MediPASS program. These variables included a dummy variable indicating whether MediPASS was available for the observation month and county, the share of the county's Medicaid patients in the MediPASS program, share squared to account for nonlinear effects, the duration of the MediPASS program in the county measured in months, and the

interaction of MediPASS share with the duration of the program in the county. HMO effects, the second category of explanatory variables, was modeled using the share of Medicaid patients in the HMO plan and the share squared. We used these two variables to account for possible bias in HMO enrollment. Because we are interested in Medicaid costs related to MediPASS recipients we did not model the HMO effects further. Third, time, linear, and nonlinear effects to control for temporal changes in costs, were also included. Fourth, we adjusted the model for patient population factors utilizing gender and age distribution. County effects, the final category of explanatory variables, were measured as dummy variables to control for unobserved county-level effects. We considered including specific county-level covariates, such as population morbidity, health status, and the supply of health care resources, but opted against this approach due to concerns over the lack of theoretical and empirical guidance concerning the selection of specific covariates. We were also concerned about the high likelihood of both significant collinearity among available predictors and the likelihood of an omitted variable bias from excluding covariates that are important but not available. The inclusion of county-level dummy variables attempts to incorporate unexplained variation occurring across counties, however some changes that occurred during the study period were still unaccounted for in the model. Using dummies also prevented us from determining the "active ingredient" that influenced costs at the county level.

After observing the data distribution across county and time, we included a variable to indicate whether the observations occurred during fiscal year 1992. During this year there was a sharp increase in costs across all categories. We were unaware of any explanation for this increase. To avoid confusion with the PCCM effects, we utilized this variable to remove variance associated with fiscal year 1992.

Explanatory variables were identical across the eight resource categories, with the exception of the regression to determine pharmacy costs. The pharmacy regression included variables for the total TANF enrolled population, not just those in Medicaid managed care. All dependent and independent variables are described in Table 2.

Observations were weighted by the number of non-HMO Medicaid enrollees within the county for all but the pharmaceutical cost analysis. For that regression, the weights were the total number of Medicaid enrollees in the county.

The principal question was whether the MediPASS program had a significant influence on each category of Medicaid costs. As the regressions included five variables to represent the MediPASS effects, tests of individual

Table 2: Variable Names and Descriptions

Variable	*Description*
Time variables	
Time	A value, ranging from 1–72, representing the month of the study period
Time squared	The time variable squared
FY1992	A factor that accounts for a one year increase in costs and allows this increase not to be confused with the PCCM program effects
Patient variables	
Proportion age 1–4 years	Proportion of Medicaid non-HMO enrolled population age 1–4 years
Proportion age 5–14 years	Proportion of Medicaid non-HMO enrolled population age 5–14 years
Proportion age 21–25 years	Proportion of Medicaid non-HMO enrolled population age 21–25 years
Proportion age 26–44 years	Proportion of Medicaid non-HMO enrolled population age 26–44 years
Proportion age 45–49 years	Proportion of Medicaid non-HMO enrolled population age 45–49 years
Proportion age 50 years and older	Proportion of Medicaid non-HMO enrolled population age older than 50 years
Gender	Proportion of non-HMO enrolled females in the county
County variables	A set of variables representing the counties and controlling for county-level effects, such as urban–rural status or physician supply
HMO variables	
HMO share	The proportion of recipients in the county enrolled in an HMO
HMO share squared	HMO share value squared
MediPASS Program variables	
Program	Valued at 1 if the county was in the PCCM program and 0 if it was not
Program share	Proportion of non-HMO enrollees in the county enrolled in the PCCM program
Program share squared	Program share squared
Program time	Number of months the county has been in the PCCM program
Program time × MediPASS share	Interaction between program share and program time
Dependent variable	
C_1—Inpatient services	Any care received during a hospital stay
C_2—Outpatient services	Any care received on an outpatient basis from a hospital
C_3—Physician services	Any care provided by a physician
C_4—Laboratory and radiological	All laboratory and radiological procedures billed on a separate claim
C_5—Pharmaceutical	All prescription drugs that were dispensed by a pharmacy
C_6—Special services requiring physician approval	Services that do not fit one of the above categories but required approval by the patient manager. All claims with provider categories of medical supplies, pediatric services, and home health care.
C_7—Special services not requiring physician approval	Services that are unrelated to managed services. All claims with provider categories of optometric, chiropractic, family planning, and EPSDT services
C_8—Dental care	Services provided by a dentist

PCCM, primary care case management; HMO, health maintenance organization.
EPSDT, Early and Periodic Screening, Diagnostic and Treatment.

coefficients are of less interest than the set of all five coefficients within a single regression. Accordingly the analysis included partial *F*-tests to establish whether the parameter estimates for the PCCM program variables, taken as a group, were significantly different from zero.

To estimate the cost savings in each cost category resulting from the PCCM program over the study period, we used the following formula:

$$\text{Cost savings} = (\text{predicted costs in the absence of the PCCM program}) - (\text{actual costs}) - (\text{PCCM administrative costs})$$

Predicted costs were computed from the regression results. For each observation, the predicted value was computed after setting the five MediPASS variables to zero but holding other right-hand-side variables at their observed values. That simulates what costs would have been in the absence of the PCCM program. The resulting projected per-Medicaid enrollee cost was then multiplied by the number of Medicaid patients in the county and those results were summed over counties, months, and resource categories.

Measures of actual costs and administrative costs were obtained from state records. Actual costs are statewide, annual total expenditures for Medicaid patients. Administrative costs include the payments to the physician case managers. All analyses were performed using SPSS (1998).

RESULTS

The multivariate regression results suggest that the MediPASS program shifted the distribution of program expenses away from the hospital and towards the outpatient setting. Greater MediPASS enrollment shares were associated with significant decreases in costs for inpatient care, physician services, laboratory and radiology services, and special services requiring a physician's approval (Table 3). In contrast, a greater MediPASS share was associated with increasing cost for outpatient care, pharmaceuticals, and special services not requiring a physician's approval. Seven of the eight cost functions had significant *F*-tests, rejecting the null hypothesis that the MediPASS program did not influence costs. Not surprisingly, the only resource category not affected by the MediPASS program was dental costs, which was outside the scope of the MediPASS program.

The results for the interaction term reflecting the share of the MediPASS program and program duration indicated that the cost reducing effects of the MediPASS program increased over time. This result held for inpatient care,

Table 3: Regression Coefficients and *F*-test Results for the Eight Service Categories

Variable	*Inpatient Care*	*Outpatient Care*	*Physician Services*	*Lab and Radiologic Services*	*Pharmaceuticals*	*Special Services Requiring Physician Approval*	*Special Services Not Requiring Physician Approval*	*Dental Care*
Time effects								
Time	0.69*	0.27*	−0.01	0.01*	0.06*	0.05*	0.01*	0.00
Time squared	−0.01*	0.00	0.00	0.00*	0.00	−0.00	0.00*	−0.00
FY1992	4.30*	4.84*	3.53	0.12*	1.70*	0.19	0.36*	1.03*
Patient effects								
Proportion age 1–4 years	95.84*	2.22	8.26	0.11	0.00*	−9.41*	−0.22	−3.47
Proportion age 5–14 years	79.02*	9.79	−7.79	−0.88*	−0.00	−8.78*	2.72*	0.61
Proportion age 21–25 years	23.69	41.37*	9.76	0.79	−0.00	−0.78	−0.89	−3.14
Proportion age 26–44 years	−41.77	8.62	−8.87	−0.86	−0.00	−17.62*	0.86	3.53
Proportion age 45–49 years	−250.05	−15.77	−55.46*	0.67	0.00	−60.23*	3.19	2.10
Proportion age 50 years and older	−135.64	−141.82*	−64.64*	−5.29*	−0.01*	−2.00	2.61	−15.54
Gender	98.95*	2.92	9.77	−0.30	−0.00	0.69	5.73*	−1.46
HMO effects								
HMO share	−53.86*	1.33	−1.93	−0.28	−1.05	19.50*	−2.73*	1.18
HMO share squared	70.01*	−11.73	0.31	0.72*	−2.19	−14.39*	6.70*	30.34*
PCCM program effects								
Program	2.25	−0.09	1.73*	0.06	−0.59	−0.01	-0.12	0.31
Program share	−44.23*	11.61*	−12.63*	−1.32*	6.72*	−4.05*	1.4*	−0.28
Program share squared	49.87*	−17.64*	10.95*	1.33*	−7.76*	6.77*	−1.78*	−0.25
Program time	0.52*	−0.01	0.01	0.02*	−0.04*	0.08*	0.02*	−0.00
Program time × MediPASS share	−0.74*	−0.01	−0.01	−0.03*	0.04	−0.16*	−0.02*	0.00
Group *F*-test for PCCM effects	5.07*	14.56*	27.73*	86.15*	12.34*	21.00*	15.24*	0.74
Adjusted R^2	0.23	0.48	0.41	0.78	0.57	0.54	0.60	0.65

*Coefficients significant at 5% level.

PCCM, primary care case management; HMO, health maintenance organization.

laboratory and radiology, and both special services categories. Thus, for some resource categories, the MediPASS program appeared to slow down the overall temporal trend of increasing costs to a greater extent the longer the program was in place.

Patient population demographics within a county influenced costs. A greater percent of Medicaid enrollees who were younger (ages 1–14) increased hospital costs, and a greater percent of older enrollees (age >45) decreased the cost of physician services. Outpatient care was increased by a greater percentage of patients in the 21–25 age range, and decreased by a greater percentage of patients over 50.

Increases in the percent of patients enrolled in an HMO were associated with "spillover" effects on the costs per member per month for the non-HMO enrollees. Increases in HMO penetration decreased the cost per month for inpatient care and special services not requiring physician approval, and increased costs for special services requiring physician approval. These effects could be the result of selection bias such that enrollees requiring more services chose the HMO option. However, within managed care we would anticipate that the HMO selection bias would result in healthier enrollees choosing the HMO, not those who are less healthy.

Dummy variables reflecting the counties were significant in all regressions, as measured by partial F-tests for the set of all coefficients. These county effects collectively explained the largest amount of variation in costs (results not shown). Thus, county-level characteristics not directly measured by our set of explanatory variables, such as patient and provider characteristics, were the most important determinants of cost.

Based on our comparison of actual versus predicted costs, we estimate the MediPASS program reduced statewide Medicaid expenditures by \$66 million over the 8 years of this study (Table 4). This represents a savings of approximately 3.8 percent of total Medicaid expenditures during the study time period. Even though the cost of some resource categories increased with the growth of MediPASS, offsetting reductions in other categories (e.g., inpatient care, physician expenses) lead to a net cost savings.

DISCUSSION

The results of this study are consistent with the hypothesis that PCCM leads to decreases in total health care costs. Our study indicates significant reductions in Medicaid expenses associated with the growth of the MediPASS program,

Table 4: Total Program Cost Savings

Year	*Predicted Costs*	*Actual Costs*	*Administrative Costs*	*Projected Savings (Dollars)*	*Projected Savings (% of Predicted)*
1991	165,860,726	162,669,920	763,460	2,427,346	1.5
1992	233,605,150	230,103,360	1,286,596	2,215,194	0.9
1993	193,507,748	186,786,592	1,750,570	4,970,586	2.6
1994	209,009,588	197,841,740	2,558,626	8,609,222	4.1
1995	201,967,092	187,942,605	3,459,101	10,565,386	5.2
1996	198,336,858	185,174,078	2,163,184	10,999,596	5.5
1997	190,733,281	180,051,877	2,110,663	8,570,741	4.5
1998	182,933,972	163,310,188	1,644,379	17,979,405	9.8
Total	1,727,931,684	1,645,863,629	16,051,885	66,016,170	3.8

even after accounting for administrative expenses. We observed significant decreases in inpatient and physician services costs, and increases in outpatient care and pharmaceutical expenses. This pattern suggests that the program was successful in changing the location of medical care delivery from the inpatient to the outpatient setting, with a substitution of medications and clinic visits for hospital services. This pattern is consistent with the expected effects of a PCCM program. In addition, the effect of the MediPASS program became stronger over time. These effects were significant after controlling for temporal trends in cost, patient population differences, county level effects, and HMO penetration.

Our results provide insights into other factors that affect Medicaid costs. Patient population demographics and county level differences captured in our dummy variables are important determinants of cost. While the county-level dummy variables reflect differences that we could not otherwise measure (e.g., supply of medical resources, physician practice patterns, health status, patient preferences), the patient demographic variables indicate that in general, younger Medicaid patients are cost increasing and older Medicaid patients are cost decreasing.

The results for the effects of increases in HMO enrollment on our cost measures provides indirect evidence concerning whether HMO plans selectively enroll sicker or healthier patients. If HMOs are selectively enrolling healthier patients, then we would expect the coefficient on the effects of HMO penetration on MediPASS costs to be positive—that is, as lower cost, healthier patients are enrolling in HMOs, the relatively sicker patients enrolled in the MediPASS program will increase its costs per member per month. In contrast, a negative coefficient for greater HMO share indicates that as HMO enrollment increases, costs from the PCCM enrollees were declining.

The coefficients on the HMO penetration differ across cost categories, suggesting that the selection effects of HMOs on MediPASS costs are complicated. For "special managed care service," a category that includes items not routinely paid for by HMOs (e.g., family planning and enhanced services), greater HMO penetration is selectively leaving people in the MediPASS program who have a greater risk of using these services. The negative coefficient for inpatient costs is consistent with HMOs selectively enrolling patients more likely to use inpatient services, thereby reducing the inpatient costs of MediPASS enrollees.

We found that an increase in the MediPASS share was related to increased expenses for outpatient care, pharmaceuticals, and special services not requiring physician approval. This is not surprising, as the program was intended to shift the location of care from the inpatient to the outpatient setting. Likewise, increases in pharmaceutical costs may represent an effort to substitute pharmaceuticals for other health care resources, greater detection and treatment of problems as a result of more outpatient visits, or differences in patient or physician characteristics.

Cost increases in some categories were more than offset by larger cost decreases in other categories. The pattern is also consistent with the intended effects of MediPASS to reduce emergency room utilization, hospital admissions, and consultation with specialists. Unfortunately, our data do not allow us to distinguish between primary care and specialty physician payments, so we cannot determine if the PCCM program led to a different mix of treating physicians.

We have attempted to overcome the limitations of previous efforts to estimate the effects of a PCCM program on costs by adopting a statewide perspective to reduce the likelihood that hidden differences in patient characteristics may be responsible for cost differences. We also examined the distribution of costs across different categories of resources for the entire Medicaid population in a longitudinal framework, controlling for unobserved differences across counties.

Previous research has shown mixed results concerning the cost effects of PCCM programs in both private sector and Medicaid settings. Researchers have demonstrated decreases in costs associated with PCCM programs (Martin et al. 1989; Rask et al. 1999; Ferris et al. 2001a), while others have found little effect, or even cost increases (Schoenman, Evans, and Schur 1997; LoSasso et al. 2000; Escarce et al. 2001; Ferris et al. 2001b). However, many of these studies have been limited by a small sample size, limited program duration, inability to measure the cost shifting away from inpatient and towards

outpatient care that one would expect, and a lack of adequate theoretical and statistical methods. Many previous studies examining the effects of gatekeeping have been done on privately insured patients, as opposed to the Medicaid population, which is the focus of our paper. In addition, studies using observational data at the level of the individual patient might be biased due to unobserved differences in patients' health status that might account for cost differences.

This study has several limitations. We report the experience in one state, so we do not know if PCCM programs have the same effect on costs in other settings. All HMOs in Iowa are open panel or IPA models, with no closed model HMOs. Different models of HMO organization may lead to different results. In addition, we were not able to measure any effects of MediPASS on the quality of care. Although we do not have a reason to think that cost reductions lead to differences in quality, the issue merits further study. The data are retrospective (1989–1997); other changes in the health care system at that time could affect how it might operate in some states currently. The time period chosen, however, was related to the start up period of the PCCM program and lends important information about both the implementation and expansion periods of the program. In addition, we are unable to determine whether selection bias exists as individuals choose to enter the HMO. Before completing the study we were most concerned that HMOs would successfully market to the more healthy individuals resulting in "cream skimming." However, the results indicate that as HMO share increases MediPASS costs decrease, suggesting that HMOs are not taking the healthiest individuals. Further research is required to determine exactly what selection bias may exist in the current system. Finally, we did not estimate a multi-equation system; therefore, we were unable to determine whether there were cross effects from one service type to another. For example, we do not know whether a decrease in inpatient costs might have been related to a decrease or increase in outpatient costs.

Further research is necessary to determine the mechanisms and degrees of behavior change by providers and patients in a PCCM system that lead to cost savings. Are physicians significantly altering their care provision and referrals once they are identified as the patient's primary care case manager? Are patients altering their care-seeking behavior, particularly their use of the emergency room for nonemergent conditions? Or is it primarily the identification of a primary care provider for a person who did not previously have one that creates most of the change?

In addition, as the county dummy variables explained the greatest proportion of the variance within the models, further research should focus on

specific county-level factors that predict the successful implementation of managed care. In Iowa, each county needed a sufficient number of providers who would act as "gatekeepers" before instituting the MediPASS program. What characteristics of the county may predict whether a sufficient number of providers exists would be important, particularly to states and counties working to identify areas that would be able to implement a managed care program.

Our study addresses an important public policy question. As states rely on managed care to control costs, it is important to understand the forces influencing the costs of care. We found evidence that a program designed to improve coordination of care and reduce unnecessary resource utilization, as decided by physician gatekeepers, significantly changed where and how care was delivered. More importantly, it changed the distribution of costs and reduced overall costs compared with what aggregate costs would have been without the program. Although the percentage reduction in costs was not large, the net savings increased over time, and on a statewide basis, the magnitude of the savings was substantial.

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