Managed Care and Preventable Hospitalization among Medicaid Adults

Jayasree Basu, Bernard Friedman, and Helen Burstin

Objective. The study examines the association between managed care enrollment and preventable hospitalization patterns of adult Medicaid enrollees hospitalized in four states.

Data Sources/Study Setting. Hospital discharge data from the Healthcare Cost and Utilization Project (HCUP) database of the Agency for Healthcare Research and Quality (AHRQ) for New York (NY), Pennsylvania (PA), Wisconsin (WI), and Tennessee (TN) residents in the age group 20–64 hospitalized in those states, linked to the Area Resource File (ARF) and American Hospital Association (AHA) survey files for 1997.

Study Design. The study uses separate logistic models for each state comparing preventable admissions with marker admissions (urgent, insensitive to primary care). The model controls for socioeconomic and demographic variables, and severity of illness.

Principal Findings. Consistently in different states, private health maintenance organization (HMO) enrollment was associated with fewer preventable admissions than marker admissions, compared to private fee-for-service (FFS). However, Medicaid managed care enrollment was not associated with a reduction in preventable admissions, compared to Medicaid FFS.

Conclusions. Our analysis suggests that the preventable hospitalization pattern for private HMO enrollees differs significantly from that for commercial FFS enrollees. However, little difference is found between Medicaid HMO enrollees and Medicaid FFS patients. The findings did not vary by the level of Medicaid managed care penetration in the study states.

Key Words: Preventable hospitalization, ambulatory care sensitive admissions, Medicaid, managed care, HMO enrollment, access

Despite the rapid growth in Medicaid managed care (MMC) during the 1990s, there are limited data about the impact of managed care on Medicaid beneficiaries. Although managed care has been shown to improve access to primary care in some communities (e.g., Mitchell et al. 2002), its effect on a Medicaid population may depend on constricted levels of funding and other factors. Studies indicate that MMC may have major differences from commercial managed care (Institute of Medicine 2000). Compared with

privately insured persons, those under Medicaid are far more vulnerable, have less access to nonmedical services (e.g., transportation to clinic, provision of child care, translation services, and so on), and their experience and capacity to exercise choices are more limited. Based on patient surveys, MMC enrollees were found to be more likely than low-income privately insured managed care enrollees to be poorer, have health problems, and experience access problems (Lillie-Blanton and Lyons 1998). In general, the literature on Medicaid managed care access, utilization, quality, and patient outcome and satisfaction shows mixed results (Rowland et al. 1997). However, results to date have been sufficiently negative to raise some concerns about access to care of these enrollees (Miller 1998).

In this article, we will analyze the effects of managed care enrollment on Medicaid enrollees hospitalized in four states. We will address, by examining the hospital admission patterns for preventable conditions, whether managed care differentially impacts access to primary care between Medicaid and commercially insured patients. The preventable conditions, alternatively known as ambulatory care sensitive (ACS) conditions, are used often to measure access to primary care (Bindman et al. 1995; Homer et al. 1996). A higher hospitalization rate from these conditions may suggest less primary and preventive care before hospitalization. Preventable hospitalization rates derived from hospital discharge data are often used as indicators of primary care access. Several studies in the past have examined the predictors of admissions rates for these conditions (e.g., Weissman, Gatsonis, and Epstein 1992; Billings et al. 1993).

Preventable hospitalizations are an emerging focus of interest, especially on the part of state Medicaid programs. States are increasingly enrolling their Medicaid population into managed care with the hope that MMC will provide enrollees with a medical home where sufficient preventive and primary care will be available (Long and Coughlin 2001), and the use of costly services such as inpatient care or emergency rooms will be subsequently reduced. Because health maintenance organizations (HMOs) have been known to focus more

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resources than other health plans on preventive care (Miller and Luft 1994), it can be hypothesized that HMOs would reduce the use of hospitals for preventable conditions. The hypothesis has been validated in a number of studies. For example, a recent study of New York children found that an increase in the penetration of private managed care in a community was associated with a reduction in ACS admission rates in 1994 (Friedman and Basu 2001). Another study using time series data reached the same conclusion for adults in California (Backus et al. 2002).

However, there are limited data on preventable hospitalizations among Medicaid enrollees. Several studies reported a weak association between managed care enrollment and ACS hospitalization among Medicaid children (Gadomski, Jenkins, and Nichols 1997; Long and Coughlin 2001). The effect of MMC on preventable admissions among adults has not been sufficiently investigated. A recently completed study on New York adults (Basu, Friedman, and Burstin 2002) provides some evidence that the managed care did not have the expected effect on preventable admissions for this group. However, at the time of the study (1995) Medicaid managed care was still in its early stage of implementation in New York (Cantor, Haslanger, and DeGuire 2000).

This study will focus on HMO enrollment among adults enrolled in the Medicaid program in 1997 in four states. By 1997, more than one-quarter of the Medicaid population in 40 states and Washington, DC, were enrolled in managed care. The states, New York, Pennsylvania, Wisconsin, and Tennessee, were selected to represent different levels of MMC penetration in 1997 as well as varying program characteristics (Table 1). Tennessee had full MMC enrollment, and comparisons to fee-for-service (FFS) Medicaid could not be performed. However, this state was included because it added power to the comparisons with the privately insured. We specifically examined whether HMO enrollment was associated with a decline in preventable admissions for Medicaid enrollees, who usually exhibit higher rates of such hospitalizations. Many important research questions distinguish between FFS and those covered by managed care contracts. In this study, we examined the following questions: (1) Does HMO enrollment reduce the likelihood of preventable admissions for Medicaid enrollees? (2) Does HMO enrollment have a greater or lesser impact on preventable admissions in the Medicaid population than in the privately insured population?

To address these questions, we assessed the association between preventable hospitalization and the types of insurance coverage among nonelderly adults, controlling for various patient and county characteristics.

Table 1: Medicaid Managed Care Plan Type and Penetration Rates by State, 1997

	*Number of Plans by Type**					*Managed Care Penetration (%)***	
	Comprehensive MCO	*Medicaid Only*	*PHP*	*Other*	*PCCM*	*Full Risk*	*PCCM*
New York	21	17	8	2	1	27	1
Pennsylvania	5	5	3	0	2	39	16
Wisconsin	18	3	6	2	0	48	0
Tennessee	9	0	2	0	0	100	0

*Data reported as of June 30, 1998.

Source: http://www.cms.hhs.gov/medicaid/managedcare/plantyp8.pdf. Definitions of plan types can be found at http://www.cms.hhs.gov/medicaid/managedcare/nsglos99.pdf

PHP = Prepaid Health Plan

PCCM = Primary Care Case Management

MCO = Managed Care Organization

**Percent of Medicaid enrollment, reported as of June 30, 1997.

Source: http://newfederalism.urban.org/html/occa26.html. Managed care data do not include mental health, dental, transportation, home or community-based waivers, or other limited service programs. Full-risk HMO plans are fully capitated for a comprehensive set of services (they typically include comprehensive MCOs and Medicaid-only MCOs).

We provided comparisons of preventable hospitalizations with other admissions by using a multivariate cross-sectional framework with patient-level data for each state. Some previous studies analyzed variations across individuals (e.g., Weissman, Gatsonis, and Epstein 1992; Culler, Parchman, and Przybylski 1998). The present study took a different approach and examined the determinants of admission pattern for preventable conditions in comparison to a control group of conditions. Preventable admissions are compared with admissions for "marker conditions," which are more urgent in nature but not preventable by ambulatory care. These conditions have been defined as diagnoses for which provision of timely and effective ambulatory care immediately before admission will likely have little impact on the need for hospital admission (Billings et al. 1993). Since marker admissions should be insensitive to primary care, they provide an appropriate comparison group (Basu and Clancy 2001) for preventable admissions. By restricting to a specific comparison group, the study will offer less sensitivity to the impact of particular areas with an unusual mixture of admissions (Basu, Friedman, and Burstin 2002).

Conceptual Hypothesis

The utilization of preventive services and timely primary care for acute conditions should strongly influence the likelihood of hospital admission for the narrowly defined class of preventable admissions. The actual use of ambulatory care cannot be directly measured in this study. Instead, it is possible to measure some variables likely to be correlated with use of ambulatory care. Among the factors determining demand and supply of these services, this study is particularly focused on insurance coverage and the associated financial incentives. Other influences to be controlled are gender, race, severity of illness in admitted patients, and the local availability of private office-based physicians.

Private patients in fee-for-service plans typically have a wider choice of physicians and hospitals than do HMO enrollees, but must pay more out-of-pocket for office-based services. This could lead to less use of primary and preventive services by FFS enrollees. The health plan has an incentive to provide and encourage more screening and preventive services as well as drugs for effective control of conditions that would otherwise worsen and require hospitalization. The incentives for physicians and clinics will be affected by payment arrangements within an HMO plan (Hellinger 1996). When the primary care physicians are organized in a staff or group model, or even in independent practice with capitation arrangements (or any risk-sharing for hospital expenses), they have more incentive to provide effective and timely services to reduce the risk of a preventable admission. The proportion of primary care physicians subject to strong incentives to prevent hospitalization is not known in this study, but it is larger in HMO than in fee-for-service plans.

Medicaid patients and physicians serving them are under somewhat different incentives than in private insurance. It is not clear whether Medicaid enrollees in general or Medicaid HMO enrollees in particular would have lower rates of preventable admissions than persons with private insurance. The out-of-pocket cost of primary care is lower for Medicaid patients. However, Medicaid reimbursement may be substantially below what physicians can charge other patients, so primary care physicians may be less willing to accept Medicaid beneficiaries as patients (i.e., there is less supply than what is apparently available). Medicaid HMO enrollees are similar to other Medicaid patients in facing minimal out-of-pocket costs for primary care. Unlike commercially insured patients, Medicaid patients may, therefore, lack the financial incentive to enroll in managed care. Those enrolled in HMOs, however, are theoretically expected to have reduced ACS admissions

because of the increased preventive services they could receive in HMOs. However, as HMO plans treat more chronically ill and severely disabled Medicaid enrollees, they could face more challenges in controlling preventable hospitalizations. The combination of these forces may complicate the likely effect of managed care enrollment on preventable hospitalization among Medicaid patients.

Data and Method

Source of Data and Description of Variables

Information on hospital discharges during 1997 for residents of New York, Pennsylvania, Wisconsin, and Tennessee, aged 20–64, was drawn from complete hospital discharge files for these states. These records were assembled, edited, and standardized as part of the Healthcare Cost and Utilization Project (HCUP) database of the Agency for Health Care Research and Quality. To create the analytical file, inpatient discharge records from HCUP files were linked to the 1997 Area Resource File (ARF) for sociodemographic and other information on patients' county of residence, and to the American Hospital Association's (AHA) survey files for 1997 for information on hospitals where patients were treated.

The study compares two groups of conditions: preventable conditions and marker conditions. Preventable and marker condition groups are defined on the basis of past research by Billings and others (1993). The Billings team developed a diagnostic framework for analyzing hospital use patterns based on the recommendation of a medical advisory panel. The conditions are usually defined by principal diagnoses diagnostic codes from the International Classification of Diseases, Ninth Revision (ICD-9-CM) system. In several cases, specific exclusion criteria based on age, sex, and selected procedures have been used. Preventable conditions included congenital syphilis; immunization-related conditions; severe ear, nose, and throat infections; chronic obstructive pulmonary disease; diabetes; convulsions; gastroenteritis requiring hospitalization; asthma; congestive heart failure; angina; bacterial pneumonia; tuberculosis; hypertension; cellulitis; hypoglycemia; kidney/urinary tract infection; dehydration-volume depletion; iron deficiency anemia; nutritional deficiencies; failure to thrive; pelvic inflammatory disease; and certain dental conditions. Marker conditions included appendicitis with appendectomy, gastrointestinal obstruction, fracture of hip/femur, and acute myocardial infarction. The latter admissions may be preventable with long-term

risk-factor reduction, but the view of the advisory panel was that most new admissions for myocardial infarction were not preventable by the use of primary and preventive services within the several weeks prior to admission.

The independent variables used in these regressions include the broad categories of patient characteristics, county characteristics, and characteristics of the hospitals where the patients were treated. The following patient characteristics, based on individual-level data, were considered: age, race, gender, insurance status, source of admission, and severity of illness. Except for severity of illness, other patient characteristics were used as categorical variables. Race is grouped in four categories: white (non-Hispanic), African American (non-Hispanic), Hispanics, and other, unless missing.

Insurance status of patients was grouped into Medicare, Medicaid fee-for-service, Medicaid HMO, self-pay, commercial HMO, and all other types of insurance (principally private insurance with a small group of other types of public programs). Medicaid HMO patients primarily included those enrolled in full-risk HMO plans. A small number of Medicaid patients in other forms of managed care (e.g., primary care case management [PCCM], or in partial capitated plans, such as a prepaid health plan [PHP]), would be included under Medicaid fee-for-service. The all-other-types category was the largest payer group in all states and was used as the default category (referred as private FFS) for insurance status variable in the logistic models in Table 3. Additionally, we used Medicaid FFS and commercial HMOs alternatively as defaults for comparisons in Table 4. Since all Medicaid patients in Tennessee were enrolled in managed care, the Medicaid FFS category is not separately identified in that state.

Three major sources of admissions were distinguished: admission from emergency rooms, transfers from another facility, and all others. The first two sources are indicators of a relatively high severity of illness. A more direct measure of severity of illness was calculated using a variable called RDSCALE, which is a later development of the Disease Staging System (Gonnella, Hornbrook, and Louis 1984; Coffey and Goldfarb 1986) by Medstat, Inc. The RDSCALE is a single-resource-based predictor assigned to each patient, and represents a patient's within-diagnosis-related-group (DRG) severity and the complexity of his or her DRG (Christoffersson, Conklin, and Gonnella 1988). Although RDSCALE values are usually expressed in percents, they have been divided by one hundred in our study in order to make the effect of a unit change in this continuous variable more discernable.

County-level variables included geographic location of the county, sociodemographic conditions, and county resources. Data for these variables

were obtained from 1997 ARF. In terms of geographic location, residents were grouped into three categories: metropolitan, nonmetropolitan and adjacent to metropolitan areas, and nonmetropolitan and not adjacent to metropolitan areas. To capture county demographic factors, we used data on median county family income, and the proportion of population in the nonwhite group. Four county-resource variables were used in this study: inpatient days per capita, hospital outpatient visits per capita, the number of primary care physicians per one-thousand population, and the number of specialists per one-thousand population. Although reflecting utilization, both outpatient visits and inpatient days per capita represent, respectively, total hospital outpatient and inpatient capacities in the county. Primary care physicians outside hospitals included office-based general internists, general practice, and family practice physicians. Primary care physician availability was expressed as total number of primary care physicians per one-thousand population. Note that this fails to represent the role of nurse practitioners in primary care that may be particularly important for HMOs. The number of specialist physicians is also expressed per one-thousand total population in a county.

We also examined selected hospital attributes from the AHA file of the hospitals where patients were treated. These attributes included urban versus rural, teaching status, and number of beds. Except for teaching status, the other major descriptors were subsequently dropped because of collinearity with other variables and low predictive power. Teaching status is indicated by membership in the Council of Teaching Hospitals (COTH), and is a categorical variable. Another variable used as an indirect measure of severity is "distance" from patient's home to admitting hospital (Welch, Larson, and Welch 1993; Basu and Cooper 2000). This variable was calculated by using software that connects latitudes and longitudes of patient zip codes with those of the hospital zip codes.

Study Design

Table 2 reports data on means for selected variables under study by each admission type. For example, admissions by Medicaid FFS patients accounted for 33 percent of preventable admissions in New York. Likewise, mean severity score for marker admissions, calculated as sum of individual severity scores divided by the statewide total of marker admissions, was 1.8 in New York. To test the patient characteristics associated with different types of hospital admissions, we used a multivariate logistic regression model for each state separately. The odds ratios in the logistic model represent the odds of

Table 2: Means of Variables by State and Categories of Hospitalization, 1997

	NY		*PA*		*WI*		*TN*	
Adults, Aged 20–64	*Preventable*	*Marker*	*Preventable*	*Marker*	*Preventable*	*Marker*	*Preventable*	*Marker*
Number of admissions	148,299	20,449	94,812	14,591	28,071	5,408	48,495	6,945
Admissions per 1,000 adult population	13.8	1.90	13.6	2.10	9.33	1.79	15.04	2.15
Patient Insurance (%)								
Medicaid FFS	33.18	15.98	18.85	11.66	12.74	4.40	0	0
Medicaid HMO	1.94	0.924	4.69	1.65	1.62	0.536	29.46	17.88
Self-pay	9.75	10.57	3.95	3.48	7.74	8.04	4.74	6.42
Private HMO	12.73	22.32	18.15	23.34	25.31	33.28	16.11	24.00
Commercial and other	27.69	40.00	33.75	45.42	34.31	43.99	28.51	37.39
Patient Characteristics								
Patient severity score (RDSCALE) [1]	0.99	1.80	1.03	2.14	0.996	1.84	1.01	2.38
African American (%)	28.37	12.6	21.8	9.12	15.45	5.41	24.22	15.27
Hispanics (%)	12.23	9.04	3.55	2.79	2.38	1.94	0.22	0.37
Age group 20–44 (%)	42.63	41.17	39.12	37.12	43.23	45.41	39.74	35.14
Male (%)	46.22	57.50	45.55	56.39	45.7	56.19	43.21	56.64
Transfer patients (%)	2.14	9.42	2.67	11.95	2.18	6.23	2.12	8.25
From ER (%)	74.24	71.8	66.41	67.16	56.66	61.05	59.67	67.31
County Characteristics								
Metro area (%)	93.43	92.38	86.01	84.92	69.96	65.77	63.77	65.96
Nonadjacent area (%)	2.08	2.12	1.96	1.98	7.65	7.65	15.52	13.59
From NYC (%)	53.39	38.64	–	–	–	–	–	–
Median County Income ($1,000s)	35.198	37.893	34.401	35.886	38.114	38.898	31.905	32.212
Hospital Characteristics								
Mean distance to hospital (in miles)	5.96	8.71	7.39	10.19	11.61	13.73	13.29	18.17
In teaching hospital (%)	41.52	43.52	31.64	30.42	23.13	16.54	7.20	5.44

continued

Table 2. *Continued*

	NY		*PA*		*WI*		*TN*	
Adults, Aged 20–64	*Preventable*	*Marker*	*Preventable*	*Marker*	*Preventable*	*Marker*	*Preventable*	*Marker*
County Resources								
Primary care physicians per 1,000 population	0.738	0.7458	0.589	0.586	0.6208	0.611	0.567	0.576
Inpatient days per capita	1.24	1.088	1.04	0.953	0.731	0.7045	0.877	0.861
Specialists per 1,000 population	1.47	1.47	1.16	1.11	0.95	0.90	1.04	1.05
Outpatient visits per capita	2.53	2.44	2.62	2.52	2.11	2.01	1.82	1.75

[1] A predicted charge defined in the text, measured in hundredths of a percent, across all DRGs nationally.

Note: Denominators of means for all variables are statewide admissions in the respective category of hospitalization.

admissions for preventable conditions relative to the odds of admissions for marker conditions. For example, in Table 3, odds ratio for preventable admissions (odds of preventable versus marker) is 69 percent for men of what it would be for women in New York. In the case of a continuous variable, the odds ratio is the change in relative odds for a one-unit change in the independent variable. For example, in Table 3, a one-unit increase in severity score (RDSCALE) from its combined mean value (= 1.09) in New York would be associated with a 17 percent lower odds of preventable admissions (odds ratio = 0.83) relative to marker admissions.

In identifying adults in preventable or in "marker" groups, cases falling under dual admission categories (of preventable and marker) have been assigned to "marker" based on principal diagnosis of these discharges. The individual case was the unit of observation, while some independent variables at a larger level, such as a county, are also used. The model controlled for socioeconomic and demographic variables, severity of illness, and county resources. Each state was fit separately because of differences in Medicaid extent of coverage of population, and the types of managed care contracts. Similar models were used for each state except for New York, where New York City was included as an additional predictor. The parameters of the models were estimated by maximum likelihood methods in the *STATA* software package, using established strategies, including the allowance for correlated errors within county of residence ("clustering"). Without this allowance for correlated errors, the precision of estimation with a large sample of cases would be overestimated (i.e., the reported standard errors of coefficients would be too low).

RESULTS

Table 1 provides the descriptive statistics on Medicaid managed care plan types and managed care penetration rates in four states. While Tennessee was a waiver state with all Medicaid patients in managed care, Wisconsin had a small Medicaid population, but a moderate level of managed care penetration among Medicaid patients (49 percent). New York had a large Medicaid population but a small managed care penetration (28 percent), while Pennsylvania had a large Medicaid population and a fairly large managed care penetration in 1997 (55 percent). The characteristics of the programs also varied. Whereas Pennsylvania had a significant amount of enrollees (16 percent), primarily children, still in primary care case management (PCCM),

Table 3: Results of Logistic Regression, by State (Ages 20–64), 1997

	Odds Ratio (OR) for Preventable Admissions vs. Marker Admissions [1]	
Variables	*New York*	*Pennsylvania*
Patient Insurance		
Private HMO vs. private FFS	0.69 (0.64, 0.75)*	0.81 (0.77, 0.85)*
Medicaid FFS vs. private FFS	2.00 (1.81, 2.22)*	1.67 (1.56, 1.78)*
Medicaid HMO vs. private FFS	1.63 (1.27, 2.08)*	1.95 (1.67, 2.28)*
Self-pay vs. private FFS	0.92 (0.84, 1.01)	1.09 (1.00, 1.23)
Patient Characteristics		
African American vs. white and others	2.41 (2.08, 2.79)*	2.24 (2.05, 2.45)*
Hispanic vs. white and others	1.26 (1.08, 1.47)*	1.19 (0.97, 1.46)
Male vs. Female	0.69 (0.67, 0.73)*	0.73 (0.69, 0.77)*
Ages 20–44 vs. ages 45–64	0.82 (0.76, 0.89)*	0.78 (0.70, 0.86)*
Source of admission = transfer vs. other	0.23 (0.17, 0.30)*	0.22 (0.18, 0.26)*
Source of admission = ER vs. other	0.69 (0.62, 0.77)*	0.57 (0.52, 0.63)*
Severity score (RDSCALE)	0.83 (0.81, 0.85)*	0.72 (0.66, 0.78)*
County Characteristics		
Metro area vs. metro-adjacent	0.86 (0.72, 1.03)	0.99 (0.87, 1.13)
Not adjacent vs. metro-adjacent	1.06 (0.87, 1.28)	1.04 (0.88, 1.22)
Median county income	1.004 (0.99, 1.01)	0.99 (0.98, 1.00)
New York City vs. rest of New York	1.37 (1.02, 1.84)**	—
Hospital Characteristics		
Distance to admitting hospital	0.997 (0.995, 0.999)*	0.997 (0.995, 0.999)**
Teaching status of admitting hospital vs. nonteaching status	0.79 (0.73, 0.85)*	1.11 (1.00, 1.23)**
County Resources		
Outpatient visits per capita	1.06 (0.98, 1.14)	0.94 (0.90, 0.97)*
Primary care physicians per 1,000 population	0.34 (0.12, 0.95)**	0.29 (0.15, 0.55)*
Per capita inpatient days	0.95 (0.79, 1.13)	1.20 (0.99, 1.45)
Specialists per 1,000 population	1.23 (0.95, 1.60)	1.35 (1.12, 1.63)*

*Significant at the 1% level.
**Significant at the 5% level.
[1] The standard errors of this model are adjusted for "clustering" within counties of patient residence.

	Odds Ratio (OR) for Preventable Admissions versus Marker Admissions [1]	
Variables	*Wisconsin*	*Tennessee*
Patient Insurance		
Private HMO vs. private FFS	0.78 (0.69, 0.87)*	0.68 (0.63, 0.73)*
Medicaid FFS vs. private FFS	2.69 (2.22, 3.25)*	—
Medicaid HMO vs. private FFS	1.96 (1.49, 2.56)*	1.66 (1.53, 1.79)*

continued

Table 3. *Continued*

Variables	*Odds Ratio (OR) for Preventable Admissions versus Marker Admissions [1]*	
	Wisconsin	*Tennessee*
Self-pay vs. private FFS	1.06 (0.94, 1.19)	0.83 (0.73, 0.92)*
Patient Characteristics		
African American vs. white and others	2.49 (2.15, 2.88)*	1.88 (1.57, 2.25)*
Hispanic vs. white and others	1.11 (0.97, 1.27)	0.62 (0.46, 0.84)*
Male vs. female	0.73 (0.69, 0.78)*	0.72 (0.69, 0.76)*
Ages 20–44 vs. ages 45–64	0.63 (0.56, 0.72)*	0.85 (0.78, 0.93)*
Source of admission = transfer vs. other	0.40 (0.33, 0.48)*	0.30 (0.26, 0.36)*
Source of admission = ER vs. other	0.62 (0.56, 0.68)*	0.53 (0.49, 0.57)*
Severity score (RDSCALE)	0.65 (0.59, 0.71)*	0.64 (0.59, 0.70)*
County Characteristics		
Metro area vs. metro-adjacent	1.15 (0.94, 1.40)	0.94 (0.78, 1.12)
Not adjacent vs. metro-adjacent	1.07 (0.88, 1.29)	1.10 (0.97, 1.26)
Median county income	0.98 (0.97, 0.99)**	0.99 (0.98, 1.00)
Hospital Characteristics		
Distance to admitting hospital	0.999 (0.997, 1.00)	0.995 (0.992, 0.997)*
Teaching status of admitting hospital vs. nonteaching status	1.64 (1.38, 1.95)*	1.66 (1.40, 1.97)*
County Resources		
Outpatient visits per capita	0.99 (0.94, 1.04)	1.04 (0.98, 1.11)
Primary care physician per 1,000 population	1.20 (0.72, 2.01)	0.39 (0.20, 0.74)*
Per capita inpatient days	0.92 (0.79,1.07)	1.09 (0.93, 1.27)
Specialists per 1,000 population	1.01 (0.84, 1.21)	1.01 (0.85, 1.21)

*Significant at the 1% level.
**Significant at the 5% level.
[1] The standard errors of this model are adjusted for "clustering" within counties of patient residence.

other states had almost all of their Medicaid enrollees in full-risk plans (Zuckerman, Evans, and Holahan 1997). Except Tennessee, which had a statewide mandatory program, the other three states had a combination of mandatory and voluntary managed care programs in 1997. A significant proportion of managed care plans in New York and Pennsylvania were Medicaid-only HMOs (42 percent and 33 percent, respectively), while Wisconsin and Tennessee had a majority of Medicaid managed care patients in commercial HMO (or comprehensive MCO) plans.

Tables 2 and 3 respectively provide the means and the results of the logistic models for each state. Table 4 reports results of logistic models where Medicaid HMOs are directly compared with Medicaid fee-for-service and with commercial HMOs.

Table 4: Odds Ratios of Preventable Admissions Relative to Marker Admission, by States, Adults, 1997

State	*Medicaid HMO versus Medicaid FFS*	*Medicaid HMO versus Private HMO*
New York	0.83 ($p = 0.102$)	1.51 ($p = .002$)
Pennsylvania	1.21 ($p = 0.007$)	1.81 ($p = .000$)
Wisconsin	0.91 ($p = 0.483$)	1.91 ($p = .000$)
Tennessee	—	1.57 ($p = .000$)

Note: The data in this table are derived from logistic regression models by using Medicaid FFS and commercial HMOs alternatively as defaults for the insurance status variable in each state.

Table 2 provides a summary profile of the four states. Preventable admission rates per one-thousand population were found to be much higher than marker admission rates in all states. While marker rates were relatively stable across states, preventable admission rates varied with Wisconsin (WI) having the lowest rate, possibly due to socioeconomic factors and a relatively high overall HMO penetration. Uniformly, all states showed proportionately more marker admissions for enrollees in commercial plans and in private HMOs compared with Medicaid. Next to Tennessee, Pennsylvania had the highest proportion of Medicaid managed care patients admitted with a preventable diagnosis, followed by New York, and then Wisconsin. New York had the highest proportion of Medicaid adults in fee-for-service plans.

Compared to the commercially insured fee-for-service patients (the default group), preventable admissions were less likely to occur among patients enrolled in commercial HMO plans but more likely to occur among those enrolled in Medicaid HMO plans as well as those enrolled in traditional Medicaid (fee-for-service). These findings are uniform across states (in Tennessee, Medicaid FFS patients are very small in number and have not been separately accounted for), validating the hypothesized association between managed care enrollment and preventable admissions among commercially insured patients.

However, the same association could not be reported for Medicaid beneficiaries. Preventable hospitalizations were more likely to occur than marker admissions among Medicaid patients, irrespective of their enrollment status (FFS or MMC), than among privately insured patients. Both Medicaid HMO enrollees and fee-for-service Medicaid patients were more likely than other patients to be admitted for preventable conditions relative to marker conditions. Although this might be expected based on unmeasured health status differences between Medicaid and privately insured patients, the two

odds ratios in Table 3 indicate little difference between FFS and managed care enrollment for Medicaid patients across states. Table 4 shows that, within Medicaid population, managed care did not have the desired association with preventable admissions. For Wisconsin and New York, the odds ratios for Medicaid HMO patients were slightly lower than those in fee-for-service plans, but the difference was not statistically significant (Table 4). In Pennsylvania, odds ratios for Medicaid HMOs were actually significantly higher than those for Medicaid FFS. In all four states, Medicaid HMO patients were nearly twice as likely to have a preventable admission compared with private HMO patients (Table 4), although this latter comparison should be used with caution since it does not take into account the health status differences between Medicaid and commercially insured HMO patients.

Demographics and Other Patient Factors

Nonwhites are, as expected, more likely to be admitted for preventable conditions. African Americans in all states, and Hispanics in New York, were significantly associated with more preventable admissions. (Surprisingly, in Tennessee Hispanics were less likely to be admitted for preventable admissions, though limited by small population). In general, across all states admissions for preventable conditions were more likely to be Medicaid or African American patients relative to marker admissions. Preventable admissions were also frequent among female, older (45–64) patients with less severity. Several direct and indirect measures of severity used as controls in the model (RDSCALE, source of admission as transfer or emergency rooms, travel distance) show severity associated with fewer preventable than marker admissions.

County Factors

Consistent with previous research (Basu, Friedman, and Burstin 2002), primary care physician density was found to be associated with fewer preventable hospitalizations in three out of four states. For example, one additional primary care physician per one-thousand population in a county in New York was associated with a 66 percent lower probability (OR = 0.34) of a preventable admission relative to marker admissions (note that an increase of one primary care physician per one-thousand population would be a doubling of the average availability). Only one state showed that counties with more office-based specialists per capita were more likely to have preventable admissions than marker admissions. Though specialists may provide preventive services and manage chronic conditions, their density did not appear to reduce

preventable admissions. Location in a rural or a metro area did not predict admission types in any state, although New York City was associated with more preventable admissions. The county income level was generally not found significant.

DISCUSSION

The study reports noteworthy findings on the effect of insurance coverage under HMO plans. The results strongly suggest a pattern in which the growth of managed care has been associated with fewer preventable admissions for private HMO enrollees. The findings identify HMO enrollees under commercial plans as less likely to be admitted for preventable conditions, possibly as a result of a higher level of primary and preventive care that HMOs may provide. These findings indicate that HMO penetration might reduce preventable admissions relative to other admissions. Further tests showed that this result was generally true across racial groups.

Unlike private HMO enrollees, we found distinctly different admission patterns in response to managed care among adult Medicaid beneficiaries. In fact, admission patterns for Medicaid patients under managed care were not different from their fee-for-service counterparts. This finding is in agreement with other studies on adults (e.g., Coughlin and Long 2000) where no significant difference in access between managed care and FFS Medicaid enrollees was found. Studies also suggested that Medicaid HMO enrollees may actually face greater access barriers than their FFS counterparts (e.g., Porell 2001). This was found true in Pennsylvania, which showed a significantly higher likelihood of preventable admissions among MMC enrollees compared with Medicaid FFS.

The findings from our study support the current evidence (e.g., Lillie-Blanton and Lyons 1998; Institute of Medicine 2000) that Medicaid managed care appears to have major differences from commercial managed care in terms of access to primary care. The difference may exist irrespective of the differential health status between the two groups. Although the data did not permit us to sufficiently control for the differences in the underlying health status of different populations, we focus our comparisons on within-group differences, for example, Medicaid FFS versus Medicaid HMO, and private FFS versus private HMO, which have similar health status. The main attempt to capture potential differences in health status among population groups in this study was the Medstat severity index, based on serious comorbidities and age within diagnostic groups. This index has been used in a number of

published articles with hospital administrative data. In addition, our analysis included race and median county income, which may also capture some of the differences in health status, combined with other determinants of the use of primary and preventive services.

We also explored whether differences in health status within Medicaid (between FFS and HMO) patients could bias our results. A primary reason for such differences could be the eligibility categories (SSI versus TANF), which could not be included in this study because of lack of data. However, the difference in health status was not found likely to bias the relative rates of preventable versus marker admissions. If admission per enrollee is a measure of health status, further analysis (data available from authors) did not reveal any marked difference between preventable and marker admission rates per enrollee in two enrollment categories (FFS and HMO). Additionally, we tested interactions of severity (RDSCALE) with Medicaid FFS and Medicaid HMO enrollment. There was no clear indication that patients admitted for preventable conditions with higher severity were more likely to be Medicaid FFS enrollees than Medicaid HMO patients relative to marker admissions, as the two odds ratios had very close values.

Selection bias is another issue that often challenges the researchers in a comparison of HMOs with FFS. Because we focused on within-group differences, Medicaid FFS versus Medicaid HMO and private FFS versus private HMO, and selection bias may occur among both Medicaid HMO and private HMO patients, our conclusions should not be affected. Moreover, the direction of effect of unmeasured severity bias is counter to the results shown. Health maintenance organizations usually have favorable selection, so selection bias would tend to make HMOs seem more effective.

Selection bias is usually a more important issue in states with voluntary Medicaid HMO enrollment. Except Tennessee, all three other states had a combination of mandatory and voluntary programs. It was not possible to know from hospital discharge records which beneficiaries were subject to mandatory managed care in these states. The expected bias due to the inclusion of voluntary enrollees is that the Medicaid managed care would seem to reduce hospital admissions due to selection of healthier enrollees. This bias would be opposite to the findings. We tried to control for selection bias with a larger number of indicators: RDSCALE, source of admission, teaching status of admitting hospital, and distance traveled for hospitalization.

Another source of potential bias could be found in our inability to correctly identify Medicaid patients who were previously uninsured. This could have a disproportionate effect on Medicaid FFS because most patients

who would transition from uninsured to Medicaid at the time of admission might enter into Medicaid fee-for-service. It is likely that the bias could be more important for patients admitted for marker conditions because these are mostly urgent admissions. However, while some of the preventable conditions are flare-ups of chronic conditions, many are also acute infections or other problems that were not promptly treated and required an urgent admission (e.g., bacterial pneumonia, cellulitis, urinary tract infection, dehydration, and so on). Further analysis of enrollment data (available from authors) suggests that the marker admission rate per enrollee for Medicaid FFS versus Medicaid HMO was no greater than the corresponding ratio for preventable admissions in these two enrollment categories.

Several other sensitivity tests were done in our study where several variables, including admission from emergency rooms, transfer admissions, teaching hospital, and distance were dropped due to the likelihood of association with marker admissions, and are not adequately representing causes of admission. These exclusions did not cause any change in our major findings.

To summarize, the study shows that while HMOs were associated with fewer preventable admissions in the privately insured population, there was no such association found among the Medicaid population. There could be various explanations for this, several of them cited in other studies (Institute of Medicine 2000; Nawacheck, Hughes, and Studdard 1996; Lillie-Blanton and Laveist 1996; Rosenbaum and Shin 1998). These include the poorer health status of these beneficiaries, their more diverse need, lack of choice, and dependence on nonmedical services. The demands placed on managed care may be far greater within Medicaid as plans treat more chronically ill and severely disabled individuals and provide a far broader range of services to patients with large unmet needs (Zuckerman, Evans, and Holahan 1997; Weinberger, Oddone, and Henderson 1996). From a provider perspective, lack of experience with Medicaid populations and low payment rates could act as access barriers. Unlike most commercial enrollees, Medicaid clients do not typically have continuous enrollment in a plan throughout the year. This intermittent eligibility is a common issue in Medicaid managed care and could lead to administrative complexity and costs for provider and plans (Hurley and Wallin 1998).

CONCLUSION

Despite the rapid growth in Medicaid managed care during the 1990s, limited research exists on how such care affects beneficiaries. Based on 1997 inpatient

discharge data of four states, this study adds to the current knowledge base on the effect of MMC on access to care. We compared hospital admission patterns of adult Medicaid beneficiaries for preventable conditions relative to a control group representing nonpreventable urgent conditions. The particular focus of the analysis is a comparison of Medicaid HMO enrollment with fee-for-service Medicaid as well as commercial HMO enrollment.

While commercial HMO plans have lower rates of preventable hospitalizations, these results have not been replicated among Medicaid beneficiaries. State policies to shift Medicaid enrollees from FFS plans to managed care may not be achieving desired quality improvements and cost reductions. Continued assessment is needed of the factors that result in greater preventable admission rates among Medicaid enrollees under managed care, including Medicaid contractual arrangements, availability and quality of primary care providers, and patient perceptions of access barriers to care. Regardless of whether managed care contracting is used, new approaches for prevention and management of chronic conditions seem to be desirable. These results suggest that continued diffusion of state-based managed care initiatives for Medicaid enrollees require further policy and outcome analyses.

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