Effect of the Structure of Hospital Payment on Length of Stay

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In response to rapidly rising costs, payers for health care services have made a number of changes in the way they reimburse hospitals for care. In this article we study the effect of different payment methods on the length of stay of Medicaid patients. We examine supply response by type of patient (medical, surgical, and psychiatric) and hospital ownership. We find that per case payment systems and negotiated contracts lead to significant decreases in the length of stay for all groups. Prospective per diem with limits in most cases leads to decreases in the length of stay. In general, we find that the supply response is stronger for psychiatric patients than for medical and surgical patients, and that publicly owned hospitals are more responsive to payment system incentives than are nonpublic hospitals.

In response to rapidly rising health care costs, governments and other major payers for health care services have become aggressive in searching for mechanisms to control their expenditures. A variety of approaches have been implemented. Those that involve changing the ways that providers are paid can be labeled supply-side policies because they are specifically designed to create rules and incentives for providers that encourage them to deliver services efficiently.

Gauging the success of payment policies calls for analyzing both the responses of providers to the embedded incentives and whether the responses differ from one another according to differences in type of

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provider. In this article we study the effect of a number of supply-side strategies on the hospital length of stay for Medicaid patients. We are interested in determining whether the "supply response" differs by type of patients (psychiatric, medical, and surgical) and by hospital ownership (public versus private). (Heterogeneous responses to payment incentives may suggest difficulties associated with implementing certain policy options.) We begin with a brief discussion of the different Medicaid hospital payment systems and the anticipated effects of these systems on length of stay, and a review of the literature. We then develop a more comprehensive framework for considering the factors that influence patient length of stay. We go on to describe our data and to report estimates from a length of stay model. We close with a summary and policy conclusions.

HOSPITAL PAYMENT POLICY AND HOSPITAL RESPONSE: GENERAL CONSIDERATIONS

Each state administers its own Medicaid program subject to broad federal guidelines. This independence has led to considerable diversity in the approaches that states have taken to hospital cost containment. For example, while some states continue to pay hospitals on the basis of retrospective costs, most have implemented some type of prospective payment system. The prospective payment systems have ranged in nature from per diem to per case systems. Table 1 presents summary descriptive information on the various Medicaid hospital payment and utilization management systems that were in effect in 1984.

THE EXPECTED EFFECT OF PAYMENT ON LENGTH OF STAY

In order to develop hypotheses concerning the relative strengths of provider responses to different payment policies, it is useful to consider the nature of the incentives associated with each payment system. Since the model of hospital decision making proposed here has been developed extensively in the work of Ellis and McGuire (1986), Seidman and Frank (1985), and Lave and Frank (forthcoming), we will briefly summarize the incentives contained in each payment system.

Under a *prospective per diem system*, a price independent of actual costs is set for each inpatient day. If the per diem rate is set above the marginal cost of a day of care, the hospital will earn net revenues for

Table 1: Characteristics of Medicaid Hospital Payment Systems, 1984

Program Characteristic	*Number of States*
Payment Systems	
Retrospective cost, no limits	6
Retrospective cost-based with limits	12
Prospective per diem, no limits	8
Prospective per diem with limits	12
Prospective case	11
Negotiated contract	1
Utilization Management	
Preadmission review	32
Utilization review	31

Source: Intergovernmental Health Policy Report, "A Comparative Survey of Medical Hospital Reimbursement Systems for Inpatient Services, State by State 1980-85." George Washington University, Washington DC, December 1985.

each day of care provided and will therefore have a financial incentive to extend the length of stay. We expect that the length of stay will be longer under per diem prospective payment systems than under simple retrospective cost-based payment (RCBP). However, if the prospective rate is set below marginal cost, then the hospital will lose money on each day of care. Clearly, there is then a strong incentive to reduce lengths of stay. In fact, in the long run, costs of treating these patients would be viewed in much the same way as treating the uninsured—as charitable donations. However, analysis of the selected contracting experience in California suggests that the Medicaid-contracted per diem rates were often set below marginal costs (Johns, Derzon, and Anderson 1985). Thus, we expect that, relative to RCBP, length of stay will be lower under the selected contracting experience in California.

Under a *per case prospective payment system*, a fixed payment—often based on diagnostic groupings (DRGs) as in Medicare's Prospective Payment System (PPS)—is made for each discharge. Under this payment system, a hospital's net revenues are reduced for each day of care provided by an amount equal to the marginal cost of a day of care. For the average patient (based on historical patterns of care), payment rates are often set to just cover costs. Hospitals can therefore earn "profits" by reducing the length of stay below the average (assuming that per diem costs are similar to the national average). Relative to RCBP, per case prospective payment systems contain strong incentives for hospitals to reduce lengths of stay.

Prospective per diem rate payment systems in which *limits* are set on the number of reimbursable days represent a mix of the per diem and per case payment systems. If rates are set above marginal costs, hospitals earn net revenues up to the point where the limit is imposed. After the limit is reached, the hospital incurs costs and no revenues for each additional day of care; thus, there are strong incentives not to provide additional care once the limit is reached. The effect that this payment policy will have on the length of stay depends on two factors: the level at which the day limit is set and the amount of the per diem rate.

It is more difficult to predict the effect of preadmission review and utilization review on length of stay. A priori, one would expect that preadmission review would lead to a decrease in admission for the less seriously ill patients and consequently to an increase in hospital length of stay, whereas utilization review would lead to a decrease in unnecessary days at the end of the stay and thus to a decrease in length of stay. However, utilization review could also serve as a "quality control" device, providing a buffer against premature discharge particularly in hospitals under financial pressure.

A payment system could evoke a different type of response in the treatment in different sorts of cases. Frank and Lave (1985) found that coefficients of variation for both length of stay and standardized charges were considerably higher for medical and psychiatric cases (DRGs) than for surgical cases (DRGs). While some of this variation is due to limitations of the DRG classification system, some may be due to less standardization in the treatment of medical and psychiatric cases relative to surgical cases. If this is the case, it may be easier to decrease the length of stay of psychiatric and medical patients than of surgical patients.

The response to payment arrangements may also differ across types of institutions. Hospitals in which net revenues are relatively more important may respond more strongly to incentives to reduce length of stay (Ellis and McGuire 1986). Hence, for-profit hospitals and hospitals under financial pressure are expected to be more responsive to the incentives embedded in Medicaid payment systems. Financially stressed hospitals may include a disproportionate number of publicly owned ones because they treat relatively more patients who are uninsured or covered by Medicaid (Anderson et al. 1989). The revenues of public hospitals may be especially sensitive to Medicaid payment policy because on average 13 percent of their patients are paid for by Medicaid compared to about 8 percent for other hospitals. This is particularly true if their budgets are fixed in any given year and administrators are held accountable for deficits.

LITERATURE ON "SUPPLY RESPONSE"

Research on hospital supply response has grown notably in the past six years. This research has been stimulated by the ongoing experimentation with hospital payment arrangements. Worthington and Piro (1982) examined the effect of payment policy on length of stay as part of the national evaluation of the early state prospective payment systems. Using the hospital as the unit of analysis, they found that the per diem systems were associated with relatively longer lengths of stay.

A number of studies have examined the effect of state prospective per case payment systems. The experiments in New Jersey and Maryland have received the most attention. Rosko and Broyles (1986) examined the initial impact of the implementation of DRG-based per case prospective payment in New Jersey. Using the hospital as the unit of observation, they found that relative to a per diem prospective payment system, lengths of stay in hospitals being paid under the DRGs fell by 3.4 percent, while costs per admission fell by 4.4 percent. Salkever, Steinwachs, and Rupp (1986) examined the Maryland experience with a modified per case prospective payment system and a prospective per service system. Using the hospital as the unit of observation, they found that the method of payment had little differential effect except in those cases where additional penalties were levied on hospitals that had previously been found to be high-cost providers. In those cases they found significant reductions in both costs and length of stay. They also reported that in nonteaching hospitals, the length of stay was lower in hospitals under the case-based payment than under the per service system but that this effect decayed over time.

Several analysts have examined the early experience with Medicare's Prospective Payment System (PPS). Feder, Hadley, and Zuckerman (1987) reported a significant supply response to the payment system; moreover, they found that decreases in length of stay were larger in those hospitals that were under greatest financial pressure. Guterman and Dobson (1986) and Prospective Payment Assessment Commission (1986) both reported supply responses to the introduction of PPS that indicated reductions in length of stay of between 7 and 9 percent.

Several studies have reported the impact of various payment systems on inpatient psychiatric care. Rupp, Steinwachs, and Salkever (1984) found that relative to the per service system, the modified per case payment system led to small reductions in the length of stay of psychiatric patients in Maryland. Frank and Lave (1986) examined the effect of prospective per diem rates and limits on reimbursable days

compared to cost-based reimbursement for Medicaid patients discharged from psychiatric units in general hospitals. They found that lengths of stay were longer for cases paid under per diem rate-setting arrangements and shorter for cases where limits on reimbursable days were in effect.

Frank, Lave, Taube, et al. (1987) examined the impact of PPS on the length of stay of psychiatric patients treated in general hospitals without psychiatric units (those that could not be exempted from PPS). Their results indicated that PPS led to a reduction of roughly 17 percent in the length of stay. Freiman, Ellis, and McGuire (1989) extended the work on the impact of PPS on psychiatric patients. They found one-year effects similar to those of Frank, Lave, Taube, et al. (1987), but found that the impact continued beyond the first year, although the additional effects were modest.

Overall, the research to date consistently shows significant response to per case prospective payment for all patients. In addition, there is evidence that the response is likely to be stronger in institutions under financial pressure. The research further suggests that the response for psychiatric patients is stronger than that for other patients. That evidence, however, is only suggestive as no studies have been published that have examined relative supply response across different categories of cases and hospitals using similar data and methods.

A Model of Length of Stay

The structure of the Medicaid payment system represents only one set of factors that will influence patient length of stay. The characteristics of the patient population, the characteristics of the hospital, and the availability of alternative treatment settings will all affect length of stay. Thus, in order to obtain consistent estimates of the supply response to payment policy, the effect of these factors must be taken into consideration. We therefore propose a model where the length of stay is hypothesized to be a function of four classes of variables: (1) patient characteristics that may influence the quality-quantity relationship, (2) hospital characteristics that may influence the efficiency with which care is produced, (3) health care delivery system variables that may facilitate hospital discharge, and (4) the Medicaid payment structure. The operationalization of each of these classes of variables and their expected effect on length of stay are described.

Patient Characteristics. The main factor influencing a patient's length of stay should be the patient's health status. Patient health status

is measured in part by the DRG to which the patient is assigned—the only available indicator of clinical status in the data we used. Other patient characteristics expected to influence length of stay are age, race, and sex. There are additional patient clinical characteristics, such as the severity of the illness, as well as other socio-demographic characteristics, such as marital status, that may be related to length of stay. However, the data that we used did not include measures of these characteristics.

Hospital Characteristics. Hospital characteristics expected to influence length of stay are the hospital bed size and the level of teaching intensity. In analyzing the length of stay of psychiatric patients we include additional hospital characteristics: the presence or absence of (1) a psychiatric emergency room, (2) a partial hospitalization program, (3) long-term beds, and (4) the presence of and the number of beds in a psychiatric unit. We expect that the lengths of stay will be shorter in hospitals with partial hospitalization programs because an alternative to inpatient care is immediately available. Length of stay may be longer in hospitals with long-term care beds, because some of the "observed" patients may have been discharged from them and almost by definition would be expected to stay longer than patients discharged from an acute bed. The size of psychiatric units is used because lengths of stay of patients who are discharged from general hospitals with psychiatric units have been shown to be longer than those of patients discharged from hospitals without such units (Goldman, Taube, and Jencks 1987). (Lengths of stay are longer both because the treatment patterns are more intense and because hospitals with psychiatric units are believed to admit relatively sicker patients.) We have no prior expectations with respect to the presence of a psychiatric emergency room or an organized outpatient department.

System Characteristics. These variables serve to define the availability of treatment resources in each market area (county). We include per capita estimates of the number of psychiatrists and other physicians as well as the number of psychiatric and general short-term hospital beds in the county in which the hospital from which the discharge takes place is located. We also include the region in which the hospital is located. Regions are included because of the long-established differences in practice patterns across the United States (Gornick 1982).

The Medicaid Payment Structure. These variables include the basis of payment under the Medicaid program, as well as the presence or absence of preadmission screening and utilization. The expected effect of these variables on length of stay was discussed earlier. As noted above, we expected that both the structure of the payment system and

the level of the payment would influence length of stay. In this study we use only measures of the structure of the payment system to characterize the payment system.

DATA

Data for calendar year 1984 on individual patients (including DRG, demographics, and length of stay) came from a subset of Medicaid discharges from the 1,670 hospitals that subscribe to Professional Activity Study (PAS) of the Commission on Professional and Hospital Activities (CPHA). Patients were selected according to the following criteria: the patient had to be over 18 years of age, had to stay in the hospital at least over night, and had to be discharged alive. For patients who met these criteria, we obtained data on all patients with a primary psychiatric diagnosis as well as all patients who were classified into one of the 20 most frequent medical and surgical DRGs. A list of the DRGs, the number of cases in each DRG, and the average length of stay is given in Appendix A.

Data on the Medicaid Benefit Structure were obtained from Medicaid reimbursement regulations published by the Health Care Financing Administration and compiled by the Intergovernmental Health Policy Project at George Washington University, and the Congressional Oversight Committees.

Information on hospital characteristics was obtained from the American Hospital Association's (AHA) 1985 Annual Survey of Hospitals. In most cases we used the data as they were reported to the AHA. To characterize a hospital's commitment to teaching, however, we used the CPHA teaching intensity variable kept on its file. The formula for that variable is given in Appendix B.

Data on the number of physicians and hospital beds per capita in the county in which the hospitals were located were obtained from the Area Resource File, a data file on health resources sponsored by the Department of Health and Human Services and maintained by Applied Management Sciences Inc.

We used patient-level data from the CPHA to examine the effect of the payment structure on the length of stay of different types of patients and hospitals because it was the only available national data base that enabled us to test a fully specified length of stay model. With CPHA data one can merge patient-level data with hospital characteristics, state Medicaid program characteristics, and system characteristics. The data from the National Hospital Discharge Survey cannot be

used for these purposes since privacy concerns prevent the National Center for Health Statistics from giving out both state identifiers (which are needed to link Medicaid program variables with individual discharges) and hospital characteristics. The CPHA data, however, do not come from a nationally representative sample of hospitals. Relative to the population of general hospitals, hospitals subscribing to PAS are less likely to be large, teaching institutions or to be located in the southern region of the United States. Appendix C presents data comparing the PAS hospitals with the universe of general hospitals.

Descriptive statistics for variables used in the regression models are presented in Table 2. Most of the variables are self-explanatory. Patient age and the size of the psychiatric unit have been transformed into logs for purposes of the analysis. For reasons of space, we do not provide information on the proportion of patients in each of the DRGs; this can be calculated from the data in Appendix A.

EMPIRICAL RESULTS

We estimated ordinary least squares (OLS) regressions for the three classes of diagnoses for each of the two groups of hospitals. In estimating the length of stay regressions, we transformed the dependent variable into logs. This transformation is appropriate both because the distribution of length of stay is approximately log-normal rather than normal, and because we expected the responses to payment variables to occur proportionately rather than linearly. With minor exceptions, the identical model is tested for each group. As noted earlier, in the model of the length of stay of psychiatric cases we include a set of hospital characteristics particular to psychiatry. The surgical length of stay model does not include patient sex as an independent variable because the 4 surgical DRGs in the top 20 medical and surgical DRGs were all related to obstetrics and gynecology. The regression results are presented in Table 3.

In discussing the results we first examine the overall results, and then the effect of the specific variables, with special emphasis on the payment variables.

OVERALL RESULTS

The model accounts for between 17 and 57 percent of the variation in the log length of stay depending on the type of patient and hospital category being examined. The proportion of the variation accounted

Table 2: Characteristics of Sample Discharges

Variable	Public Hospitals			Nonpublic Hospitals		
	Psychiatric	Medical	Surgical	Psychiatric	Medical	Surgical
Program Characteristics						
Proportion of patients/states with						
RCBP no limits	.02	.04	.05	.07	.05	.07
RCBP limits	.27	.41	.42	.41	.40	.40
Per diem, no limit	.04	.05	.04	.13	.16	.17
Per diem limit	.19	.26	.29	.18	.23	.22
Prospective case	.23	.10	.09	.13	.10	.09
Negotiated contract	.26	.13	.11	.09	.06	.05
Utilization review	.48	.61	.61	.76	.82	.81
Preadmission screening	.70	.75	.72	.86	.87	.88
Patient Characteristics						
Log age	1.52	1.58	1.48	1.52	1.58	1.49
Proportion of patients who are:						
Black	.16	.34	.30	.21	.35	.32
Other nonwhite	.07	.06	.08	.08	.10	.10
Male	.33	.27	.01	.33	.27	.01
Against medical advice	.06	.02	.00	.07	.02	.00
Hospital Characteristics						
Log acute unit psy beds	1.21	—	—	1.37	—	—
Proportion of patients discharged						
< 100 beds	.15	.33	.34	.04	.12	.14
100–199 beds	.18	.19	.24	.19	.26	.30
200–299 beds	.23	.16	.17	.22	.21	.19
300–499 beds	.32	.16	.12	.37	.27	.25
500 ≥ beds	.12	.16	.12	.18	.15	.13
Mid-teaching	.05	.09	.09	.23	.19	.18
High teaching	.30	.27	.17	.22	.17	.16
Psych emergency room	.80	—	—	.80	—	—
Psych partial hospital program	.23	—	—	.36	—	—
Psych outpatient department	.47	—	—	.43	—	—
Psych long-term beds	.01	—	—	.02	—	—

Continued

for is much higher for surgical cases than for medical and psychiatric cases. This occurs because the DRGs are a much better classification system for surgical patients than for other patients (Frank and Lave 1985).

Table 2: Continued

Variable	*Public Hospitals*			*Nonpublic Hospitals*		
	Psychiatric	*Medical*	*Surgical*	*Psychiatric*	*Medical*	*Surgical*
System Characteristics						
Psych bed cap × 1,000	.32	.21	.17	.33	.26	.28
Psych MD/cap × 1,000	.11	.11	.08	.14	.12	.12
MDs cap/1,000	1.82	1.67	1.43	1.98	1.86	1.83
Short-term beds/1,000	4.80	4.82	4.58	5.38	5.32	5.29
Proportion of discharges from:						
Northeast	.00	.01	.02	.16	.18	.18
North Central	.48	.43	.39	.49	.52	.50
South	.14	.35	.37	.14	.18	.19
West	.38	.21	.23	.21	.12	.13
Number of Cases	3,118	14,087	3,348	23,969	73,533	18,403

The Effect of the Payment Variables

In general, the signs of the estimated coefficients for the method of payment were consistent with our hypotheses. The expected coefficient signs were obtained for all cases under per case prospective payment systems: relative to RCBP, the implementation of per case prospective payment systems led to a decrease in the length of stay. In five out of six cases, the coefficient was statistically significant (at the .05 level). The estimated coefficients indicated that the magnitudes of the response to per case prospective payment were consistent with those found by other analysts. For example, for medical cases, per case payment was associated with a 2 percent decrease in the length of stay in nonpublic hospitals and an 8 percent decrease in public hospitals; for psychiatric cases the respective decreases in length of stay were 8 percent and 18 percent.

The results indicate that negotiated contracts had a consistent negative and statistically significant effect on length of stay. As noted above, all of these discharges come from California, so it is impossible in the context of this study to distinguish between a payment effect and a state effect. (However, in a study of supply response for psychiatric cases over time, Frank and Lave [1989] found a strong response to the implementation of negotiated contracts in California even after controlling for a state effect.) The coefficients of RCBP with limits were negative, as expected, in five out of six cases. The sign of the coefficient of the per diem systems was mixed. However, as we argued at the beginning, under General Considerations, the level of payment for per

Table 3: Factors Affecting Patient Length of Stay (*t*-Statistics in Parentheses)

	Public Hospitals			*Nonpublic Hospitals*		
Variable	*Psychiatric*	*Medical*	*Surgical*	*Psychiatric*	*Medical*	*Surgical*
Payment Structure Characteristics						
RCBP limit	-.019	-.009	-.026	-.037	-.010	.016
	(0.32)	(0.65)	(1.68)	(3.70)	(1.96)	(2.49)
Per diem, no limit	-.055	.036	-.092	-.019	.018	.013
	(0.69)	(1.77)	(3.78)	(1.44)	(2.71)	(1.51)
Per diem, limit	.013	.012	-.064	.005	.010	.004
	(0.21)	(0.72)	(3.68)	(0.43)	(1.84)	(0.54)
Prospective case	-.179	-.093	-.088	-.078	-.020	-.003
	(2.97)	(5.54)	(4.57)	(6.29)	(3.13)	(0.35)
Negotiated contract	-.284	-.052	-.121	-.085	-.023	-.050
	(3.68)	(2.88)	(5.97)	(5.05)	(2.66)	(4.36)
Utilization review	.058	.023	.038	-.010	.002	.004
	(1.96)	(3.07)	(4.18)	(1.38)	(0.45)	(0.74)
Preadmission screening	-.040	-.015	-.001	-.039	-.011	-.613
	(0.96)	(1.65)	(0.85)	(3.53)	(2.40)	(1.00)
Patient Characteristics						
Log age	.080	.252	.158	.168	.330	.230
	(1.53)	(14.03)	(5.73)	(9.84)	(40.97)	(18.00)
Black	-.023	.015	.053	.003	.054	.071
	(1.09)	(2.51)	(6.51)	(0.52)	(21.82)	(20.32)
Other nonwhite	-.075	-.028	-.002	-.005	.002	.027
	(2.53)	(2.65)	(0.20)	(0.50)	(0.56)	(5.08)
Male	-.034	-.013	—	-.020	-.026	—
	(2.32)	(2.39)	—	(3.97)	(10.75)	—
Against medical advice	-.285	-.162	.07	-.330	-.193	.023
	(.981)	(8.91)	(1.16)	(36.32)	(28.43)	(0.82)
DRGs included*						
Hospital Characteristics						
100-200 beds	.097	.035	.004	.042	.066	.034
	(3.46)	(4.93)	(.46)	(3.19)	(17.05)	(6.72)
200-299 beds	.138	.066	.035	.036	.063	.030
	(4.77)	(7.86)	(3.31)	(2.67)	(15.35)	(5.45)
300-499 beds	.150	.106	.040	.044	.070	.025
	(3.86)	(9.61)	(2.87)	(3.18)	(16.49)	(4.43)
500≥ beds	.088	.116	.032	.049	.068	.014
	(1.58)	(8.40)	(1.74)	(3.14)	(12.97)	(1.93)
Mid-teaching	-.148	-.030	-.030	-.023	-.027	-.012
	(3.21)	(2.66)	(1.99)	(3.29)	(8.53)	(2.65)

Continued

Table 3: Continued

Variable	*Public Hospitals*			*Nonpublic Hospitals*		
	Psychiatric	*Medical*	*Surgical*	*Psychiatric*	*Medical*	*Surgical*
High teaching	.022	-.086	-.047	.004	-.022	-.013
	(.48)	(6.48)	(2.59)	(.48)	(5.60)	(2.23)
Psych emergency room	-.058	—	—	-.027	—	—
	(2.67)	—	—	(3.98)	—	—
Psych partial hospital program	-.151	—	—	-.003	—	—
	(3.89)	—	—	(.45)	—	—
Psych outpatient department	.015	—	—	-.032	—	—
	(.31)	—	—	(5.31)	—	—
Psych long-term beds	.529	—	—	.108	—	—
	(2.52)	—	—	(5.58)	—	—
Log acute unit psych beds	.298	—	—	.170	—	—
	(11.08)	—	—	(28.58)	—	—
System Characteristics						
Psych beds/cap × 1,000	-.190	-.023	.009	.024	.003	-.013
	(3.17)	(1.39)	(.38)	(1.78)	(.86)	(3.26)
Psych/cap × 1,000	-.921	-.096	.035	.038	-.007	-.061
	(2.90)	(1.96)	(.57)	(1.07)	(.45)	(2.71)
MDs/cap × 1,000	.118	.016	.007	.034	.018	.009
	(3.18)	(2.05)	(.69)	(5.47)	(6.76)	(2.37)
Short-term beds/1,000	.000	.000	.001	-.012	-.002	.004
	(.00)	(.85)	(.53)	(5.71)	(2.97)	(4.01)
Northeast	-.116	-.031	.038	.179	.100	.074
	(.77)	(1.28)	(1.27)	(15.88)	(17.81)	(9.44)
North Central	-.041	-.035	.038	.117	.123	.088
	(.99)	(3.03)	(2.70)	(10.99)	(21.90)	(11.82)
South	-.041	.026	.076	.016	.074	.065
	(.60)	(2.15)	(5.24)	(1.36)	(12.37)	(7.91)
R^2	.30	.17	.58	.20	.18	.54
F-values	34.96	65.64	161.30	165.75	375.51	(782.32)

*DRGs were included in the regression. The full regressions are available from the authors.

diem systems is a critical determinant of the direction of the hospital's response. Our ambiguous findings could be a result of the fact that the relation between the per diem rate and marginal cost varied across patient types and hospitals.

We compared the relative responses to the payment structure for the different types of patients. For both groups of hospitals, the coefficient of the payment variables was larger for psychiatric patients than it was for medical cases. With the exception of the estimated response to per diem systems with limits, the coefficient of the payment variables

was larger for psychiatric cases than it was for surgical cases. The differences in the size of the estimated response were statistically significant in only a few cases. In Table 4 we show the ratio of the estimated supply responses to a payment system in those cases where the differences were statistically significant. It is worth noting that in nonpublic hospitals the supply response for psychiatric patients was roughly four times that for medical patients for three key payment systems. Few other consistent patterns emerge from Table 4.

We also examined the ratio of estimated response to payment variables across the two groups of hospitals. As indicated in Table 3, in most cases for the three groups of patients, the coefficient of the payment variable is larger for the public hospitals than it is for the nonpublic hospitals. Table 5 presents the data on the response ratios for those cases in which the differences were statistically significant. Under those payment systems where the incentives to reduce length of stay are

Table 4: Comparison of Payment Impact by Patient Type

	Public Hospital			*Nonpublic Hospital*		
Payment Variable	*Psych/Med*	*Psych/Surg*	*Med/Surg*	*Psych/Med*	*Psych/Surg*	*Med/Surg*
RCBP limit	NS*	NS	NS	3.7	2.3	0.63
Prospective case	NS	NS	NS	3.9	26.0	6.7
Negotiated contract	5.6	2.3	0.42	3.7	1.7	0.46

*t-Test for significance level calculated from data in Table 3. NS = not significant.

$$t = \frac{B_i - B_j}{\sqrt{se_i^2 + se_j^2}}$$

Table 5: Relative Hospital Response by Hospital Category Significant Differences

	Psych Public vs. Psych Nonpublic	*Med Public vs. Med Nonpublic*	*Surg Public vs. Surg Nonpublic*
Per diem limit	NS*	NS	2.76
Prospective case	2.29	4.65	2:93
Negotiated contract	3.34	2.26	2.42

*t-Test for significance level calculated from data in Table 3. NS = not significant.

$$t = \frac{B_i - B_j}{\sqrt{se_i^2 + se_j^2}}$$

strongest relative to RCBP (negotiated contract and prospective per case), the effect on length of stay was larger for the public hospitals. Table 5 indicates that for per case payment and negotiated contracts, the supply responses of public hospitals were between two and five times larger than that of the nonpublic hospitals for all diagnostic groups. This is a surprising result. We suspect (as noted above) that public hospitals respond more strongly in part because Medicaid patients make up a larger portion of their patient population. Consequently, changes in Medicaid payment policies will have a larger effect on hospital revenues, an effect that can be moderated through supply response.

Other Medicaid Program Characteristics

The other Medicaid program characteristics were found to have somewhat unexpected effects on length of stay. Utilization review was associated with a statistically significant increase in the length of stay of all patients in public hospitals but not in private hospitals. Perhaps in public hospitals they guard against premature discharge. Preadmission screening was found to be associated with a decrease in the length of stay of psychiatric and medical patients in nonpublic hospitals. We cannot account for this finding.

Patient Characteristics

In most cases, patient characteristics were found to have consistent effects on the length of stay for all groups of patients in both sets of hospitals. Age is associated with an increase in the length of stay. Males spend a shorter period of time in the hospital. With the exception of Medicaid psychiatric patients, blacks had longer lengths of stay than whites in public hospitals while, with the exception of surgical patients in nonpublic hospitals, nonwhites were found to stay shorter periods of time than whites. Psychiatric and medical patients who left against medical advice not surprisingly stayed a significantly shorter period of time than those who left when recommended. The effect is most pronounced for psychiatric patients. Approximately 6 percent of psychiatric patients left against medical advice, compared to 2 percent of medical patients and a minuscule number of surgical patients.

Hospital Characteristics

Not surprisingly, the length of stay was found to increase with hospital bed size for all groups of hospitals. However, the effect found for

teaching hospitals in this sample was unexpected. In general, hospitals with teaching programs were found to have shorter lengths of stay. The characteristics of the psychiatric services offered by hospitals were found to be associated with lengths of stay, and were more important for public hospitals. As expected, lengths of stay are generally shorter in hospitals with partial hospital programs while they are longer in hospitals with long-term beds and with psychiatric units.

System Characteristics

The system characteristics were found to have mixed effects on length of stay, and they varied by hospital and by disease grouping.

DISCUSSION

As noted, in general, the findings were consistent with our prior expectations. The structure of the payment system does influence length of stay, and it does so in the expected direction. There are, however, some shortcomings with the analyses.

First, the information that we had on patient characteristics was very limited. Clinical information on the patients as well as some sociodemographic data were lacking. While better patient data might have improved our ability to account for differences in the (log) length of stay across patients, we do not believe that they would have made much difference in our estimates of the effects of the payment system on length of stay. It is possible that payment systems might have had a differential effect on healthier or sicker patients in the DRG, and this is something that should be explored in further work. However, we should point out that to date, it has been difficult to develop indicators of patients' clinical conditions that have been useful in accounting for differences in the resource use among patients (Jencks and Dobson 1987).

Second, in this analysis we used data only on the characteristics of the structure of the Medicaid payment system. However, the level of payment as well as the structure is important in influencing the pattern of resource use within hospitals. The estimated impact of payment would be more precise if we had data on the relationship of the level of the rate and the hospitals' costs.

Third, we found that the characteristics of the health care delivery system within which the hospital was located did not have an effect on the length of stay. We are not convinced that this result would be

sustained with a more complete modeling effort or more precise data or both.

SUMMARY AND CONCLUSION

Public policy with respect to hospital payment mechanisms faces the challenge of balancing desires to contain costs of hospital care with the need to protect patients against undertreatment by providers of care. One concern with the application of per case prospective payment to the Medicare and Medicaid systems is that for cases where the regimen of treatment is not very specific, there may be an overresponse to strong financial incentives. This is particularly true in the cases of vulnerable populations such as the disabled, elderly, children, and the mentally ill. This research has probed differences in provider response to payment systems for three classes of patients and two types of providers. The purpose of the research was to inform policy regarding areas where application of prospective payment systems might be particularly risky with respect to overresponse by providers.

The empirical results suggest that there are important differences in response to incentives contained in the per case prospective payment systems and to systems where we suspect that the payment rates were set very low. Responses are substantially stronger for psychiatric cases than for either medical or surgical cases. Further, public hospitals appear to be more responsive to per case prospective payment across all classes of patients. The reasons for these differences are not clear. In the case of differences by patient class several reasons are possible for the findings: (1) there is more waste in average inpatient psychiatric care and therefore more room to improve efficiency; (2) a significant amount of undertreatment occurs in response to per case prospective payment (e.g., dumping to the community); or (3) cost is being shifted to the public mental hospital system. If the first explanation is true, that would be good news. The second and third explanations would either indicate potential undertreatment or possible decreases in the quality of care.

We cannot provide any firm judgments about the ultimate impact of these policies on patients and their families nor about the overall impact on the cost of care. The results do serve to indicate areas where too much supply response may occur. Heterogeneity in behavior provides an important reason for investigating actions that might "fine tune" payment systems to make them more broadly applicable. This leads us to recommend a cautious approach to the use of per case

payment in the area of mental health together with further analyses into the reasons for the observed responses.

APPENDIX A

Length of Stay by DRG

		Public		*Nonpublic*	
DRG	*Name*	N	*L of S*	N	*L of S*
Psychiatric					
424	OR PROC W/MENT ILLN	51	23.6	451	20.2
425	ACUTE ADJUST REACTN	225	4.9	1,431	7.0
426	DEPRESSIVE NEUROSIS	501	8.7	4,202	9.2
427	OTHER NEUROSIS	135	8.7	980	8.3
428	PERS/IMPLS DISORDRS	183	13.1	1,121	10.4
429	ORG DISTRB/MENT RET	93	9.4	603	15.1
430	PSYCHOSIS	2,028	13.0	16,616	13.4
431	CHILD MENTL DISRDRS	19	8.6	71	9.3
432	OTHER MENTL DISRDRS	29	5.5	68	13.9
Medical					
24	SEIZR/HEAD + CC	418	4.9	2,213	6.7
25	SEIZR/HEAD NO CC	758	4.0	4,217	4.6
88	CHRON OBST PULM DIS	523	6.1	2,841	7.7
89	PNEUM/PLEURISY + CC	598	8.6	2,764	8.8
96	BRONCH/ASTHMA + CC	641	5.5	3,483	6.6
97	BRONCH/ASTHMA NO CC	941	4.0	6,279	4.9
127	HEART FAILURE&SHOCK	636	6.9	3,035	7.9
140	ANGINA PECTORIS	958	4.4	4,507	5.2
143	CHEST PAIN	595	3.5	2,858	4.1
182	ESO/GAST/DIGEST + CC	1,220	4.8	6,260	5.3
183	ESO/GAST/DGST NO CC	1,644	3.7	8,843	4.1
204	PANCREAS DIS, NONMAL	550	6.3	3,047	7.3
243	MEDICAL BACK PRBLMS	1,039	5.6	7,188	6.4
294	DIABETES AGE ≥36	871	6.7	4,887	7.7
321	KIDN/URIN INF NO CC	694	4.4	2,855	4.7
368	FEMALE REPROD INFEC	927	4.4	4,861	4.7
395	RED BLOOD CELL DISR	715	5.7	3,041	6.5
410	CHEMOTHERAPY	527	3.2	3,127	3.6
Surgical					
198	CHOLECYS NON CDE, CC	686	6.0	3,586	6.7
355	NONRAD HYSTER NO CC	1,121	6.3	6,216	6.5
358	UTER/ADNX NONM PROC	550	5.4	3,657	6.1
359	TUBAL INTERR NONMAL	516	2.6	2,097	2.6
364	D&C CONIZATN NONMAL	516	2.3	3,701	2.6

APPENDIX B

The Teaching Intensity Index

Teaching intensity is defined as:

$$I_p = 9.9\,(JCA) + 14.0\,(CP) + 28.0\,(RES) + 14.7\,(MS) + 13.3\,(PNS) + 20.1\,(COT)$$

where

JCA: Accreditation by Joint Commission on Accreditation of Hospitals.

CP: Cancer program approved by American College of Surgeons.

RES: Residency approved by American Medical Association.

MS: Medical school affiliation report by American Medical Association.

PNS: Hospital-controlled professional nursing school, reported by National League for Nursing.

COT: Member of Council of Teaching Hospitals of the Association of American Medical Colleges.

The following cut-offs are used to stratify hospitals:

Low: I_p value under 25.0
Medium: I_p value 25.0–75.9
High: I_p value 75.0+

Source: Philips and Hai 1976.

APPENDIX C

Bed Size and Region, Professional Activity Study (PAS) Hospitals Compared With All Short-Term Nonfederal Hospitals* in the United States, 1984

Hospital Class	*U.S. Total*†	*PAS Hospitals*	
		Number	*Percent of U.S. Total*
Bed size			
6- 99	2,784	750	26.9
100–199	1,233	388	31.5
200–299	693	221	31.9

Continued

APPENDIX C

Continued

Hospital Class	U.S. Total†	PAS Hospitals	
		Number	Percent of U.S. Total
300-399	417	141	33.8
400-499	270	91	33.7
500+	314	79	25.2
Total	5,711	1,670	29.2
Region			
Northeast	819	332	40.5
North Central	1,689	594	35.2
South	2,141	402	18.8
West	1,062	342	32.2
Total	5,711	1,670	29.2

*Hospitals with average stay less than 30 days, excluding psychiatric hospitals.

†American Hospital Association 1983.

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