Analysis of Nursing Home Use and Bed Supply: Wisconsin, 1983

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This article presents evidence that in 1983 excess demand was a prevailing characteristic of nursing home care markets in Wisconsin, a state with one of the highest bed to elderly population ratios. It further shows that excess demand is the source of at least three types of error in use-based estimates of the determinants of the need for nursing home care. First, if excess demand is present, estimates of the determinants of Medicaid use may simply represent a crowding out of Medicaid patients, driven by the determinants of private use. As a result, factors associated with greater overall need in an area will be correlated with fewer Medicaid patients in nursing homes, ceteris paribus. Second, estimates of the substitutability of home health care for nursing home care may be misleadingly insignificant if they are based on the bed supply–constrained behavior of Medicaid-eligible subjects. Third, because the determinants of bed supply become the determinants of overall use under excess-demand conditions, the determinants of use will reflect, to some extent, the nursing home's desire for profits. Because profitability considerations are reflected in use-based estimates of need, these estimates are likely to be misleading.

Providing nursing home care to those who need it has long been a goal of federal and state policy. This goal, however, has not been easy to achieve largely because experts disagree on what constitutes "need" (Vladeck 1982; Pillemer 1984). In the absence of a consensus definition of need, the determinants of nursing home use have been proposed as proxies for the characteristics of need. As a result, an extensive literature has developed investigating the patient and population characteristics associated with nursing home use. It has long been known, however, that the characteristics of people who use nurs-

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ing home care may differ significantly from the characteristics of those who need it.

One source of this difference is the possible constraining of use by the availability of beds. Scanlon (1979, 1980) was the first to argue that excess demand is a pervasive characteristic of nursing home markets in the United States. The generally high occupancy rates in nursing homes across states are consistent with this hypothesis. If the bed supply constrains use, then nursing homes may be able to choose which patients they want to admit. If so, there is no guarantee that the characteristics of those admitted will necessarily be the characteristics of those most in need of nursing home care.

On the other hand, researchers have also pointed to the wide variation across states in the number of beds per thousand elderly. This ratio would seem to measure bed availability relative to population need, since it is generally accepted that elderly people both use and need nursing home services more than the general public. The wide variation in this statistic would suggest that certain states or geographical areas have provided greater access to nursing home care than others. Indeed, Swan and Harrington (1986) and Rohrer (1987) have identified those states that are relatively "underbedded" based on analyses of this statistic. The implication of these studies is that states with high beds per thousand elderly ratios, such as Wisconsin, are unlikely to be experiencing use constrained by the number of available beds and would, therefore, be likely to produce use determinants that accurately represent the determinants of need.

This article is an attempt to assess under what conditions the determinants of nursing home use are reasonably good estimates of the characteristics of nursing home need, using a state with one of the highest ratios of beds per thousand elderly: Wisconsin. In the first section, the relationship between use and bed supply in Wisconsin counties is explored. It is shown not only that bed supply determines overall use to the exclusion of all other explanatory variables, but that it also has a markedly different effect on private and Medicaid use, consistent with Scanlon's theory of the behavior of nursing homes under excess demand conditions. Consistent with a shortage of beds and the nursing homes' preference for private patients, the number of Medicaid patients in a county decreases with an increase in any factor (such as the number of elderly in an area) that is associated with greater need for care. Further, it is shown that the substitutability of home health care for nursing home care is more easily observed on the private side of the market than on the Medicaid side, again consistent with the effect of excess demand on the market.

In the second section, the determinants of the nursing home bed supply are investigated. It is shown that "number of patients" can be substituted for "number of beds" as the dependent variable in the bed supply equation with no appreciable difference in results. Moreover, since the determinants of the bed supply are the same as the determinants of use, factors not associated with need (such as profitability) influence use, implying that use-based measures of need are likely to be flawed.

In the final section, the article is summarized and the implications for public policy are discussed.

THE DETERMINANTS OF NURSING HOME USE

THE DETERMINANTS OF OVERALL USE

The literature on the determinants of nursing home use can be divided into two groups. The larger group of studies (Branch and Jette 1982; Brody and Gummer 1967; Brody, Poulshock, and Masciocchi 1978; Evans, Beland, Butler, et al. 1975; Evashwick, Rowe, Diehr et al. 1984; Greenberg and Ginn 1979; Kraus, Spasoff, Beattie et al. 1976; McCoy and Edwards 1981; Nielson, Blenker, Bloom et al. 1972; Palmore 1976; Shapiro and Tate 1985; Vincente, Wiley, and Carrington 1979; Williams and Hornberger 1984) uses individuals as the units of observation and attempts to determine, either cross-sectionally or longitudinally, which individual characteristics are associated with nursing home institutionalization.

A recent review of this literature (Wingard, Jones, and Kaplan 1987) has identified four factors that are consistently found to increase the risk of institutionalization: age, sex, availability of noninstitutional caregivers, and functional status. The risk of institutionalization increases with age and functional dependency. People who are not married or who do not have nearby caregivers are also at significantly greater risk. Women have been found to be at greater risk than men in some studies, but this relationship is diminished or is found to be insignificant in multivariate studies that account for the fact that their longer life expectancy makes women more likely than men to outlive a caregiver spouse. These studies can best be used to predict institutionalization when the specific characteristics of the individual are known.

A smaller number of studies (Scanlon 1980; Chiswick 1976; Dunlop 1976; Harrington and Swan 1987; Henry 1970; Morreale

1975; Wolf 1978) use geographical areas (e.g., states or standard metropolitan statistical areas) as the units of analysis. These studies test for the influence of contextual or market factors, as well as population characteristics, on nursing home use. As such, they are more useful to planners, such as certificate-of-need agencies, because they rely on data readily available to planning agencies. The present study falls into this category since it uses Wisconsin counties in 1983 as the units of observation.

In his review of these latter studies, Scanlon (1980) observed that, although these studies purport to capture the behavior of the consumer (i.e., demand behavior), they may simply capture supply-constrained utilization. He argued that, because previous studies did not recognize the possibility of excess demand, they did not recognize that the supply of beds may significantly influence use. If supply does constrain use and a bed supply variable is omitted, the coefficients of the explanatory variables that are correlated with the bed supply will be biased. Scanlon's study corrected for this by including a bed supply variable in the regression: the number of unfilled beds per elderly population. This variable was the strongest predictor of overall utilization in his regressions.

One problem with this approach, however, is that unfilled beds per elderly population is not a pure measure of the bed supply. It is constructed by subtracting the number of patients in homes D from the number of beds S and dividing by the number of elderly people E, a determinant of D. Since

$$\text{unfilled beds per elderly population} = (S - D)/E,$$

this variable represents variations in the bed supply S only to the extent that increases in the number of beds are not matched by increases in use D or by proportional increases in elderly population E. That is, the bed supply can increase and not be reflected by this variable.

One way to better capture the effect of bed supply on use is to employ the number of beds per thousand elderly S/E—or, better yet, simply the number of beds S—as the bed supply variable in the equation. If supply perfectly constrains demand, then we would expect that increasing the bed supply by one bed results in one more patient admitted. The regression coefficient for such a relationship would approach 1, as would the R^2. Moreover, no other variable—demand or supply—would be a significant determinant of use, since the relationship between beds and use would represent a tautology. If supply imperfectly constrains demand, the degree to which the supply constraint holds is measured by the extent to which the coefficient differs

from 1 and by the amount of explanatory power exhibited by the other independent variables.

To test the relative effects of bed supply and other variables on use, two regression equations are estimated.[1] In the first equation, nursing home patients per thousand elderly is regressed on beds per thousand elderly. By constructing the bed supply variable in this way, the results represent a relatively minor departure from Scanlon's specification. In the second equation, nursing home patients is regressed on the number of beds, excluding the denominators but retaining the number of elderly in the county as a separate explanatory variable. This, of course, represents a more significant departure from previous studies. The same additional explanatory variables appear in both regressions and generally represent those conventionally employed in utilization studies. Where appropriate, these variables have either been divided by the elderly population in the county or used in raw form in keeping with the specification of the dependent variable. In the following discussion of the empirical results, the former are referred to as the "ratio-specified" equation and the latter as the "raw-specified" equation.

OVERALL USE RESULTS

The (nonstandardized) regression results of the ratio-specified equation are reported in column A of Table 2, descriptive statistics for all variables having been reported in Table 1. The bed supply variable measures the number of actual (as opposed to licensed) beds available in the county. Its coefficient is 0.9656 and is significant at the .0001 level with a t-statistic of 47.624. The R^2 for this regression is .9868. None of the other coefficients is significant except for the average Medicaid reimbursement rate, which is weakly significant (at the 10 percent level). The negative sign on this variable's coefficient, however, is so puzzling that we may simply be able to dismiss it as a specious result. The raw-specified equation results are reported in column A of Table 3 and mirror the ratio-specified results, except that the average Medicaid reimbursement rate variable is no longer significant.

The average occupancy rate (total number of patients divided by the total number of beds in all nursing homes in Wisconsin) for these data is 94.6 percent. This high occupancy rate itself indicates the likelihood of excess demand, since on any given date there are bound to be some empty beds because of normal turnover and because of the tendency of some nursing homes to keep some beds open for private patients (Bishop 1979). In comparison, the raw-specified regression

Table 1:   Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Nursing home patients per thousand elderly*	83.67	30.03	28.63	201.71
Nursing home patients	741.42	1275.84	60.00	10280.00
Private patients per thousand elderly	20.62	9.02	6.79	42.83
Private patients	192.14	307.19	8.00	2337.00
Medicaid patients per thousand elderly	63.06	26.21	21.57	178.14
Medicaid patients	549.28	979.22	47.00	7943.00
Nursing home beds per thousand elderly	88.95	31.44	33.73	209.57
Nursing home beds	783.93	1334.13	62.00	10742.00
Residents of county receiving home health care per thousand elderly	65.06	40.11	17.36	197.57
Residents of county receiving home health care	609.66	1438.15	19.00	11805.00
Per capita income	9627.52	1708.03	6684.00	15260.00
Private SNF price per patient day	52.17	5.31	37.78	65.17
Medicaid SNF reimbursement rate per patient day	45.03	4.34	33.46	55.70
Average number of violations in nursing homes in county	25.35	21.79	1.00	146.33
Number of elderly (> 65)	8478.87	14486.64	750.00	119300.00
Percentage of elderly who are women	52%	6.9%	40%	82%
Percentage of elderly who are over 85	9%	1.9%	5%	13%
Percentage of married women who are working	50%	5.2%	37%	63%
Deaths per thousand population in 1983	9.66	1.83	5.96	13.85
Milwaukee area county (= 1)	0.10	0.298	0	1

*All variables represent county levels. N = 70 counties (one county was excluded because of missing data).

coefficient indicates that the marginal bed has a 95.5 percent probability of being filled, which is slightly higher than the average probability. A simple regression of beds on patients yielded a coefficient of .9562, with an R^2 of .9996. These high bed supply coefficients and the lack of explanatory power by the other independent variables seem to suggest that beds constrained use in most Wisconsin counties in 1983.[2]

These results differ from Scanlon's (1980). Using the state as the unit of observation, Scanlon found that the percentage of elderly population over age 85 (as well as the percentage of elderly who are black, the climate measured in mean annual heating-degree days, a dummy variable measuring whether the state has admission screening, and the number of unfilled beds per elderly population) was significant. In the present regressions, however, the percentage of elderly population over 85 was not significant. One explanation for the discrepancy in significance is that the unfilled-beds variable in Scanlon's regressions did not completely capture the bed supply; therefore, the degree to which use was constrained by the bed supply may not have been adequately controlled for in his regression. Perhaps if a purer bed supply variable had been employed, none of his other explanatory variables (besides bed supply) would have been significant. Scanlon's other significant variables might simply represent factors that are individually part of the supply decision, rather than variables that capture the behavior of consumers.

DETERMINANTS OF PRIVATE AND MEDICAID USE

The preceding findings can be interpreted as representing the existence of excess demand only to the extent that we can be sure that the bed supply is exogenous. That is, regression results would exhibit the same correlation between bed supply and bed utilization if the bed supply were responsive to changes in the demand for beds. There are three reasons, however, why the exogenous bed supply assumption is reasonable. First, the bed supply decision is a long-run decision. Therefore, it is unlikely that changes in the bed supply could be responsive to short-run changes in quantity of care demanded. Second, the bed supply was regulated by certificate of need. Third, in July 1981 Wisconsin had imposed a moratorium on new bed construction. This moratorium remained in effect throughout 1983. As a consequence of these factors, it is unlikely that the bed supply could have been so responsive to demand as to have generated these results.

To further test whether excess demand is behind these findings, we must look for additional evidence that nursing home behavior is responding to excess demand. To do this, we turn to a separate analysis of the determinants of private and Medicaid nursing home use.

Scanlon argued that, if supply constrains demand, nursing homes would be able to choose among patients. If so, they would almost always opt for the higher-paying private patients over Medicaid patients. As a result, private patients would have priority for openings.

Table 2:   Nursing Home Use Regression Results,
Ratio-Specified Variables (Patients per Thousand Elderly)

| | Dependent Variables | | |
| | A | B | C |
Variable	Total Patients	Private Patients	Medicaid Patients
Intercept	7.446*	-13.718	21.164
	(12.413)†	(16.352)	(22.589)
	.5510‡	.4050	.3527
Beds per thousand elderly	0.966	0.099	0.867
	(0.020)	(0.027)	(0.039)
	.0001	.0005	.0001
Per capita income	0.000044	0.00280	-0.00276
	(0.000533)	(0.00070)	(0.00097)
	.9345	.0002	.0062
Average private SNF price	0.0847	-0.5600	0.6847
	(0.1391)	(0.1833)	(0.2532)
	.5450	.0018	.0090
Average Medicaid SNF rate	-0.279	0.0212	-0.300
	(0.165)	(0.217)	(0.300)
	.0963	.9227	.3217
Number of elderly	-0.0000058	-0.0000633	0.0000576
	(0.0000386)	(0.0000509)	(0.0000704)
	.8811	.2184	.4165
Percent elderly over 85	-83.699	100.114	-183.812
	(61.193)	(80.609)	(111.356)
	.1768	.2193	.1043
Deaths per thousand population	-0.0268	0.0760	-0.1028
	(0.3937)	(0.5186)	(0.7164)
	.9460	.8840	.8864

Continued

Only Medicaid use would be constrained by the number of beds available. This suggests that the supply of beds should not constrain private use, only Medicaid use.

To test this in Wisconsin, the number of private patients and Medicaid patients (both ratio specified and raw) were regressed on the same list of explanatory variables in separate equations. If the bed supply has no effect on the number of private patients admitted, then the bed supply coefficient in the private equation would be expected to approach zero. However, it is likely that, since the number of private patients is correlated with the overall number of patients (r = .55, p < .0001), the number of beds in a county will be correlated with the

Table 2:   Continued

	Dependent Variables		
	A	B	C
Variable	Total Patients	Private Patients	Medicaid Patients
Percent elderly who are women	16.127 (11.531) .1674	19.792 (15.190) .2299	-3.665 (20.983) .8620
Percent married women who work	-3.809 (16.786) .8213	17.634 (22.112) .4285	-21.443 (30.546) .4855
Residents receiving home health care per thousand elderly	-0.0100 (0.0120) .4071	-0.0091 (0.0158) .5683	-0.00095 (0.0219) .9654
Average number of weighted violations per nursing home	-0.00119 (0.02194) .9569	0.0212 (0.0289) .4652	-0.0224 (0.0399) .5762
Milwaukee area location	1.641 (2.125) .4429	3.397 (2.799) .2299	-1.755 (3.867) .6516
R^2	.9868	.7425	.9422
F-value	335.359	13.693	77.414
N	70 counties	70 counties	70 counties

*Regression coefficient.
†Standard error.
‡Significance level.

number of private patients even under excess demand conditions. Therefore, perhaps a better test for excess demand is to compare the marginal effect of one additional bed (as evidenced by the bed supply regression coefficients) with the average effect (as evidenced by the percentage of beds occupied by each type of patient).

If faced with a surplus of beds, nursing homes will admit patients in the order that they apply for admission. The probability that an additional bed will be filled with a Medicaid patient will be reflected by the percentage of all beds occupied by Medicaid patients. As a result, the regression coefficient will not differ significantly from the average Medicaid occupancy rate. If faced with excess demand, however, Medicaid patients are only admitted after private demand is satisfied. Because the home can discriminate, the probability of an additional bed being filled with a Medicaid patient (as reflected by the regression

Table 3:   Nursing Home Use Regression Results,
Raw-Specified Variables

| | Dependent Variables | | |
| | A | B | C |
Variable	Total Patients	Private Patients	Medicaid Patients
Intercept	83.408*	-330.046	413.454
	(90.118)†	(185.496)	(219.341)
	.3586‡	.0805	.0645
Beds	0.955	0.112	0.844
	(0.018)	(0.036)	(0.043)
	.0001	.0033	.0001
Per capita income	-0.00159	0.0222	-0.0238
	(0.00362)	(0.00746)	(0.00882)
	.6621	.0042	.0091
Average private SNF price	0.419	-4.734	5.154
	(0.957)	(1.969)	(2.329)
	.6628	.0195	.0309
Average Medicaid SNF rate	-1.193	1.701	-2.894
	(1.119)	(2.303)	(2.723)
	.2907	.4632	.2923
Number of elderly	0.000913	0.0133	-0.0124
	(0.001841)	(0.0038)	(0.0045)
	.6216	.0009	.0075
Percent elderly over 85	-126.428	-429.430	303.003
	(375.349)	(772.613)	(913.574)
	.7375	.5805	.7414
Deaths per thousand population	1.252	1.412	-0.160
	(2.726)	(5.610)	(6.634)
	.6478	.8022	.9809

Continued

coefficient) will be significantly greater than the average Medicaid occupancy rate.

A similar story can be told for private patients. The priority that nursing homes accord private patients results in a bed supply coefficient that is significantly lower than the private occupancy rate.

Regarding the other variables in the regressions, we would normally expect that many of the characteristics that determine private use also determine Medicaid use. For example, we would expect both Medicaid and private use to be greater in counties with more or higher percentages of older people, because older people tend to need nursing home care more than others. Empirical estimates, however, of the

Table 3:   Continued

Variable	Dependent Variables		
	A	*B*	*C*
	Total Patients	*Private Patients*	*Medicaid Patients*
Percent elderly who are women	-43.349	335.920	-379.269
	(78.909)	(162.425)	(192.059)
	.5849	.0432	.0531
Percent married women who work	-53.451	286.978	-340.429
	(115.919)	(238.606)	(282.138)
	.6465	.2341	.2326
Residents receiving home health care	-0.00816	-0.0405	0.0324
	(0.01015)	(0.0209)	(0.0247)
	.4245	.0573	.1954
Average number of weighted violations per nursing home	0.0249	0.2799	-0.2550
	(0.1505)	(0.3098)	(0.3663)
	.8692	.3701	.4892
Milwaukee area location	22.085	-9.250	31.336
	(14.481)	(29.808)	(35.247)
	.1328	.7574	.3777
R^2	.9997	.9751	.9966
F-value	13928.471	185.665	1381.336
N	70 counties	70 counties	70 counties

*Regression coefficient.
†Standard error.
‡Significance level.

determinants of nursing home use by Medicaid patients may not show this under excess-demand conditions. Indeed, they may show a counterintuitive *negative* relationship between Medicaid use and factors associated with greater need. This is because, as nursing homes face greater need by patients in general, they are able to admit more private patients. As more private patients are taken, there is less room for Medicaid patients who are crowded out. Therefore, because of the nursing homes' preference for private patients and the excess demand for beds, any factor that *increases* overall need for care would *decrease* Medicaid use, *ceteris paribus*. As a result, variables with positive coefficients in the private use equation should exhibit negative coefficients in the Medicaid use equation, and vice versa.

This hypothesis does not apply simply to population characteristics related to the prevalence of private or Medicaid patients. For

example, under all market conditions we would expect counties with high per capita income to have more private patients (positive coefficient) and fewer Medicaid patients (negative coefficient), because qualifying for Medicaid is dependent on income.[3] Instead, this hypothesis applies to those characteristics (like the number or percentage of elderly in an area) that would seem to relate to greater use by all patients.

Before reviewing the results, one explanatory variable merits special attention: the number of people residing in the county who receive home health services. The difference between the effect of home health use on private nursing home use, on the one hand, and of home health use on Medicaid nursing home use, on the other, may explain the general lack of a significance in the federally sponsored investigations of the substitutability between these two forms of long-term care. A short digression will explain.

Much interest in recent years has been directed at the possibility that home health care can be substituted for nursing home care, thereby avoiding institutionalization and possibly saving taxpayers' money. The federal government has funded a number of demonstrations and experiments that have tested for substitutability between these two services by providing home health care services to an experimental group of people at risk of institutionalization. (These include, for example, Weissert, Wan, Livieratos, and Katz 1980; Hughes, Cordray, and Spiker 1984; Weissert, Wan, Livieratos, and Pellegrino 1980; Skellie, Mobley, and Wan 1982; Hughes, Manheim, Edelman et al. 1987; Mitchell 1978.) The institutionalization rate of an experimental group is then compared with the institutionalization rate of a control group that did not have access to free home care. These studies have shown a small but generally insignificant substitutability effect (U.S. General Accounting Office 1982; Hughes 1985; Weissert 1985; Hedrick and Inui 1986; U.S. Dept. of Health and Human Services 1986). This has led some observers (Weissert 1985, for example) to conclude that nursing home care and community-based care are not substitutes for one another.

One problem with these experiments is that they may not account for the possible effect of excess demand in suppressing the significance of their results. Because the experiments generally use potential Medicaid patients as subjects, excess demand may be constraining their subjects' ability to gain admission to nursing homes. For example, suppose the control group has 30 Medicaid-eligible patients sick enough to require nursing home care and the experimental group has only 20 because 10 are now being cared for at home as a result of the

experiment. If only ten beds are available for each group because of bed shortages, each group will have ten nursing home patients. Thus, there will be little difference between the nursing home utilization rates of each group even though significant substitution would have occurred. Since private patient behavior is not constrained by supply, we would expect to find a significant decrease in the number of private nursing home patients as the number of home health patients increased, but not in the number of (shortage-constrained) Medicaid patients.[4]

PRIVATE AND MEDICAID USE RESULTS

Columns B and C of Table 2 show the private and Medicaid regression results, respectively, for the ratio-specified equation. The same columns in Table 3 show private and Medicaid results, respectively, for the raw-specified equation. For the ratio specification, the bed supply coefficient is .0990 for the private equation and .8666 for the Medicaid. For the raw specification, the coefficient is .1117 for the private equation and .8436 for the Medicaid equation. In each specification, these coefficients represent the probability that an additional bed will be occupied by a private and Medicaid patient, respectively. For private patients, these marginal probabilities (9.9 and 11.2 percent) are significantly smaller than what would be expected on average, since the proportion of all beds occupied by private patients (24.5 percent) lies outside the 99 percent confidence interval for both regression coefficients. Similarly, the proportion of beds occupied by Medicaid patients is 70 percent, again lying outside the 99 percent confidence interval for the Medicaid equations' bed supply coefficients (implying that an additional bed has an 88.66 or 84.36 percent probability that it will be occupied by a Medicaid patient). All coefficients support the existence of behavior that is consistent with excess demand.

Regarding the other coefficients from columns B and C of Table 2, the signs of the private-use equation are consistent with normal expectations about the types of patients who are likely to need nursing home care. In contrast, the signs of the Medicaid equation coefficients are exactly opposite of what would be expected, suggesting a preference for private patients and a crowding out of Medicaid patients under excess-demand conditions. These results imply that trying to identify the true determinants of Medicaid use in the presence of excess demand may be impossible. Only the coefficients for the per capita income and average skilled nursing facility (SNF) price were significant; the coefficient for the home health use variable in the private equation was not significant

and therefore did not conform to expectations. Perhaps dividing by the number of elderly persons has a confounding effect on this relationship.

For the raw-specified results from Table 3, the signs of the private equation coefficients are again the opposite of the Medicaid equation coefficients but, in addition, more variables are significant. The number of private patients increases as the percentage of elderly who are women increases, while the number of Medicaid patients decreases. Further, private use is associated with greater numbers of elderly in the county, and Medicaid use with fewer elderly, *ceteris paribus*. Out of context, the Medicaid results are clearly unbelievable. Since nursing home patients are usually women and over 65, both private and Medicaid use are expected to increase with these population characteristics. In the context of excess demand, however, the results are reasonable because they imply that, when there are more patients seeking beds than beds available, Medicaid patients are being crowded out by private patients. Finally, although the home health use coefficient is not large (100 additional county residents receiving home health care results in only 4 fewer private nursing home patients), the substitutability effect is significant at the .0573 level for private patients, and not for Medicaid patients, consistent with expectations.[5]

Harrington and Swan (1987) use state-level data from 1978 to 1983 to regress *Medicaid* patients per thousand elderly on the bed supply per thousand elderly and other variables. Their results are similar to those reported here in that bed supply was the most significant variable. Percent unemployed in state was also significantly associated with more Medicaid use, as was whether or not the state had a program for the medically needy. Both relationships are consistent with the per capita income result of the present study. Although most of the other explanatory variables in their study seem to be predictors of Medicaid use rather than overall use and therefore have reasonable signs, the coefficients of some of the variables (such as the negative sign for the "percent aged 65 +" variable) may be implicitly driven by the effect of these factors on private use.

Also, Harrington and Swan find no significant relationship between the average intermediate care facility (ICF) reimbursement rate in the state and Medicaid use, consistent with the present study's finding. They had hypothesized that "higher reimbursement rates would increase utilization by encouraging nursing homes to accept more Medicaid recipients" (Harrington and Swan 1987, 164). They explain the lack of relationship by speculating that "Medicaid rates are so far below private rates that even the highest Medicaid rates have

little leverage in-encouraging [sic] the admission of Medicaid patients" (Harrington and Swan 1987, 165). A more likely explanation is that, even with higher rates, the Medicaid payment is still below the private payment, and any difference at all establishes private patients as the preferred patients, other things held constant.[6]

SUMMARY

It appears that the bed supply did generally constrain use in Wisconsin in 1983, a state possessing one of the highest beds per elderly population ratios. Considering private and Medicaid use separately, it was found that if an additional bed were to become available, there was an 84 to 87 (10 to 11) percent chance that it would be filled by a Medicaid (private) patient, even though Medicaid (private) patients occupy 70 (25) percent of the beds. The discriminatory behavior that these statistics suggest is consistent with the presence of excess demand. This evidence suggests that, even though private patients are preferred to Medicaid patients under all market conditions because they are more profitable, it is only under shortage conditions that nursing homes can afford to act on these preferences by discriminating against Medicaid patients and admitting private patients to their exclusion.

Moreover, it was found that the determinants of private use are opposite to those of Medicaid use. This is consistent with the hypothesis that, since private patients are preferred and there is an excess demand for beds, any factor that increases overall demand for nursing home beds tends to crowd out Medicaid patients. Therefore, the existing findings regarding the determinants of Medicaid nursing home use may be misleading. The separate regressions, however, were useful in identifying excess demand as a possible explanation of why the federally supported experiments generally found that community-based care was not a significant substitute for nursing home care.

THE DETERMINANTS OF THE
BED SUPPLY

If supply constrains use, then the determinants of the bed supply are interesting in themselves because they determine the characteristics of areas with greater or lesser use.

THE BED SUPPLY DECISION

Theoretically, both the firm and the certificate-of-need (CON) agency are involved in the bed supply decision. The decision to build nursing home beds in a certain area can be viewed as being initiated by the firms, both existing and prospective. Since 70 percent of nursing homes and 80 percent of the beds nationwide are proprietary (Institute of Medicine 1986), it is safe to assume that the strength of the firm's desire to build beds is generally related to the amount of profits that are expected to be derived from their use. Although the desire to build is initiated by the firm, the final decision to permit building rests with the certificate-of-need agency. The CON agency has its own objectives that are sure to reflect in part the agency's perception of the degree of need for beds in an area, and in part the amount of funds available to the state to pay for Medicaid patients, as well as other considerations. Since the firm's decision is, to some unknown extent, filtered through certificate-of-need agency objectives, it is unlikely that we can confidently identify any one objective (such as profit maximization) as the basis for developing a model of what determines nursing home bed supply.

Because of this theoretical complexity and because the decision-making procedure suggests that both the firm and the CON agency influence the bed supply decision, both supply- and need-related variables have been included in the bed supply regression equation. Clearly, some need-related variables represent the behavior of the consumer. The combining of variables associated with both the firm and the consumer in a bed supply equation renders inappropriate the use of a conventional two-stage least-squares analysis for sorting out the true relationship between the private price and the bed supply (since bed supply so closely mirrors bed use). Consequently, the equation is estimated with ordinary least-squares, and the coefficients should be interpreted as reflecting descriptive relationships rather than structural ones that relate to the behavior of the firm alone.

The number of beds in an area is expected to increase with the profitability of the market and with the need for beds. Per capita income, average private SNF price of nursing homes in the county, and the average SNF Medicaid reimbursement rate were included as measures of profitability. It was expected that, as each one of these increased, more beds would be supplied to the market. Because we were not able to adequately isolate the behavior of the firm, the private price may reflect a demand relationship with the dependent variable and, therefore, exhibit a negative coefficient. The Medicaid rate can-

not similarly exhibit a demand relationship because it does not represent a cost to the consumer.

The need for beds is represented by the number of elderly in the county, the percentage of elderly who are over 85, the number of deaths per thousand population (a measure of the county's health status), and the percentage of elderly who are women. The number of beds approved by certificate-of-need agencies would theoretically increase with all of these variables.[7] The need for beds is also represented by the availability and use of alternative care. The number of beds supplied, therefore, may also be responsive to the availability of informal care, measured by the percentage of married women who are working, and the use of home health care, measured by the number of home health patients. In addition, we tried to hold constant the quality of care in nursing homes by including a measure of the average number of weighted violations of the Medicaid certification code in nursing homes in the county. Finally, an urban dummy variable was included to control for the counties in the Milwaukee area. There are no expectations regarding the coefficients of these latter two variables.

BED SUPPLY EQUATION RESULTS

The results are presented in columns A and B of Table 4. Column A reports the results of the ratio-specified equation regression (beds per thousand elderly) and column B reports the raw-specified equation results (beds). Considering first the ratio-specified regression results, two of the profitability variables — per capita income and the average Medicaid reimbursement rate — were significant and exhibited the expected signs. Of the need variables, the supply of beds increased significantly with the percentage of elderly over 85 and weakly with the percentage of elderly who are women. Swan and Harrington (1986) found that the only significant determinant of bed supply per thousand elderly was the relative age of the elderly population. Income was included in their regressions but was not found to be significant.

Regarding the results for the raw-specification regressions (column B), only three variables were significant: the average Medicaid rate, the number of elderly, and the percentage of elderly who are over 85. Consistent with Swan and Harrington (1986), income was not significant in this equation.

If use is overwhelmingly determined by the supply of beds, then it should not matter whether the dependent variable in the bed supply equation is the number of beds or the number of patients who are using those beds. To test this, the same regressions were run with patients per

Table 4:   Nursing Home Bed Supply Regression Results

	Dependent Variables			
	A	*B*	*C*	*D*
Variable	*Beds per Thousand Elderly*	*Beds*	*Patients per Thousand Elderly*	*Patients*
Intercept	-124.101*	-1879.876	-112.387	-1712.501
	(78.718)†	(620.552)	(76.961)	(598.618)
	.1203‡	.0037	.1496	.0059
Per capita income	0.00654	0.0301	0.00636	0.0272
	(0.00334)	(0.0266)	(0.00327)	(0.0256)
	.0551	.2616	.0564 ·	.2932
Average private SNF price	-0.392	-4.292	-0.293	-3.681
	(0.900)	(7.068)	(0.880)	(6.818)
	.6650	.5460	.7400	.5913
Average Medicaid SNF rate	2.676	19.947	2.305	17.863
	(1.009)	(7.866)	(0.987)	(7.587)
	.0103	.0139	.0230	.0220
Number of elderly	0.0000569	0.0858	0.0000491	0.083
	(0.0002502)	(0.0077)	(0.0002447)	(0.0074)
	.8210	.0001	.8416	.0001
Percent elderly over 85	1727.133	7661.362	1584.043	7192.729
	(324.981)	(2593.343)	(317.725)	(2501.678)
	.0001	.0045	.0001	.0056
Deaths per thousand population	1.110	20.011	1.045	20.369
	(2.545)	(20.027)	(2.489)	(19.319)
	.6645	.3219	.6761	.2961

Continued

thousand elderly and patients as the dependent variables. The results are reported in columns C and D of Table 4, respectively. It is apparent that no appreciable differences occur between the bed supply regressions (columns A and B) and these use regressions (C and D). This implies that previous studies of the determinants of nursing home use may simply have been studies of the determinants of the bed supply, if excess demand was a prevailing characteristic in their data.

It further implies that, since bed supply determines use, the use of nursing home care is not based entirely on need. Although a measure of need (aged population) was a significant factor in determining beds and thus use, so was the reimbursement rate. In Wisconsin's prospective reimbursement system, the 1983 reimbursement rates simply represented 1981 reimbursement rates adjusted for inflation (Wisconsin 1983). As a result, it is difficult to connect the size of the reimbursement payment with a county's need for nursing home care. This

Table 4:   Continued

| | Dependent Variables | | | |
| | A | B | C | D |
	Beds per Thousand Elderly	Beds	Patients per Thousand Elderly	Patients
Percent elderly who are women	-124.058 (72.876) .0940	-331.641 (583.153) .5718	-103.665 (71.249) .1511	-360.177 (562.541) .5245
Percent married women who work	-101.973 (107.878) .3484	443.134 (583.153) .6071	-102.276 (105.469) .3362	369.890 (826.780) .6563
Residents receiving home health care per thousand elderly/ residents receiving home health care	-0.053 (0.0775) .4947	0.0452 (0.0750) .5490	-0.0615 (0.0758) .4206	0.0350 (0.0723) .6301
Average number of weighted violations per nursing home	0.0679 (0.1418) .6340	0.346 (1.114) .7572	0.0643 (0.139) .6443	0.336 (1.075) .7420
Milwaukee area location	-15.559 (13.607) .2575	-112.429 (106.298) .2946	-13.383 (13.304) .3184	-85.322 (102.540) .4088
R^2	.4872	.9826	.4620	.9823
F-value	5.010	297.325	4.527	292.148
N	70 counties	70 counties	70 counties	70 counties

*Regression coefficient.
†Standard error.
‡Significance level.

appears to indicate the likelihood that use-based estimates of need are flawed.

SUMMARY

This section has shown evidence that the Medicaid reimbursement rate and the age of the population are determinants of the bed supply. Moreover, bed supply determines use to such an extent in Wisconsin that it is possible to substitute nursing home use for bed supply as the dependent variable in the bed supply equation and to show no appreciable difference in the results. This raises questions about the reliability (in the nontechnical sense) of use-based measures of need, even from a seemingly "overbedded" state such as Wisconsin.

CONCLUSIONS

This article has shown evidence that excess demand is the source of at least three types of error in use-based estimates of the need for nursing home beds. First, estimates of the determinants of Medicaid use may simply represent a crowding out of Medicaid patients driven by the determinants of private use. This crowding out results in counterintuitive empirical evidence that appears to show Medicaid use decreasing as the need for care in a geographical area increases, *ceteris paribus*. As a result, estimates of need that are based on the determinants of Medicaid use in an area would be seriously flawed since they do not reflect the true (unconstrained) behavior of Medicaid patients.

Second, the estimates of the substitutability of home health care for nursing home care have generally been based on the behavior of Medicaid-eligible experimental subjects. If their access to nursing homes was constrained by a shortage of beds, then differences in nursing home use between those who have and those who do not have access to home health care may not reflect the true degree to which substitution would have occurred.

Third, if beds constrain use, then the determinants of the bed supply become the determinants of overall use. Since the bed supply is determined to a certain extent by considerations other than need (such as profitability), the use of nursing homes will reflect these objectives. Therefore, use-based estimates of need are likely to be flawed.

These findings suggest that previous studies of use, and especially studies of Medicaid use, may not reflect the true need for nursing home care, if the behavior these studies tried to capture was constrained by a shortage of beds. While this clearly applies to the studies using geographical areas as units of observation, it may also be true for patient-level studies. Whether a given patient-level study is affected, however, depends on the specifics of the study.

It also depends, of course, on whether there is a shortage of nursing home beds. One of the major findings of this study is evidence — bed supply coefficients and R^2s that approach unity in the overall use regression, bed supply coefficients significantly different from the average occupancy rates for private and Medicaid patients, Medicaid use evaluation coefficients that have opposite signs from those of the private use coefficients — that excess demand generally exists in a state with one of the highest bed to elderly population ratios. This implies that excess demand may be more widespread than the investigations that attempted to determine "undersupply" would lead us to believe. As

a result, the accuracy of many, if not most, use-based estimates of need may be in question.

Clearly, because excess demand seems to constrain only Medicaid patient behavior, we can use the estimates of the determinants of private use to generally confirm or question existing Medicaid and overall need estimates. For example, the effect of home health care use on private nursing home use shown here is small, indicating that little of the pressure for beds is likely to be eased by the funding of home health services for Medicaid patients. This would tend to confirm the conclusions of the home health care experiments.

Still, employing private-use estimates to assess the reasonableness of Medicaid-use estimates may be unsatisfactory for at least two reasons. First, from a clinical perspective, Medicaid patients may generally be more or less needy than private patients. For example, we might find that, because Medicaid patients are poor, they may be sick earlier in life than private patients. Therefore, the relationship between population age characteristics and need may be different for Medicaid patients. Second, much of the question of "need" is a political question. Clearly, taxpayers are not interested in providing free care to just anyone who wants it. On the other hand, taxpayers may want to provide care to those who, from a clinical point of view, are marginally undeserving, but who need the housing, board, and social support. From both of these points of view, private use–based estimates of need are inadequate.

Given the difficulties with the estimation of need from use-based statistics, and given the difficulty of arriving at a consensus clinical definition of need, perhaps we should not continue to pursue the goal of discovering a clinical gold standard for Medicaid need. Clearly, even clinical perceptions of "need" are to some extent politically motivated. Since the question, Who needs nursing home care? is more easily answered as a political than a clinical question, maybe specific Medicaid eligibility requirements should be defined through the political process. If we find that the eligibility is incorrectly dispersed, then we can make corrections in the requirements. Given enough iterations, we may arrive at a politically acceptable definition of Medicaid "need."

Even if we have acceptable private and Medicaid estimates of the need for nursing home care, we must also consider the requirements of the market when determining whether a given geographical area has a sufficient number of beds. If the number of beds in an area is exactly equal to the number of people needing nursing home care, there may still not be enough beds. If there are just enough beds to place all patients, nursing homes are not required to compete for patients. Even

the worst nursing home knows that its beds will be filled, most likely with Medicaid patients. As a result, the quality provided when there is no need to compete for patients is likely to be significantly lower than the quality of care provided in markets with a surplus of beds. For example, elsewhere it is shown both that the number of violations of the Medicaid certification code decreases (Nyman 1985, 1988a, 1989a) and that the proportion of the (prospective) reimbursement payment spent on patient care increases (Nyman 1988b) as the average number of empty beds per nursing home in the county increases. This indicates that the optimal number of beds in a market is to some extent greater than the number that simply covers private demand and Medicaid need.

In a larger sense, this article represents additional evidence in support of an alternative paradigm for explaining the problems of the nursing home industry. Past explanations have centered on what might be called the inadequate-reimbursement/consumer-irrationality paradigm. According to this paradigm, the low-quality care provided by a large proportion of nursing homes was due to Medicaid reimbursement rates that were insufficient to cover the costs of providing adequate-quality care. Also, inadequate reimbursement rates were behind the difficulty that heavy-care patients experienced in gaining access to nursing home care. Further, because of the cognitive difficulties of the patients, it was necessary for the government to regulate the quality of care forthcoming. Policies consistent with this paradigm are the raising of reimbursement rates to increase quality and to assure access by heavy-care patients, and direct regulation to establish adequate-quality care.

In contrast, the alternative excess-demand paradigm holds that quality is inadequate because the bed shortage has eliminated the need to compete for patients, especially Medicaid patients. It enables nursing homes to select the more profitable light-care patients, even though the reimbursement rate is sufficient to cover the costs of caring for light- and heavy-care patients alike. Excess demand means that prospective patients "choose" obviously poor-quality homes not because the patients are irrational, but because they (and their agents) do not have a choice. They are forced to take the first available bed. According to this paradigm, policy should be directed at ensuring that all patients have a choice among homes and that the nursing homes have the incentives to provide better-quality care and to take the heavy-care patients.

This article has presented evidence that excess demand seems to be present in a state with one of the highest ratios of beds per thousand elderly in the country. If excess demand could be present in Wisconsin,

it could be present in many other states. If excess demand is present and represents the true paradigm, then existing and proposed solutions (raising reimbursement rates, adopting case-adjusted prospective reimbursement, increasing regulation, employing certificate of need) to the problems of nursing homes are likely to be either ineffective or even counterproductive. Clearly, more research is needed to ascertain the true source of the problems that have traditionally plagued the nursing home industry. The paradigm that best explains the behavior of nursing homes and their patients is the true paradigm.

ACKNOWLEDGMENTS

NOTES

1. The data for this study are taken primarily from the 1983 Wisconsin Annual Survey of Nursing Homes. To this data set, information from a number of other data sets was added. The number of home health residents (aggregated to the county level) was taken from the 1983 Wisconsin Annual Survey of Home Health Agencies; 1983 violations data (aggregated to the county level and averaged for the nursing homes for which data were available in the data set) from the Wisconsin Bureau of Quality Compliance; county per capita personal income estimates from the "Survey of Current Business" (U.S. Dept. of Commerce 1985); and county population characteristics from Wisconsin's *Population and Vital Rates 1983–1984* (Wisconsin 1986). The nursing home patient data represent the characteristics of those patients residing in nursing homes in Wisconsin on December 31, 1983, and were also aggregated to the county level.
2. This does not rule out the possibility that some Wisconsin counties may have a surplus of beds. Other work with this data set has shown evidence of a significant variation in the average number of empty beds for nursing homes in the county, a measure of the likelihood or degree of excess demand. This variation, however, is not inconsistent with a *general* finding of excess demand.
3. Likewise, we might expect higher private per diem prices to be associated with fewer private patients and more Medicaid patients because any given patient admitted as private will run out of private funds (and become a Medicaid patient) more quickly as the private price increases. The effect of the size of the private price on the speed of spend-down has been investigated elsewhere (Nyman 1989b). In that study, evidence was found that the

size of the private price did not seem to influence observably the speed at which private patients depleted their funds. Therefore, the negative relationship found in the study reported here simply may represent a conventional demand effect. If so, higher average private prices are associated with fewer private patients, which frees up more beds for Medicaid patients.

4. In Wisconsin in 1983, every county had at least one home health agency serving it. Moreover, as of March 31, 1984, Wisconsin was 1 of only 16 states with no limits on Medicaid coverage of part-time nursing services or aide services provided by home health agencies. While there were limits on medical supplies and equipment, and on the use of physical therapy, occupational therapy, and speech and hearing therapy, Wisconsin seems to have been less restrictive than other states (Health Care Financing Administration 1985).

5. Another explanation is that the insignificance of the Medicaid coefficient may be caused by the effect of two opposing forces: one, the substitution effect reducing Medicaid use as more patients receive home care, and the other, a negative crowding-out effect as Medicaid nursing home use increases because more private patients receive care at home. In either case, however, the insignificance is due to excess demand.

6. The difference between absolutely and relatively low reimbursement rates is crucial to understanding nursing home behavior. Many observers have seen poor-quality care in Medicaid-dominated nursing homes and have concluded that the reimbursement rate is insufficient to pay for higher-quality care. This is not necessarily true if there is excess demand. With excess demand, it is simply necessary for the private per diem payment to be higher than the Medicaid payment to establish a preference for private patients — competition will occur for private patients, and not for Medicaid patients. As a result, Medicaid-dominated homes will provide low-quality care, even though the reimbursement rate covers much higher quality care.

   Similarly, many observers see that heavy-care Medicaid patients are excluded from nursing homes and conclude that the Medicaid reimbursement rate is insufficient to pay for the costs of heavy-care patients. This is again not necessarily true, if there is excess demand. Prospectively paid nursing homes make greater profits if they admit the lighter-care patient. Therefore, if there are, say, 120 Medicaid patients and 100 available beds, nursing homes may exclude the 20 heaviest-care patients even though the reimbursement rate is sufficient to cover the costs of these patients.

7. It is not clear whether or to what extent certificate of need constrains the bed supply. Because of its existence, however, it would be a mistake to ignore the possibility that certificate of need may effectively constrain the building of nursing home beds in a state. Indeed, as mentioned here, the supply of beds in Wisconsin has been additionally constrained since 1981 by a construction moratorium.

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