The Relative Importance of Physician-induced Demand in the Demand for Medical Care

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IN MOST MARKETS, CONCERN OVER LARGE INCREASES in the supply of manpower would focus on expected declines in earnings, difficulties in securing steady employment, and lower prices for consumers. While this describes many labor markets, it does not describe expectations about the market for physicians in the 1980s. Among the various explanations for this discrepancy is the lack of appropriate consumer information entailing reliance on providers as suppliers of information which is thought to produce an interdependence between supply and demand. This is in addition to the predominance of third party payments which shelter both providers and consumers from concerns about the costs of medical care. As a result, it has been suggested that an increased supply of physicians will not lower but rather increase prices and utilization as physicians attempt to maintain levels of income. The mechanisms whereby physicians are hypothesized to be able to increase both fees and volume of services in the presence of an increasing manpower supply vary, but taken together they represent a belief in the theory of demand inducement.

The purpose of this paper is to analyze the validity of studies regarding demand inducement and discuss some of the major problems

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in this literature. We also review the findings from a series of newer studies on demand inducement using data from the National Medical Care Expenditure Survey of the National Center for Health Services Research. Our focus here is on the overall pattern of effects observed from this series of studies and particularly on the policy implications of these findings.

Literature Review and Methodological Problems

In this section we evaluate some of the empirical evidence to date on physician-induced demand and then raise several methodological issues which we think have plagued many of these studies.[1] Focusing either on utilization or on fees as indicators of physician inducement, earlier studies have typically used the physician-to-population ratio as the correlate of physician-induced demand. As we shall describe, however, physician behavior in this respect has many more dimensions and is more complex than can be described by a simple measure like the physician-to-population ratio.

Aggregate Data[2]

In a pioneering study on this question, Fuchs and Kramer (1972) used national, aggregate cross-section data to identify supply factors, technological change, and the number of physicians as major determinants of the increase in expenditures for physician services from 1948 through 1968. They not only found the physician-to-population ratio to be important in explaining visits per capita but to be much more important than consumer income, price, or insurance coverage.

In a later article, Fuchs (1978) attempted to test this notion of physician-induced demand by relating the supply of surgeons to the

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[1] A more detailed review of the literature available prior to 1981 was recently completed by Mitchell and Cromwell (1981). Readers interested in detailed information on the populations studied, the methodologies used, and the resulting findings should consult this report.

[2] This term implies that the unit of observation is an area such as a region or state, as opposed to disaggregate or microlevel data where the unit of observation is a person or family.

demand for operations. Again national, aggregate cross-section data were used and again a positive relationship was found between the physician-to-population ratio and the number of operations performed. Cromwell and Mitchell (1982), too, using aggregate cross-sectional data, reported a significant and positive relationship between density of surgeons and total, elective surgical demand.

In addition to these relationships between the physician-to-population ratio and service utilization, studies using both aggregated and disaggregated data have reported positive associations between physician density and fees, and particularly between surgeon density and surgical fees. Evans (1974), who focused on the theoretical implications of shifts in consumer demand in response to supplier behavior, reported a positive relation between medical prices and the physician-to-population ratio in some Canadian provinces. Mitchell and Cromwell (1981) found a strong positive relationship between surgeon density and surgical fees. On the other hand, in an early study using aggregate time-series data, Feldstein (1970) found no effect between physician density and pricing decisions. Dyckman (1978) also found no effect between fees and physicians per population when analyzing surgical fees across metropolitan areas adjusted for cost of living differences.

Identification of Physician-induced Demand

A variety of methodological problems appear in most of these studies. First, the use of aggregate cross-section data produces what can be described as a fundamental identification problem. As discussed by Sloan and Feldman (1978), Reinhardt (1978), and Yett (1978) and more recently by Green (1978), Ramsey (1981), Pauly (1980) and Auster and Oaxaca (1981), criticism of findings from aggregate cross-section analysis centers on the validity of attributing the positive association between per capita use or prices and the physician-to-population ratio exclusively to physician inducement, and of ignoring tastes, income, the incidence of illness, or more or better insurance coverage as factors increasing per capita demand. The factors correlated with the physician-to-population ratio are the same as those affecting use rates or prices of physician services; thus, a relationship between the physician-to-population ratio and these variables may reflect any number of correlated areawide characteristics. The positive relation between the physician-to-population ratio and fees is particularly prob-

lematic because we would expect more income-motivated physicians in areas with higher fees, thus raising the question of causality. This identification problem is probably the most serious drawback of aggregate cross-section studies, but other issues are of importance as well.

Other Problems with Aggregate Cross-section Data

As described by Sloan and Feldman (1978), border crossing is a phenomenon not accounted for by aggregate data. Surgical rates in a particular geographic location, for example, are a function of the number and types of hospitals in that area. Since people cross area borders to receive surgery, one problem in comparing surgical rates across areas is that all surgical operations performed in an area are included in the numerator while the denominator only consists of people who live in the area. Thus, an area with a medical center will generally have higher surgical rates than one that does not. Likewise, the rate of primary care physician visits is influenced by the mix of specialists and the availability of alternative sources of care in neighboring areas. Variations in the propensity to cross established borders will influence measured rates of utilization and prices and make it difficult to interpret statistical relationships. This problem becomes less severe as the definition of the geographic area becomes larger. Thus, statewide rates are less likely to be distorted by bias or lack of comparability because of border crossing than those based on primary sampling units.

Not an error in method but a drawback of using aggregate cross-section information concerns the weight attached to each observation. Frequently, each observation has an equal weight in its contribution to the relation between the physician-to-population ratio and the dependent variables, despite the fact that observations may be quite different in terms of the size of the market they reflect. Observations which account for perhaps a small part of the total care delivered or a small part of total expenditures may be determining a relationship that is then used to characterize behavior for all care or all expenditures. Thus, a finding that market areas (standard metropolitan statistical areas [SMSAs], for example) with 10 percent more physicians than the average have 3 percent more operations of a certain kind than the average may well be correct; its significance is questionable, however,

in terms of the *total* number of operations of that type performed. If appropriate weights are available, weighted least squares can remedy this situation, but this has rarely been the practice.

The final problem is a statistical one. Cross-section aggregate studies often rely on data that are collected to represent the nation as a whole (the Health Interview Survey data are an example) but may not be self-representing for specific market areas. Variables constructed from interpolation, or proxied indices, must be examined closely. This is true for dependent variables such as per capita utilization and prices, as well as for independent variables such as insurance coverage. Because of these measurement problems, we believe that much of the previous work on physician-induced demand which has used aggregate cross-sectional data has produced results which may not be representative.

The Results from Disaggregated Data

Investigations using disaggregated data have provided mixed conclusions on the issue of physician-induced demand, irrespective of whether the physician, the patient, or the event of care has been the unit of analysis.

Studies of physicians or physician practices have generally found some evidence supporting a causal relationship between the physician-to-population ratio and demand inducement. Evans, a recognized proponent of the physician-induced demand hypothesis, used data bases on Canadian physicians for both 1969 and 1971 and on British Columbia physicians for 1969–70. He and his colleagues (Evans, Parish, and Sully 1973; Evans 1974) conclude that physician-induced demand is a significant factor in the Canadian system, as demonstrated by higher individual physician fees and gross billings in areas with higher physician-to-population ratios. Steinwald and Sloan (1974), using individual physician data, reported a positive effect between physician density and fees for internists and obstetricians, but a negative effect for general practitioners. Pauly and Satterthwaite (1981) used data from a telephone survey of physicians in office-based practice in 100 large SMSAs to test what is probably one of the most innovative theoretical models in this field. Postulating that physicians are able to become increasingly monopolistic as physician density increases because information sharing among consumers is more difficult where

there are large numbers of physicians, they expected prices to be higher in physician-dense areas. This is an alternative explanation of the physician density-fee relationship which does not rely upon demand inducement, and their data support this hypothesis. Redisch, Blaxall, and Gabel (1981) report a negative relation between physician-to-population ratios and patient visits but not between physician-to-population ratios and physician gross and net income per visit. They conclude that physician-induced demand exists because otherwise lower prices would be expected where the supply of providers is greater. Concentrating on remuneration methods, Woodward and Warren-Boulton (1981) used the Health Care Financing Administration's 1976 Physicians' Practice Costs Survey data to study the relationship between physician density and the various ways in which physicians receive net practice income. Because Woodward and Warren-Boulton were able to hold constant practice and area characteristics, their results are of particular importance. While their model suggests that the absence of physician inducement would lead to lower output and income in physician-dense areas, this relationship is not found. Thus, they conclude that physicians may be able to generate demand for their services.

Patient-based studies, on the other hand, generally find little evidence that physicians induce demand. In an early study using the individual as the unit of analysis, May (1975) reported a positive correlation between the physician-to-population ratio and the number of office visits and visits to outpatient departments. May was careful not to label this physician-induced demand, indicating only that an availability effect was found. Pauly (1980) used data from the 1970 Health Interview Survey to estimate utilization equations, with measures of resource availability (including physicians per population) as independent variables. Price was measured as a dummy variable for whether the individual had health insurance or not. Pauly concludes that physician-induced demand is an issue that can safely be ignored. Held and Manheim (1981) examined patients, in Quebec, Canada, being treated for hypertension and report that a relatively large supply of general practitioners raises annual costs per person while a relatively large supply of specialists tends to lower costs. They concluded that physician-induced demand may exist, even though the effects are quite small. A study by Tussing (1981) using individual survey data from the

Republic of Ireland concludes that physician self-interest may be an important consideration in the determination of use.

Two ingenious studies of this issue are analyses of individal data. Examining utilization rates for seven surgical procedures selected because they were thought to be more discretionary than others, Bunker and Brown (1974) report that physician-patients and their spouses had 25 to 30 percent higher rates of operations than the general population. While the data for this study do not claim to be representative of large populations, a recent study by Hay and Leahy (1982), using nationally representative data and adopting more appropriate econometric techniques, confirms its results. Medical professionals and their families were found to visit physicians more often than other persons, holding constant for most of the measurable factors otherwise thought to influence demand. These results suggest that medically uninformed patients have lower use of medical care than would be expected if physicians were able to induce demand.

Using data from the Medicare program in California, Hadley, Holahan, and Scanlon (1979) examined data on events of care to measure physician-induced demand.[3] The period they examine, the Economic Stabilization Program in 1971, provided a "natural experiment" in which physician fees were controlled. They predicted that under price controls increases in the number and mix of services provided would increase gross billings, which is what in fact happened in California. Their results suggest a target income model such as the one modeled by Roehrig (1981). While the authors conclude that physicians probably are able to create demand, they also point out that their results are only for one state, account for about 13 percent of expenditures for physician services for a special period of time, and may be explained by the temporary nature of the price controls. These authors focus on demand creation primarily in terms of changes in prices or reimbursement mechanisms (Monsma 1970), rather than the specific and separate effect of the physician-to-population ratio. While the effect of reimbursement on physician behavior is an important policy issue, it is different from the effect of physician density on use and expenditures.

[3] Event level data are also available from the National Ambulatory Medical Care Survey. For the most recent report, see Cypress (1982). These data deal principally with presenting symptoms, however, and it is not possible to infer who initiated the visit.

Physician Initiation Versus Physician Inducement

Apart from these considerations, definitional problems remain. The term physician inducement clearly implies an attempt to persuade patients to do something they would not do otherwise. Yet in fact, providing advice on the level of medical care required to satisfy individual demands for health is exactly what the physician is expected to do as agent and adviser for the patient, provided that this advice is appropriate. A definition which takes consumer ignorance and physician agency behavior into account is used by Pauly (1977) and Fuchs and Newhouse (1978); here, physician initiation is inducement only when services are recommended above and beyond what the patient would be willing to pay for if the patient knew as much as the physician.

While it is obvious that physician-initiated demand and not physician-induced demand is what is observable, we can nonetheless infer whether or not inducement is an issue by analyzing the correlates of physician initiation. To the extent that physician initiation of services is associated with physician density, the physician's age or the physician's income, all of which reflect physician self-interest, the physician-induced-demand hypothesis is supported. To the extent that physician initiation is associated with lower out-of-pocket costs and health status measures, the physician's behavior is consistent with an agent/advisor role and the physician-induced-demand hypothesis is not supported.

The model we have developed considers the demand for physician services as consisting of two components: that which derives from the patient, and that which derives from the physician. Together they represent the *individual's* total observed demand for physician services.[4] In economic terms, patient-initiated demand is expected to be influenced by the out-of-pocket price (after insurance) of medical care, the market price of physician services, the time it takes to obtain the physician's services, and the personal characteristics of the individual patient—

[4] A more formal exposition may be found elsewhere (Wilensky and Rossiter 1981; Rossiter and Wilensky 1982, 1983). Some authors have written about this distinction at a conceptual level (Gertman 1974; Kohn and White 1976; Luft 1982), including the mandatory or administratively induced use of services (Kalimo, 1976). Others emphasize different aspects of physician behavior in other types of economic models (Newhouse 1970; Ruffin and Leigh 1973; Masson and Wu 1974; Enthoven 1981).

such as health status, income, age, and other characteristics which reflect the individual's attitudes and preferences toward medical care.

Physician-initiated demand is expected to be influenced by the same kinds of factors, that is, out-of-pocket price, market price, patient's income, and other personal characteristics, and, additionally, by the physician-to-population ratio. While this model of the physician is essentially a variant of one developed by Evans (1974) and extended by Sloan and Feldman (1978), it differs in significant ways. Physician-initiated demand can affect physician utility in negative ways—both because it involves more work and because it becomes increasingly distasteful to recommend medical use as marginal benefits approach zero. In contrast, physician-initiated demand has a positive effect on physician utility in that it increases the physician's income. The ultimate effect on physician behavior is thus indeterminant for a wide range of variables which influence physician-initiated demand. This expanded version of the model is used as the basis for a new series of empirical studies.

New Findings on Physician-initiated Demand

Data from the National Medical Care Expenditures Study (NMCES) allow the measurement of physician influence and the economic characteristics of the consumer and the market with considerable precision;[5] they avoid the identification problem mentioned earlier because they are disaggregated and provide a direct measure of physician initiation. Specifically, those interviewed were asked whether an appointment had been scheduled for each visit they or members of their family had made to a physician or if the visit was made without an appointment. If the visit was by appointment, they were asked whether the physician

[5] The primary source of information from NMCES comes from six interviews conducted with 14,000 randomly selected households during an 18 month period in 1977 and 1978. Supplementary and verifying information was also provided by separate surveys to a sample of the physicians and health care facilities which provided care to the household members during 1977, and to all the employers and insurance companies responsible for providing their insurance coverage (Bonham and Corder 1981; Cohen and Kalsbeek 1981; Rossiter 1980).

had arranged for it during a previous visit or whether the patient had made the appointment. Visits arranged by the physician are considered physician-initiated; those arranged by the patient, whether by calling for an appointment or walking in, are considered patient-initiated.

The NMCES also provides the information needed to construct the many variables believed to determine utilization and physician fees. These include age, race, sex of patient, health status, office waiting time, appointment waiting time, travel time, proportion of the bill paid by family, type of insurance, age of physician, specialty, physician fee, time spent with patient, income other than that from the practice of medicine, and others.

Physician-initiated Visits and Expenditures

The NMCES data indicate that the magnitude of visits initiated by physicians is not trivial. National estimates from these data indicate that overall, about 39 percent of all ambulatory physician visits in 1977 were initiated by the physician. It is also clear that the majority of visits to physicians were, in fact, initiated by patients. Of 52 percent of all visits which were patient initiated, 36 percent were made by the patient calling for an appointment and 16 percent were walk-in visits. An additional 9 percent of all visits were classified as either referrals or as unknown. While referrals are clearly physician initiated, they do not reflect financial self-interest and thus are not relevant to this discussion of demand inducement.

The numbers of visits need not be proportional with dollars spent on visits initiated by physicians (Schroeder and Showstack 1978). Physician-initiated visits could, on average, be more or less expensive than patient-initiated visits. If dollars spent were exactly proportional to the number of visits, 39 percent of dollars spent on ambulatory physician care would be initiated by physicians. Our findings indicate that physician-inititated visits on average were somewhat more expensive than patient-initiated visits, and accounted for about 45 percent of dollars spent on ambulatory physician care. This figure, however, ignores the issue of whether diagnostic tests (lab and X-ray) should be regarded as patient or physician initiated and attributes those charges to whoever initiated the visit in connection with which the tests occurred. Another approach would be to arbitrarily assume that all diagnostic tests should be regarded as physician initiated without

regard to who initiated the visit. While this may not be an entirely realistic assumption, since some tests and X-rays may be patient initiated, it represents one extreme and thus provides a useful boundary for comparison. Under this assumption, physician-initiated expenditures accounted for about 56 percent of the dollars spent on ambulatory care. The true figure for physician-initiated expenditures is thus somewhere between 45 percent and 56 percent, probably closer to the latter.

Concerns about physician-induced demand have not been limited to ambulatory care. For purposes of our analyses, and in accordance with actual patterns of practice and the physician's role as gatekeeper to most services, we have designated all surgical procedures and hospitalizations and all prescription drugs as being physician initiated. Under this assumption, 90 percent of health care expenditures are physician initiated or at least physician controlled. This number is higher than the 70 percent frequently mentioned in the literature and at least in part is due to our definitions. Physicians technically control almost all health expenditures according to these criteria, though this clearly does not imply that they are initiating services that individuals would not demand for themselves if they possessed the requisite information.

Multivariate Analysis of Physician-initiated Demand

Our analyses focus not merely on the magnitude of physician-initiated visits or physician-initiated health services, but on whether or not physician initiation appears to be related to the economic and financial conditions of the patient and market. We are particularly interested in the impact of the relative number of physicians in the area because of the large increases in the numbers of physicians expected during the 1980s (see, for example, Graduate Medical Education National Advisory Committee [GMENAC] 1981). A second level of interest is the effects of the reimbursement system on the level of physician inducement. These two effects, i.e., physician density and reimbursement, have occasionally been confused, but our analysis indicates that they have a separate impact on physician initiation.

In order to assess the importance of the physician-to-population ratio on the number and dollar value of physician-initiated services, we estimated a series of equations explaining physician-initiated visits

and expenditures for ambulatory care, surgical care, and total health care. Each of these component analyses is described in greater technical detail elsewhere (Wilensky and Rossiter 1981; Rossiter and Wilensky 1982; Rossiter and Wilensky 1983). Our purpose in reviewing them here is to present an integrated set of NMCES findings on physician-induced demand in order to emphasize the policy implications of this series of studies. These findings are shown in summary form in table 1. Columns 1, 2, and 3 cover ambulatory physician care, including all ancillary services in column 3; column 4 records the probability of a surgical procedure in the hospital; and column 5 includes all physician-initiated expenditures which by our definition encompass expenditures for all ambulatory visits initiated by physicians, all ancillary services, all hospital-related expenditures, and all prescription drug expenditures. Each of these were analyzed using multivariate techniques: columns 1 and 4 by means of a logit estimation; columns 2, 3, and 5 by means of weighted least-squares analysis for those with at least one visit or positive expenses. For each column, the direction of effect between the independent variable and the dependent variable is shown as either positive or negative; the presence of an asterisk indicates that the variable is statistically significant at the .05 level, and the number next to the sign indicates the value of the elasticity for the independent variable. The elasticity shows the amount of change which would be associated with a 1 percent change in the independent variable.

The independent variables explaining physician-initiated visits and expenditures are grouped into four categories: patient characteristics, insurance and reimbursement characteristics, the supply of physicians, and physician characteristics. In addition, waiting-plus-treatment time and travel time were included to account for the full price of care to the patient and to hold constant for quality differences. Visits of longer duration are more likely to have higher prices and thus increase expenses; and longer travel time, in addition to increasing the cost of care to the patient, may reflect the choice of specialty care which is likely to be obtained from a distant medical center.[6]

[6] Several other specific variables, e.g., beds per thousand population, number of chronic conditions, surgeons relative to primary care physicians, surgeons under 45, were utilized in the estimations but are not discussed here. They are discussed in more detail elsewhere (Rossiter and Wilensky 1982). None of the variables of interest changed in significance or in general magnitude in these alternative specifications.

TABLE 1

Summary of Findings from an Analysis of Physician-initiated Demand: Signs, Significance and Elasticities of Regression Results for Selected Dependent Variables of Various Measures of Physician-initiated Demand (NMCES: Household Data, United States, 1977)

	(1) Likelihood of an ambulatory visit[a] being physician-initiated		(2) Number of physician-initiated ambulatory visits		(3) Physician-initiated expenditures for ambulatory visits (including tests)		(4) Likelihood of surgery		(5) Total physician-initiated expenditures (including tests)	
Independent Variables	Sign	Elasticity	Sign	Elasticity	Sign	Elasticity	Sign	Elasticity	Sign	Elasticity
Patient Characteristics										
Age	+	0.369	+*	0.385	+*	0.421	+*	0.306	+*	0.448
Sex ($F = 1$)	+*	0.094	+*	0.095	+*	0.065	+*	0.122	+	0.044
Perceived health status[b]	+*	0.012–0.020	+*	0.019–0.040	+*	0.039–0.069	+*	0.019–0.062	+*	0.002–0.063
Disability days	n.a.	n.a.	+*	0.261	+*	0.225	+*	0.341	+*	0.657
Education	+	0.002–0.010	+	0.009–0.017	+*	0.014–0.056	+	0.001–0.038	+	0.010–0.025
Income[c]	−*	0.246	+*	0.006–0.014	−	0.001	−	0.002–0.019	+	0.003–0.006
Color ($B = 1$)	+	0.006	−*	0.012	−	0.009	+	0.031	+	0.001–0.008
Insurance/Reimbursement[d] (out-of-pocket payment)	−*	0.176	−*	0.069	−*	0.002–0.083	−*	0.010–0.292	−*	0.067–0.072
Supply of Physicians[e]	+*	0.125	+*	0.112	+*	0.143	−	0.004	+	0.008
Physician Characteristics										
Age	−*	0.370	n.a.	n.a.	+*	0.002	−	0.070	+	0.098
Outside income	−	0.013	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Board certification ($Y = 1$)	n.a.	n.a.	n.a.	n.a.	+	0.083	+	0.044	−	0.135

Source: National Center for Health Services Research, National Medical Care Expenditure Survey.

[a] The unit of analysis in column (1) is the visit; in columns (2)–(5) it is the person. [b] Excellent, good, fair, poor. [c] Measured income in thousands of dollars or categories of family income adjusted for family size. [d] Measured as percent paid by family in columns (1)–(3); measured as Medicare, Medicaid, private only differentiated by basic and major medical in columns (4)–(5). [e] Physicians or surgeons per 100,000 population in the county or SMSA in which the patient resides. * Significant at the 0.05 level. n.a. indicates not applicable because of differences in the unit of analysis between independent and dependent variables.

The patient characteristics which are most consistently important in explaining variations in physician-initiated demand are age, sex, and health status *or illness* measures (table 1). Older persons have more physician-initiated ambulatory visits and expenditures, are more likely to have surgery, and have higher total physician-initiated expenses. Females have more physician-initiated ambulatory care and expenses than men and are more likely to have surgery. Persons with lower perceived health status have more physician-initiated ambulatory care and higher physician-initiated expenses for ambulatory care, are more likely to have surgery, and have higher physician-initiated expenses for all health care. As expected, the same pattern exists for persons with large numbers of disability days (defined as being a day spent in bed, lost from work, or not doing normal activity because of illness). Persons with higher education have higher expenditures for physician-initiated ambulatory care, but otherwise education is not important in explaining differences in use and expenditures. Persons with higher incomes are less likely to have a physician-initiated ambulatory visit, but have higher physician-initiated expenses for ambulatory care. Blacks (compared to whites) have fewer physician-initiated ambulatory visits and have lower physician-initiated expenses for ambulatory care. They do not differ with respect to surgery or total physician-initiated expense.

The second set of characteristics, insurance and reimbursement indicators, are consistently important. In terms of ambulatory care, insurance was defined in terms of the share of the bill paid by the individual and, as expected, higher shares paid out-of-pocket are associated with lower physician-initiated use and expenditures. In explaining surgery and total physician-initiated expenditures, insurance was defined by type of insurance, e.g., basic with major medical, Medicare only, etc. (table 1). Insurance as a dependent variable was used both as the percent of the bill paid out-of-pocket and as a series of dummy variables for different types of insurance for a number of reasons. Deductibles and varying coinsurance or maximums for different services make insurance effects complex and difficult to capture in one number such as the percent paid out-of-pocket. Moreover, the method of reimbursement and not just the level of reimbursement may have an effect on the dependent variable which suggests the use of dummy variables is appropriate. In the case of surgical care and total expenses, an actual percent paid out-of-pocket is observed for only about 11 percent of the population that had surgery in 1977. Thus, the dummy variable specification was constructed from the type of insurance coverage

known for everyone and used not so much for the purpose of obtaining the most precise measure of insurance effects, but for holding constant these effects. Again, as expected, higher out-of-pocket payments are associated with less use and lower total physician-initiated expenditures.

The third set of characteristics, the supply of physicians, indicates the impact of greater physician density on care inititated by the physician. Our analyses indicate that whereas a higher physician-to-population ratio increases the likelihood of physician-initiated ambulatory care, the number of such visits, and the amount spent on these visits, it does not affect the likelihood of surgery or total physician-initiated expenditures when insurance and other personal characteristics are taken into account. This finding persisted despite the use of several different definitions of physician density.

The fourth set of characteristics, the characteristics of the physicians, were included when possible. Only the physician's age was statistically significant among the physician variables examined. Older physicians were less likely to initiate a visit but were associated with higher physician-initiated expenditures.

Physician Fees

While physician-initiated visits and expenditures are the most obvious areas of concern regarding induced demand for health services, researchers have also worried about the effects of more physicians on the level of physician fees. The NMCES data also allow an examination of the relation between physician characteristics and physician fees separate from the effect of fees on expenditures. The results are recorded in table 2. The sign, significance, and beta coefficient of the variables are presented for three regression equations. Fees, the dependent variables, are defined as the fee stated by the physician for three common types of visits: initial office visit, follow-up visit in the office, and follow-up visit in the hospital. Using uniformly defined services avoids the problems of comparing fees for heterogeneous outputs. Each has been adjusted by a cost-of-living index for the county in which the physician is located, generated from the Area Resource File of the Health Resources and Services Administration. All the data on physicians are taken from the NMCES Physician Practice Survey, a survey of 5,067 physicians who provided care to a sample of NMCES respondents.[7]

[7] For more details about this survey, see Rossiter 1983.

The unit of analysis is individual physicians but the results are weighted to be representative of all physicians in the United States in 1977 who provided direct patient care in fee-for-service settings.

There are a large number of variables which appear to be important in explaining fee levels; these include the number of patient visits in the office, board certification and eligibility, age of the physician, specialty, time spent with patient, number of days' wait for an appointment, SMSA location of practice, and whether the practice does its own lab work. The variables which are particularly important in explaining variations in fees, either because the size of the parameter or the t-statistic is large, are specialty, time spent with the patient, and, to a lesser extent, physician age and region or residence.

There is a nonsignificant positive relationship between the physician population ratio and fees, and the magnitude of this effect is very small. Estimates (not shown here) of the same equations which do not make cost-of-living adjustments to the dependent variables yield significant positive coefficients for the physician population ratio, but again the coefficients are very small; the estimated elasticity at the mean is 0.06. These findings suggest that once the measure of output is controlled and uniformly defined across physicians, detailed measures of physician characteristics are held constant, and the time the physician spends with the patient is accounted for, the fee-physician density relationship either disappears or is found to be very small in magnitude.

Conclusions

Our purpose was to review the empirical evidence regarding physician-induced demand, emphasizing the influence of physician density. Many researchers have reported finding a positive relation between the relative number of physicians in an area and the use of physician services, prices for services, and the number of surgical procedures performed. These findings have been of particular concern because of the large increases in the number of physicians who will enter practice during the 1980s. There has also been concern that the present reimbursement system has led to higher levels of use and greater levels of expenditures. While the latter issue is a very important policy problem, it ought to be regarded as separate from the effects of increasing the numbers of physicians per se.

However, reports of empirical evidence consistent with the demand-

TABLE 2

The Determinants of Physician Fees: Weighted Least Squares Estimates of Physician Fee Equations for Three Types of Visits (Fees Adjusted for Cost-of-living Differences) (NMCES: Physicians' Practice Survey, United States, 1977)

	(1) Initial visit in the office		(2) Follow-up visit in the office		(3) Follow-up visit in the hospital	
Independent Variables	*b*-value	*t*-value	*b*-value	*t*-value	*b*-value	*t*-value
Constant	11.975		8.882		6.531	
Number of office visits per week	−0.024*	2.59	−0.001	0.44	−0.001	0.45
Physician Characteristics						
Board certified (1 = yes)	3.967*	2.96	1.208	1.27	2.221*	2.85
Board eligible (1 = yes)	0.775	0.61	0.645	0.67	2.096*	2.12
Age (1 = yes):[a]						
35 to 44 years	4.783	1.22	−2.677*	2.44	−1.609	1.40
45 to 54 years	9.418	1.33	−2.683	1.86	−3.348*	2.03
55 years and older	5.925	0.85	−3.173	1.82	−1.385	0.62
Specialty (1 = yes)[b]						
Internal medicine	10.214*	4.50	1.515*	2.23	1.548*	2.26
Pediatrics	−0.452	0.30	−0.022	0.00	−0.126	0.17
Obstetrics/gynecology	7.584*	4.79	3.318*	3.12	1.295	1.16
Surgery	3.004*	2.57	1.715*	3.72	2.288*	2.62
Other[c]	12.937*	4.73	5.019*	5.74	2.880*	2.80
Sex (1 = M)	−0.810	0.41	−1.075	1.08	−0.614	0.44
Foreign Medical School Grad (1 = yes)	−2.344	1.88	0.095	0.14	2.301*	2.18

Practice Characteristics:						
Physicians' usual time with patient[d]	0.507*	7.30	0.546*	8.88	0.477*	9.15
Percent patients Medicaid	0.007	0.17	−0.027*	2.09	0.038	0.93
Days wait for an appointment	0.121*	4.22	−0.016	1.39	0.004	0.24
Accepts new patients (1 = yes)	−5.060	1.07	−1.289	0.71	−0.207	0.20
Solo or group (1 = group)	0.046	0.00	−0.196	0.56	−0.306	0.45
Does own lab work (1 = yes)	1.789*	2.00	0.524	1.50	0.739	1.21
Market Characteristics						
Not SMSA (1 = yes)	−3.822*	4.14	−1.690*	3.68	−1.335	1.65
Census region[e]						
South	1.412	0.84	−1.496	1.82	−1.502	1.48
North Central	3.833*	3.43	0.352	0.44	0.739	0.85
West	8.320*	2.56	1.753	1.81	1.289	0.99
Physicians per 100,000 population	0.004	0.69	0.001	0.24	0.002	0.45
F-Statistic	111.13*		112.13*		32.09*	
R-square	0.47		0.48		0.27	

Source: National Center for Health Services Research, National Medical Care Expenditure Survey.
[a] Omitted category is age less than 35 years.
[b] Omitted category is general or family practice.
[c] Other includes allergy, dermatology, physical medicine, psychiatry, osteopathy.
[d] For visit-type specified in equation, measured in minutes.
[e] Omitted category is Northeast.
* Significant at the 0.05 level.

inducement hypothesis (i.e., higher physician population ratios associated with higher levels of use, expenditures and/or fees) have been plagued by one or more methodological problems. The most common is an identification problem associated with the use of aggregate data in cross-section comparisons. Problems of border crossing exist, as well as the question of weights to be used with aggregate data. In addition, direct measures of inducement or physician initiation have rarely been available. Data limitations in general, and the lack of information on the level of insurance coverage in particular, have hampered research in this area.

We have summarized findings from a series of studies based on the National Medical Care Expenditure Survey which are not adversely affected by the methodological problems associated with earlier studies. In addition to providing a disaggregated data set, detailed measures of insurance coverage and direct measures of physician initiation have been obtained as well as a substantial amount of information on appointment waiting and travel time, and the economic and demographic characteristics of the physician and the patient.

Our findings indicate that the physician-to-population ratio is important in explaining variations in the likelihood of a physician-initiated ambulatory visit, the number of such visits, and the expenditures on physician-initiated ambulatory care. However, and unlike the conclusions in other studies, physician density is not statistically important in explaining the likelihood of surgery or total physician-initiated expenditures on health care (which include, by our definition, all hospital-related and prescription drug expenditures). Those findings held across several different definitions of physician density—physicians per 100,000 population, surgeons per 100,000 population, surgeons relative to primary care physicians, or surgeons under 45 years of age. We argue that the positive relationship for surgery found in earlier studies is due to their inability to control for the presence and depth of insurance at the individual level. The NMCES findings are consistent with the notion of some physician inducement, particularly when physician discretion is likely to be greater, i.e., in ambulatory care versus surgery and hospital care, and for expenditures, including those for X-rays and laboratory tests, more so than for visits. But it is also clear that even when present, the amount of physician-induced demand does not appear to be large.

These findings are not inconsistent with Wennberg's findings (Wennberg and Gittelson 1973; Wennberg 1978; Wennberg, Barnes, and Zubroff 1982), showing substantial variations in the number of procedures and operations performed for what are similar populations within very small areas. While we have reported that the patient's medical characteristics and the share of the bill paid out-of-pocket by the patient are consistently more important in explaining variations in the amount of and expenditures for health services initiated by physicians than is the physician-to-population ratio, much of the variation in that care remains unexplained. Wennberg and his colleagues report that large variations in rates of procedures are most likely to occur for illnesses where diagnosis and treatment are the subject of professional disagreement. While these findings suggest the importance of policies which promote the dissemination of additional information on alternative procedures and resulting health outcomes, they raise issues of medical decision-making that are unrelated to our conclusion regarding the relative importance of physician density with regard to physician-initiated demand. Furthermore, these variations have been observed in countries with very different reimbursement systems.

In contrast to the findings on the effect of the density of physicians, the reimbursement system and, in particular, the amount paid by insurance and/or the depth of insurance coverage are consistently important in explaining higher physician-initiated demand. The less the individual pays for medical care, the more likely is the physician to initiate visits and related expenditures. This, it should be noted, is in addition to the individual's being more likely to initiate visits and expenditures as a result of lower out-of-pocket costs. Thus, the concern frequently expressed about the effects of a comprehensive reimbursement system appear well founded. These concerns were heard most frequently when serious consideration was being given to national health insurance legislation which would have resulted in lower out-of-pocket costs for many subgroups of the population. Our findings indicate that not only would individuals have increased their demand for medical care, but that physicians would have initiated more visits as well. The competition and consumer choice plans now being considered hope to encourage either greater participation in HMOs, which could mean a very different set of financial incentives, or else the purchase of health insurance with greater out-of-pocket costs and lower premiums.

The NMCES studies indicate that this might indeed result in a reduction in physician-initiated demand—apart from the expected increase in the physician-to-population ratio.

In an earlier section, we noted that a hypothesis of physician-induced demand would be supported if physician initiation was associated with variables reflecting self-interest; that an agency role would be supported if physician initiation were associated with lower out-of-pocket costs and health status. As we have discussed, physician density, the most frequently cited correlate of inducement, is not consistently important, and its effect is not very large when present. Insurance, however, is consistently important although its effect is also not very large but larger than density for changes within the relevant range. Perhaps more importantly, however, the health status measures, perceived health status and the reported number of disability days, or measures which indicate health status such as age and sex, were not only consistently significant as explanatory variables for physician initiation but the elasticities, that is, the implied responsiveness, were much greater than for any of the economic or financial variables. This is hardly surprising. It implies that physicians initiate medical care for their patients primarily because of their patients' health status modified by their patients' financial interests rather than in a way which is consistent *only* with their own self-interest.

The NMCES findings indicate that the role of physician density, that is, the number of physicians in the population per se, in explaining physician initiation, and thus inducement, is much smaller than earlier studies have indicated. This suggests that the large numbers of physicians who will be coming onto the market during the next decade may be less a cause for concern than has been previously thought and, in fact, can result in some benefits. According to a recent study by Newhouse et al. (1982), the increasing physician supply in the 1970s resulted in a diffusion of medical and surgical specialists into smaller communities. They suggest that the increase in the physician supply in the 1980s will result in a wider range of services becoming available to populations outside metropolitan areas. Furthermore, the increased number of physicians may facilitate the growth of alternative delivery systems such as Health Maintenance Organizations (HMOs) and primary care networks. How the growth in the physician supply will affect the integration and use of the allied health manpower is less clear. While there will be less incentives for physicians to delegate their services

to such personnel, their viability is more likely to depend on the reimbursement policies of third-party payers and on the ability of professional societies to limit their independent practice privileges.

An additional concern is the impact of the increasing physician supply on physician fees and on income. NMCES findings indicate that the direct effect of physician density on physician fees is small or nonexistent, but indirect effects could be larger. Time spent with the patient is an important determinant of fees, and an increasing physician-to-population ratio is likely to result in an increase in the time spent per visit. While traditional measurement techniques would regard these visits as representing an increase in quality, they will also be more expensive. Again, however, whether or not the rate of increase observed in physician incomes over the past two decades is likely to continue will depend more on reimbursement policies than on physician inducement of visits or expenditures.

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