Patterns of Physicians' Use of Medical Resources in Ambulatory Settings

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Abstract: We studied British general practitioners' use of ambulatory resources to determine whether the quantities of different resources used were related to each other, and whether these quantities were associated with their personal characteristics. Rates of laboratory requests, referrals for specialty opinion, prescriptions, and visits per patient per year were examined for 21 physicians in seven practices over one year. Physicians who more frequently saw their patients referred and prescribed for them more often and ordered more tests, once the number of years they had practiced was taken into account. Doctors who ordered more tests referred their patients more frequently, regardless of how often they saw them. Doctors longer in practice saw and prescribed for their patients more frequently. Resource use was not related to other personal characteristics we studied. Greater frequency of patient-physician contact appears to increase costs not only through use of more professional time but also through greater use of other ambulatory resources. Attention to the use of only one type of resource may result in a distorted picture of how physicians care for their patients and the costs that such care incurs. (*Am J Public Health* 1987; 77:565–567.)

Introduction

In the present era of cost containment, increasing attention has been given to the marked variation among physicians in the amount of any particular resource they use. Large variations in the use of laboratory tests and common surgical procedures have been well documented.[1–4] Many other resources are at the physicians' disposal, however, and these have been less well studied. They include prescribing of drugs and use of their own and, through referral, other physicians' time. Understanding the utilization of these other resources and, in particular, the interrelations in their levels of use is important to developing a complete picture of practice patterns and costs. In the following study we analyzed physicians' use of four different resource measures to determine, first, whether a physician's use of one resource is related to his or her use of others and, second, whether quantities of use are related to a doctor's personal characteristics.

Methods

Twenty-two general practitioners working in seven practices in Greater London recorded information about every ambulatory visit using a standard format throughout 1980. Included in the collected data were patient age, sex, diagnosis, whether any prescriptions were given, and what referrals or laboratory tests were ordered for the patient. Laboratory tests were aggregated so that typical combinations of tests (e.g., electrolytes, liver enzymes) were entered as single, rather than multiple, requests. Diagnosis was coded using the International Classification of Disease (ICD—ninth revision). One doctor was excluded because of incomplete data recording.

Accuracy of coding was found to be greater than 97 per cent for test ordering in a 10 per cent sample of session forms. Detailed comparison of computer outputs with patient records in one practice showed test recording to be more than 97 per cent accurate. As a first step, we evaluated the possible effects of case-mix variation upon resource use differences, using a least-squares model to derive estimates, standardized for patient characteristics, of the mean number of tests ordered per visit by each physician. In this analysis we examined tests per visit as the dependent variable, rather than test use per patient per year, because diagnosis could vary for a patient from visit to visit. The independent variables in the model were patient age, sex, and diagnosis and who the doctor was. Age was categorized into four groups (<5, 5–14, 15–40, >40 years), which reflected test use. Diagnoses were grouped into 14 categories according to ICD9 chapter headings with minor modifications. Using the partial regression coefficients for the physician variable, we calculated estimates for each physician of the mean number of tests ordered per visit after standardization for patient characteristics and compared them to the pre-standardization estimates with scatterplots and Pearson correlation coefficients.

We examined the use of four resources: referrals, frequency of patient contact, tests, and prescriptions. The resources were measured for each physician as the mean quantity per patient who visited the practice per year. Referrals included all requests for specialty opinion or treatment by physicians. Frequency of patient contact was measured for each doctor as mean visits per patient per year. Prescribing was recorded as any or none at each visit and therefore represents the number of visits for which prescriptions were written. All visits made by a patient during the year were ascribed to the physician most often seen in order to calculate the average number of visits made per year by a physician's panel of patients. Information regarding the doctors' number of years in practice, gender, advanced certification (membership in either the Royal College of Physicians or Royal College of General Practitioners), and whether a clinical assistantship (additional postgraduate hospital-based clinical experience) had been completed within the previous five years was collected by questionnaire and from published sources.[5]

Univariate relationships among test ordering, referring, prescribing, frequency of visits per patient per year, and physician characteristics were examined with scatterplots, Pearson correlation coefficients, and t-tests as appropriate. Linear modeling with a least-squares method was used to examine in two separate models the associations of the

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TABLE 1—Physicians' Use of Resources*

Physician	Tests	Referrals	Prescriptions	Visits
1	.50	.04	.56	2.78
2	.56	.06	.44	3.17
3	.68	.07	.54	3.17
4	.51	.06	.38	3.81
5	.28	.05	.63	4.11
6	.31	.06	.52	3.74
7	.41	.05	.53	3.33
8	.41	.05	.52	4.08
9	.42	.08	.63	3.31
10	.47	.07	.60	2.59
11	.24	.04	.81	2.22
12	.49	.06	.60	5.28
13	.59	.04	.39	6.26
14	.49	.06	.60	4.73
15	.51	.05	.58	3.80
16	.38	.06	.63	3.63
17	.43	.05	.54	4.40
18	.55	.06	.54	3.56
19	.24	.02	.76	2.55
20	.44	.05	.47	3.78
21	.84	.07	.60	4.28

*Each expressed as use per patient per year

resource measures with one another while controlling for the effect, first, of physicians' duration of clinical practice and, second, of the frequency of patient contact. The second model was used to determine whether associations among the three other resource measures-test use, prescribing, and referring—were independent of the frequency with which the doctor saw his or her patients.

Results

There was substantial variation among the doctors in their use of the different resources, ranging from greater than twofold for prescriptions to fourfold for referrals (Table 1). In an attempt to assess whether case-mix differences among the doctors' panels of patients was likely to be an important contributor to this variation in resource use, we compared for each physician the mean number of tests per visit ordered before and after standardization for patient age, sex, and diagnosis. There remained a threefold range in test use after standardization and the correlation of pre- and post-standardization estimates of test use was high (r = .99). While these patient characteristics accounted for about one-half of the variation among patients in the tests ordered at each visit,[6] they did not explain variation among physicians in their test use. For further analyses we examined resource use expressed as use per patient per year rather than as use per visit.

Associations among Resource Use Measures

Test use was significantly correlated with referral rates (Table 2). No univariate relationship was evident between test use and prescribing behavior or frequency of visits per patient per year.

Rates of referral and prescribing were associated with one another, and both were associated with frequency of visits per patient (Table 2). We used multivariate analysis to determine whether referral and prescribing rates were associated merely through each being associated with frequency of visits, i.e., the more often the patient sees the doctor, the greater the likelihood of receiving a prescription or being referred. The two did lose their association with one another, suggesting that the dominating factor was, in fact, the

TABLE 2—Associations of resource measures with one another and with the number of years in practice

Measures	Referrals	Prescribing	Visits per Patient	Years in Practice
Test	.55 (.26, .84)	−.02 (−.45, .41)	.18 (−.23, .59)	−.30 (−.69, .09)
Referrals	—	.56 (.27, .85)	.66 (.42, 90)	.28 (−.11, .67)
Prescribing	—	—	.72 (.52, .92)	.61 (.34, .88)
Visits per patient	—	—	—	.67 (.43, .91)

95% confidence limits are in parentheses.

frequency of visits per patient while referral and prescribing behavior were related to frequency of visits per patient but not to each other.

Physician Characteristics

The number of years the doctor had practiced was strongly correlated with the mean number of visits per patient per year and with prescription use (Table 2). It was not associated with referral rate. The doctor's gender, accreditation status, and history of further hospital training were not associated with any of the four resource measures.

There was a weaker inverse relationship between years in practice and test use, doctors longer in practice tending to test less (r = −.30). We again used multivariate analysis to determine whether this inverse association was obscuring the effect of more visits resulting in more tests, an association we had observed for each of the other resource measures. We found that frequency of visits per patient was, in fact, independently associated with test use (partial regression coefficient = .098; $p < 0.02$) as was the number of years in practice (partial regression coefficient = −.012; $p < 0.01$), the latter association being inverse and stronger than noted in the univariate analysis.

Discussion

Our results demonstrate that physicians' use of different resources are interrelated; they do not indicate substitution of the use of one resource for another, but rather that physicians can be identified who, through their increased use of several types of medical resources, may be substantially more costly in their delivery of ambulatory care.

The average frequency with which a doctor saw his or her patients was the factor which dominated the associations among the resource measures. As this frequency increased so did the use of referrals, prescriptions, and—if the separate effect of how long the doctor had been in practice was taken into account—laboratory testing. More frequent contact between doctor and patient appears to result in provision of a greater intensity of several different medical resources in addition to physician time. This finding could be the consequence of certain physicians caring for a more severely ill group of patients who might require more intervention of several types. However, we attempted to control for case-mix variation among patients. Despite its usefulness in accounting for variation in test use among patients,[6] we found that case-mix control had little effect in explaining differences among physicians. Cummins and colleagues reported a similar conclusion for referral rates in general practice.[7] The lack of impact of case-mix control on doctors' test use may at least

partly be due to the substantial homogeneity among practices induced by the sample being limited to British general practitioners.

Of the four physician characteristics we studied, only duration of clinical practice was related to any of the resource use measures. Doctors longer in practice saw their patients more often and more frequently wrote prescriptions for them. The relationship of the number of years in practice with quantity of test use was more complex. A number of other investigators have reported an inverse association between test use and physician age.[8–10] We were able to demonstrate a similar, although weak, association in our group of physicians. This association strengthened significantly after we controlled for variation among the physicians in how often they saw their patients. Physicians longer in practice may test less, but this effect is partly offset by their greater frequency of patient contact. Among physicians who see their patients with the same frequency, those that have been longer in practice appear to test less.

We cannot be certain whether the results from the use of one resource affects decision-making about others or whether the association reflects a more fundamental style of practice. For instance, does greater test use or patient contact result in detection of more abnormalities, prompting, in turn, more referrals for specialty opinion or more prescribing? Or, instead, are these physicians manifesting a more fundamental trait that generally characterizes their style of clinical practice, itself a product of other yet unknown physician attributes? A third possibility would be that once the visit has begun patient and, perhaps, physician hold the expectation that something further (e.g., a test or prescription) will be given to complete the interaction. We favor the latter two explanations. However, further investigation is clearly needed.

Three further comments should be made, the first in regard to the issue of case-mix variation. Residual variation after our case-mix control due to medical, particularly severity of illness, or non-medical factors could cause some of the associations we have noted, although for reasons cited we do not believe this to be the case. Evaluation of the need for more detailed case-mix control might be important in patient populations with a greater degree of clinical heterogeneity than those found in British general practice. A second issue is our use of British physicians. Their laboratory testing does appear to be more conservative than that of community-based American internists.[11] Nevertheless, they have training programs and professional societies similar to community-based American physicians, and their resource use demonstrates many of the same patterns such as large variations among doctors[4,11] and association of use with the same physician characteristics.[8–10] Studying British doctors does provide one advantage: fee-for-service incentives do not exist for the British physician, and, therefore, cannot explain our findings about physician behavior. Finally, we have quantified only the units of use and not their cost. Further work should be directed to determining the overall costs of practice styles characterized by different mixes of resource use.

As concern increases about the appropriate use of health care resources, cost containment efforts must account for physician patterns of use and attempt to identify their determinants. Understanding limited to the use of one resource may provide an inadequate picture of overall use. Our findings suggest that the cost of an office visit may be magnified by the secondary effects of this event on the use of other resources. Much as the decision to hospitalize is the key factor resulting in the use of many different types of inpatient resources, the occurrence of an office visit appears to be a key factor in activating the use of other ambulatory resources. However, while the decision to hospitalize is solely the physician's, an office visit can be initiated by either physician or patient. Cost containment efforts targeted at reducing the use of ambulatory resources therefore need to effect both physician and patient decision-making and, in particular, decisions about future patient-physician contact. Reducing the frequency of patient visits, such as by the introduction of coinsurance or deductibles, may reduce the use of other ambulatory resources as well.[12] Any cost containment strategy based upon one of these approaches would need to ensure that neither deterioration in health status[13] nor a compensatory increase in the resources ordered at each visit occurred.

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