Do Physicians Do What They Say?

The Inclination to Test and Its Association with Coronary Angiography Rates

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OBJECTIVE: Efforts to evaluate variations in cardiac procedures have focused on patient factors and differences in health care delivery systems. We wanted to assess how physicians' inclination to test patients with coronary artery disease influences utilization patterns.

SETTING AND SUBJECTS: Physicians and the populations of Maine, New Hampshire, and Vermont.

DESIGN: We conducted a survey of 263 family practitioners, internists, and cardiologists residing in 57 hospital service areas in Maine, New Hampshire, and Vermont. Using patient scenarios, we assessed the clinicians' inclinations to test during the evaluation of patients with coronary artery disease. Self-reported testing intensities were used to create three indices: a Catheterization Index, an Imaging Exercise Tolerance Test (ETT) Index, and a Nonimaging ETT Index. Using administrative data, age- and gender-adjusted population-based coronary angiography rates were calculated. Physicians were assigned to low (2.9/1,000), average (4.2/1,000), and high (5.8/1,000) coronary angiography rate areas, based on where they practice. Analysis of variance techniques were used to assess the relation of the index scores to the population-based coronary angiography rates and to physician specialties.

RESULTS: There was a positive relationship between the population-based coronary angiography rates and the self-reported scores of the Catheterization Index ($p < .005$) and the Imaging ETT Index ($p = .01$), but none was found for the Nonimaging ETT Index ($p = .10$). These relationships were evident in subanalyses of cardiologists and internists, but not of family practitioners.

CONCLUSIONS: Self-reported testing intensity by physicians is related to the population-based rates of coronary angiography. This relationship cuts across specialties, suggesting that there is a "medical signature" for the evaluation of patients with coronary artery disease.

KEY WORDS: survey; angiography; physician practice patterns; physician decision making; small-area variation.

J GEN INTERN MED 1997;12:172-176.

patients with coronary artery disease.^{9,10} However, there was no assessment of the relationship between the clinician's answers to these scenarios and actual practice.

We surveyed family practitioners, internists, and cardiologists in Maine, New Hampshire, and Vermont to assess their inclination to test patients with chest pain and coronary artery disease. The association between their responses and the population-based utilization rates of coronary angiography was measured in order to answer two questions. Given a standardized clinical scenario, is there a relationship between clinicians' self-reported inclination to test and the population-based utilization rates of coronary angiography; and if present, does this relationship hold for different specialties?

METHODS

Survey

Sample and Response Rates

A survey by mail of physicians in Maine, New Hampshire, and Vermont was performed in 1992. Lists of all licensed physicians were obtained from state licensing boards. Physicians who classified themselves as internists, family practitioners, or cardiologists and were in active practice were identified.

Six hundred surveys were mailed, and the sample was drawn in the following manner. First, all cardiologists in the areas were surveyed. Next, using a random number table, a sample of internists and family practitioners was generated until a total of 200 physicians (including the cardiologists) per state were identified. Of the 600 physicians surveyed, 27 had either moved or retired, leaving a potential sample of 573. Of 422 physicians who returned usable surveys (response rate of 74%), 263 physicians practiced in

Efforts to explain the observed variation in cardiac procedures^{1,2} have focused on numerous components of care. Patient factors, such as race and gender,³⁻⁵ and health care delivery system factors, such as insurance status and characteristics of the hospital,⁶⁻⁸ have been found to play a role. Less attention has been placed on how the decisions physicians make in the evaluation of patients with coronary artery disease influence utilization patterns. Recent studies, using standardized clinical scenarios, revealed differences in how physicians would treat

Received from the Maine Medical Assessment Foundation, Augusta (DEW, DNS, RBK); the Division of Health Services Research, Maine Medical Center, Portland (DEW, JDD); and the Center for Survey Research, University of Massachusetts at Boston (LHB, FJF).

Presented in part at the 19th annual meeting, Society of General Internal Medicine, Washington, DC, May 1996.

Supported in part by grant HSO6813-05 from the Agency for Health Care Policy and Research.

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the 57 hospital service areas (HSAs) included in this analysis (see below).

Survey Content

Using a focus group of internists from the three-state area, a questionnaire was designed to assess physicians' inclinations to test patients with ischemic heart disease symptoms or disease. The survey described four clinical situations (an example of two of these is found in Table 1). For each scenario, clinicians were asked to answer how likely they were to use, on a 5-point Likert scale, the following in the evaluation of the patient: (A) standard treadmill exercise tolerance test (ETT); (B) an Imaging ETT (thallium and/or echocardiogram); and (C) coronary angiography. Demographic and professional data were also collected for each physician, including age, gender, primary specialty and board certification, as well as self-reported estimates of the number of patients referred for coronary angiography within the preceding 90 days.

Measures

Using the patient scenarios, three indices were created to assess the relative diagnostic intensity of the physicians: a Catheterization Index, an Imaging ETT Index, and a nonimaging ETT Index. We averaged the physicians' reported inclination to use each of these tests across the scenarios. To be included in one of the indices, a physician must have answered at least three of the four scenarios. We rescaled the 5-level responses so that each index had a possible scale range of 0 to 4; the higher the score, the more likely the clinicians' inclination to test.

Table 1. Clinical Scenarios for Patients with Ischemic Heart Disease Symptoms or Disease*

A. In your office, you are evaluating a 35-year-old male who has presented with new onset of exertional substernal chest pain occurring after heavy work which is relieved by rest. An EKG done in the office is interpreted as normal. His personal history is positive for cigarette smoking and his father died of AMI at age 58. In completing his evaluation, please indicate how often you would do the following:
(a) ETT
(b) Imaging ETT
(c) Coronary angiogram
B. The same 35-year-old male patient is eventually hospitalized with an anterior MI with CPK levels to 3,200. Please indicate how often you would do the following within 6 weeks to evaluate future risk:
(a) ETT
(b) Imaging ETT
(c) Coronary angiogram

Two similar scenarios are presented for a 75-year-old patient.

*For each test, the response scale was: (1) rarely/never; (2) less than half the time; (3) about half the time; (4) more than half the time; (5) almost always.

Calculation of Population-Based Coronary Angiography Rates

Data Sources

Discharge data for residents of Maine, New Hampshire, and Vermont were obtained from uniform hospital discharge data sets for 1992 (from the Maine Health Care Finance Commission, New Hampshire Hospital Association, and Vermont Department of Human Services). Data for residents of the three states who were admitted to hospitals in Massachusetts were obtained from the Massachusetts Data Consortium. These data sources included all discharges for nonfederal hospitals and provided the following: hospital, age, gender, race, ZIP code of residence, and up to four procedure codes using the *International Classification of Diseases*, Ninth Revision, *Clinical Modification* (ICD-9-CM). Coronary angiograms were identified by ICD-9 codes 37.22, 37.23, and 88.55–88.57. Data on ambulatory coronary angiography were obtained from the New Hampshire Hospital Association's ambulatory surgery database and from the catheterization log book from the only nonreporting hospital in Maine. Population counts came from the 1990 census (Bureau of the Census).

Hospital Service Areas and Calculation of the Population-Based Utilization Rates

For the three-state area, 72 HSAs were defined in a standard fashion.^{11,12} Based on 100% of discharges in the three states, ZIP codes were assigned to the HSA in which the plurality of residents received their care. For locations with more than one hospital and significant overlap in markets, the hospitals were aggregated into one HSA. This resulted in 72 HSAs.

There was incomplete information on ambulatory catheterization from the one facility performing catheterization in Vermont, serving 6 HSAs, and no physician responses from 9 other HSAs. Data from these 15 HSAs were dropped, resulting in 57 HSAs in this analysis. The HSAs' population-based coronary angiography rates were calculated by dividing the number of coronary angiographies per HSA by the population residing in the HSA; utilization rates were adjusted for age and gender using indirect standardization.¹³

Analysis

There were several small-population HSAs with low numbers of surveyed physicians. Therefore, we stratified the HSAs into low, average, or high coronary angiography rate areas by using a Z score calculated from each HSA's coronary angiography rate. Physicians were assigned to the low, average, or high coronary angiography rate areas based on the ranking of the HSA in which they practiced. This stratification resulted in 20 low rate HSAs containing 88 responding physicians, a population of 665,517, and a mean coronary angiography rate of 2.9 per 1,000; 28 av-

average rate HSAs containing 117 responding physicians, a population of 1,022,143, and a mean coronary angiography rate of 4.2 per 1,000; and 9 high rate HSAs containing 58 responding physicians, a population of 672,931, and a mean coronary angiography rate of 5.8 per 1,000.

Standard univariate analysis, χ^2 tests for categorical data, and Student's *t* test for continuous data were used in analyzing survey responses. Analysis of variance techniques were used to assess the relation between the means of the three diagnostic intensity indices and the HSA's high, average, or low angiography ranking as well as the relation between the scores of the diagnostic intensity indices and specialty. Using a linear contrast, a test for trend was performed on the mean index across low, average, and high ranking. All analyses were performed on SAS software (SAS Institute, Cary, NC).

RESULTS

Table 2 shows the characteristics of the responding physicians, by specialty. The majority of the physicians were young, male, and board certified. Most physicians reported having patients who had undergone coronary angiography in the preceding 90 days. Two thirds of the cardiologists had performed coronary angiographies in the preceding 90 days (not shown), suggesting that most were

Table 2. Summary of Physician Characteristics

Characteristic	Cardiologist (n = 51)	Family Practitioner (n = 111)	Internist (n = 101)
Age			
Under 40	25.5	36.5	30.2
41-50	55.3	43.9	49.0
51-60	12.8	6.5	14.6
Over 60	6.4	13.1	6.2
Gender*			
Male	100.0	87.7	82.1
Female	0.0	12.3	17.9
Board certified	91.7	92.5	86.5
Number of patients who had catheterization in past 90 days [†]			
None	8.3	28.1	15.6
1-2	0.0	30.8	31.3
3-5	6.3	35.5	38.5
6 or more	85.4	5.6	14.6
Diagnostic Intensity Index			
Catheterization Index [‡]	1.82	1.59	1.50
Imaging ETT Index [§]	1.98	1.85	1.62
ETT Index	2.61	2.98	3.20

**p* < .01.

[†]*p* = .001.

[‡]*p* = .02, comparison of cardiologists and internists.

[§]*p* < .05, comparison of cardiologists and internists.

^{||}*p* = .04, comparison of cardiologists and family practitioners, *p* = .001, comparison of cardiologists and internists.

invasive cardiologists. There were systematic differences between specialties in their self-reported diagnostic intensity. Cardiologists were the most inclined to use the more sophisticated tests, imaging ETT and coronary angiography, followed by family practitioners, and then internists. Internists were the most inclined to use nonimaging ETTs.

Figure 1 shows the scores for the diagnostic intensity indices across the three coronary angiography rate areas. For both the Catheterization Index and the Imaging ETT Index, there was a linear relation between the physicians' self-reported diagnostic intensity and the area's coronary angiography rate: physicians who practiced in higher rate areas reported that they were more inclined to evaluate patients with coronary angiography and imaging ETTs than those in average or low rate areas. No relation was found between the nonimaging ETT Index and the coronary angiography rates.

Figure 2 shows the scores of the Catheterization and Imaging ETT Indices by specialty and across areas. A stepwise pattern was found in five of the six comparisons, the exception being family practitioners for the Catheterization Index. Within specialties, physicians in high rate areas were more inclined to test than those in average rate areas, who were more inclined to test than those in low rate areas. Although sample size limited our statistical power, the relation of coronary angiography rates with the Catheterization Index for cardiologists and the Imaging ETT Index for internists were statistically significant.

DISCUSSION

In Northern New England, physicians' self-reported inclinations to test for coronary artery disease had a strong positive relation to the population's risk of undergoing coronary angiography. It is probable that the cascade does not stop with diagnosis: in previous work we found that populations exposed to higher rates of imaging ETT and coronary angiography were much more likely to undergo coronary revascularization.¹²

FIGURE 1. Mean scores of the three indices across the three coronary angiography rate areas (*p* values are for test for trend).

FIGURE 2. Mean scores of the Catheterization Index and Imaging ETT Index by specialty, across the three coronary angiography rate areas (all *p* values are for test for trend).

A recent study of the relationship between a physician's self-reported practice style and population-based admission rates was unable to find an association.^{14,15} This study related physicians' propensity to *admit* patients with chronic medical conditions to the areas' hospitalization rates. Once controlling for socioeconomic factors, these authors found no relation. In our study, the addition of median household income to the model did not change the results. The difference between our two studies may lie in the ability to describe adequately the clinical situation using a case vignette. Although a decision concerning the use of a test to discover disease or stratify risk is largely based on a patient's medical history, admission decisions are often based on a physician's gestalt about how sick a patient appears.¹⁶ It may be that historical information is more easily captured on paper than a picture of "sickness" or that other factors, such as local bed capacity,¹⁷ mask the influence of medical decision making on utilization patterns for medical admissions. With the increased

use of survey techniques to measure physician attitudes, this potential contrast should be further explored.

Our study expands on previous efforts suggesting that variations in intervention rates reflect a community's medical signature.^{12,18,19} Unlike previous studies that focused on clinical situations which are the domain of a single specialty or subspecialty,^{20,21} this study focused on patients with coronary artery disease who are cared for by multiple specialties. Despite differences between specialties in their self-reported diagnostic intensity, across the coronary angiography rate areas, cardiologists and internists demonstrated a consistent pattern in the scores of the Catheterization and Imaging ETT indices. Thus, for coronary angiography, it appears that differences in intervention rates are not simply due to differences in the distribution of specialties.

Why does this medical signature encompass multiple specialties? It is likely that the shared experience of patient care in local communities, through formal educational exposure, referrals for testing or informal "curbside" consultations,²² influences the overall care of the population with coronary artery disease. Multispecialty meetings, such as grand rounds or morbidity and mortality reports, engender cross-specialty learning. Even curbside consultations are likely to be nonrandom,²³ so opinion leaders within the medical community may sway the general practice patterns of the hospital service area. Although it is interesting to speculate about which specialty drives the signature, our study cannot answer this question.

A further explanation for the community's medical signature may be the presence of a local catheterization laboratory.⁷ Eleven of the 57 HSAs have a hospital with a catheterization laboratory, and 6 of these are high rate areas. There are, however, four HSAs with catheterization facilities that have average rates and one with low rates. In an analysis not shown, both availability and diagnostic intensity appear to be independently associated with the utilization rates in Northern New England. Furthermore, in this study we found that the association between diagnostic intensity and utilization rates was not isolated to coronary angiography intensity: the imaging ETT intensity was also related to the coronary angiography rates, and the technology needed to perform this test is widely distributed. Although local availability does not appear to be the only determinant, the association of availability and intensity does raise an interesting question: Does the local availability influence intensity, or are more diagnostically intense physicians attracted to areas with a catheterization facility? Unfortunately, we cannot answer that question with this study.

Although not our central finding, the differences in diagnostic intensity among specialties deserve some comment. Previous efforts to evaluate differences in utilization of services among specialties have found that subspecialists use more resources than general internists, who in turn use more resources than family practitioners.^{24,25} The present findings were consistent with these studies with

respect to cardiologists, but differed when considering internists and family practitioners. This may relate to who does the testing: in Northern New England internists perform nonimaging ETTs but do not routinely perform imaging ETTs or coronary angiography. Family practitioners, on the other hand, perform none of these but refer patients for testing, usually to cardiologists.

Several limitations of this study should be considered. First, although our response rate was high, differential responses by HSA could still bias the survey results. However, to alter these findings, the direction of the responder bias would have to be different by HSA (more diagnostically inclined responders in high rate areas and fewer diagnostically inclined responders in low rate areas). Second, discharge data were used to calculate the population-based rates of coronary angiography. Although systemic errors in coding may alter the results, administrative data for procedures have been found to be accurate.²⁶ Third, this was a "semi-ecological" study. Because we did not have the patient-level data, we could not measure the effect of physician decision making at the individual patient level. However, given the consistency of our findings across areas for different testing modalities and specialties, we feel this is unlikely to negate our findings. Finally, this study was not designed to assess the appropriateness of the various diagnostic approaches.

Given the same clinical information, physicians report different inclinations to test patients with coronary artery disease. Although policy makers and researchers have questioned the validity of physicians' responses to standardized clinical scenarios, we found that these self-reported inclinations are associated with regional practice intensity. This finding supports the view that physicians do what they say; it also suggests that physicians play an important role in the observed variability in coronary angiography utilization.

The authors thank Nancy Mooney from the Maine Health Information Center for her enviable ability to obtain high physician responses to surveys, as well as H. Gilbert Welch, MD, MPH, and F. Lee Lucas, PhD, for their insightful comments on manuscript drafts.

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