Physician Characteristics Affecting Referral Decisions Following an Exercise Tolerance Test

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Objective: To examine whether physician background and attitudes were related to the decision to refer a patient with chronic angina to a cardiologist following the results of an exercise tolerance test.

Design: Mailed questionnaire asking family physicians and internists how they would make referral decisions for a patient with classic angina in a detailed case vignette.

Participants: Two hundred sixty-five family physicians and 105 internists.

Outcome Measures: Physician referral decisions following results of an exercise tolerance test.

Results: Only 15% of the respondents believed that the patient should have been directly referred for cardiac catheterization without conducting an exercise tolerance test previously. Data on the remaining 85% of physicians were analyzed to identify factors influencing referral decisions. These physicians were significantly more likely to refer a patient if they were concerned about a lawsuit (68% vs 53% following a test result suggesting coronary disease and 40% vs 24% following a normal test result). Referral decisions were significantly more likely to be changed on the basis of the test result if the test was administered to determine the need for cardiac catheterization (50% vs 34%) or if the physician was a family practitioner rather than an internist (47% vs 24%). A physician's number of years in practice, experience with patients with angina, and board certification were not associated with referral decisions.

Conclusions: Many physicians with very different attitudes and backgrounds order diagnostic tests for reasons other than to make referral decisions. This problem appeared to be less prevalent among family physicians than internists, and it may partly be due to fear of lawsuits or lack of knowledge about how the test should be used.

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FOR MANY medical problems there is no single course of action that is the standard of care. As a result even well-trained physicians who understand the problem thoroughly may differ on the appropriate referral decision for a given patient. Although the differences may be justified, they can have important consequences for the patient as well as for society. A number of studies[1,2] have evaluated factors associated with referral decisions made by physicians. Often the decisions studied include the use of diagnostic tests[3-9] or those related to referral.[10-12] We studied an exercise tolerance test (ETT). The test was chosen since it is a commonly used, thoroughly investigated test that requires medical judgment to be appropriately used.

An ETT can be used by physicians for a number of purposes, including to make a diagnosis, identify coronary artery disease (CAD) requiring surgery, estimate prognosis, determine functional status, follow up a response to therapy, and increase individual motivation for entering into exercise programs.[13,14] Specific recommendations have been developed for the use of an ETT in the diagnosis of CAD. Based on the sensitivity and specificity of the test, it has been determined that an ETT should

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MATERIALS AND METHODS

METHODS

A questionnaire concerning the treatment of chronic stable angina was mailed in March 1986 to 812 randomly selected members of the state chapter of the Academy of Family Physicians who graduated from medical school before 1983. This represented half of the membership of the society at that time. A total of 280 physicians (34% of the physicians contacted) returned the questionnaire. The 265 respondents who identified themselves as family physicians were included in the study.

The questionnaire was also mailed in October 1986 to all members of the Pennsylvania chapter of the American Society of Internal Medicine. There were 650 internists in the society in 1986, representing 18% of all internists in the state. A questionnaire was mailed to only those 336 members who identified themselves as general medicine practictioners and who graduated from medical school before 1983; 105 (31%) of these physicians responded.

The questionnaire was in three parts. In the first part the physicians were asked how they would make referral decisions for a specific patient with typical angina described in the case vignette given below.

PATIENT VIGNETTE IN QUESTIONNAIRE

In this questionnaire we present a case of a patient with chest pain and ask you for your referral decisions.

Patient

A 55-year-old white, male, high school principal presents with a chief complaint of a substernal painful chest tightness consistently precipitated by moderate exercise (two flights of stairs) but not by meals. The pain usually lasts 5 to 10 minutes, is relieved with rest, and is accompanied by diaphoresis but no shortness of breath. The symptoms began 3 months ago and have not progressed. Risk factors for CAD include the death of his father from a myocardial infarction at age 56 years and a 35 "pack-year" (ie, the number of years times the number of packs per day) history of smoking. The patient is otherwise in good health and is taking no medications. The review of systems is unremarkable.

Personal Characteristics

The patient is well known to you. He is an excellent historian, complies well with your suggested treatment, and is entirely neutral about seeing a cardiologist.

Physical Findings

Physical findings are as follows: height, 175 cm (5 feet 10 inches); weight, 86 kg (190 lbs); pulse, 75 beats per minute; blood pressure: systolic, 140 mm Hg, diastolic, 85 mm Hg. The remainder of the physical examination findings are unremarkable.

Laboratory Findings

Laboratory tests reveal the following levels: cholesterol, 5.9 mmol/L (230 mg/dL); triglycerides, 2.30 mmol/L (200 mg/dL); fasting blood glucose, 5.2 mmol/L (95 mg/dL). The resting electrocardiogram is normal.

The physicians were asked to respond to the vignette as follows: (1) decide what diagnostic test, if any, they would order for the patient as part of initial treatment; (2) specify as being "minimal," "moderate," or "high," the importance of a given reason for administering a noninvasive diagnostic

only be used for diagnosis of patients with moderate probability of CAD, eg, patients with atypical angina.[15,16] For patients with a high probability of CAD, eg, middle-aged men with typical angina, the test is not sufficiently sensitive to reduce the probability of CAD to levels that would influence management. Therefore, if the test is only being used for diagnosis, patients with a high probability of CAD based on history do not require administration of an ETT. These patients should be referred directly for cardiac catheterization to determine the need for surgery.

Recommendations for uses of an ETT other than in the diagnosis of CAD are much less precise.[13] As a result it is not clear for which patients the physician should order an ETT and how the results should affect referral decisions. In a previous study we found no consensus among family physicians as to how the test should be used for management.[17] In this study we analyzed how referral decisions for both family physicians and internists depended on the results of the ETT, and we evaluated what physician characteristics and attitudes affected referral decisions.

RESULTS

Subjects who responded to the survey were representative of their medical society in terms of age and sex. Of the respondents in our study 52.3% of the family physicians and 35.2% of the internists graduated from medical school before 1970 compared with 50.5% and 27.4% of the state members of their respective societies. Ninety-two percent of the family physicians and 96% of the internists were men compared with 91% and 97% of state members of their respective societies.

The characteristics of the responding physicians are shown in Table 1. Most of the respondents were family physicians, men, and in private practice either by themselves or in a group. Nearly half had graduated from medical school after 1970. Although they re-

test (to confirm the diagnosis, to determine the need for cardiac catheterization, to determine functional capacity, and to establish a baseline for following up the response to medical therapy); (3) decide whether to refer the hypothetical patient to a cardiologist assuming the results of the ETT were positive (2 mm of downsloping depression at 8 metabolic equivalents of exercise); (4) decide whether to refer the patient assuming the results of the ETT were negative; and (5) estimate the probability of the patient having CAD following a normal ETT result.

To simplify presentation of the results the reasons for ordering the diagnostic test were grouped into two categories—minimally and moderately important reasons were included in one category and highly important ones in the other category.

The questionnaire for the internists was mailed out after the results from the family physician questionnaire were tabulated. To improve the questionnaire, we modified the question that asked the physician to estimate the probability of the patient's having CAD based on history alone. For family physicians the possible responses were 10% or less, 10% to 30%, and more than 30%. Internists were allowed to make an open-ended numerical response.

In the second part of the questionnaire physicians were asked to what degree the following factors influenced their decisions for cardiology referral in patients with angina: protection from lawsuit, the cardiologist having more expertise, and the need for catheterization. Reasons for not referring were also assessed, such as losing patients to a cardiologist, unnecessary expense, "a primary-care physician should be able to treat a patient with angina without help," and "catheterized patients are at risk of a complication." Available response categories were "none," "little," "moderately," and "greatly." For purposes of analysis we grouped none with little and moderately with greatly.

The third part of the questionnaire involved the physician's specialty, type of practice (academic, group, solo, or health maintenance organization), approximate number of patients with chronic, stable angina treated in the past year, approximate percentage of patients with stable angina referred to a cardiologist, and year of graduation from medical school.

All the information obtained from the physicians through the questionnaire was tested for an association with referral decisions following administration of the ETT. Three types of referral decisions were considered—those following a positive ETT result, those following a negative ETT result, and a change in referral decision based on the ETT result. When the physician made one referral decision following a positive test result and a different one following a negative result, it was considered a change in decision based on test result. It suggests that the results of the test were being used to make a decision and not just to increase certainty or to obtain background information.

For our analyses we only included physicians who said they would begin a diagnostic workup with a noninvasive diagnostic test. We excluded 57 physicians (15%) who stated that on the patient's first visit they would order cardiac catheterization or would not order either an ETT or a nuclear cardiology stress test (thallium test or radioventriculogram). There was no significant difference in any of the three referral decisions between physicians who ordered a nuclear cardiology test and those who ordered the ETT alone.

Statistical techniques used for the analyses included the χ^2 contingency table analysis and the Wilcoxon Rank-Sum Test. Every analysis was performed on internists, family physicians, and all physicians combined. **Tables 1 through 5** present results for all physicians combined, but any results significant for only one specialty are noted in the text.

ported a wide variation in their experience with patients with chronic angina, 88% of the respondents had seen more than 10 patients with this condition in the past year. The respondents also reported a wide variation in the percentage of their patients with chronic angina whom they referred to a cardiologist. Of the family physicians in the study 75% were board certified.

REFERRAL DECISIONS FOLLOWING THE ETT

The relationship between referral decisions and the ETT results are shown in Table 2. Fifty-five percent of these physicians referred their patients to a cardiologist following a positive ETT result, and only 28% did so following a negative ETT result. However, 58% of physicians did not change their referral decision based on the ETT result. Most of the physicians who changed their referral decision on the basis of the ETT results made a referral only if the result was positive. Most of the physicians who did not change their referral decision did not make a referral, regardless of the ETT results.

PHYSICIAN CHARACTERISTICS AND REFERRAL DECISIONS

The physician characteristics that are related to referral decisions are shown in Table 3. A referral decision following a positive ETT result was significantly more likely to be made by family physicians than by internists, and by private practitioners than by academics. The amount of experience reported by physicians with patients with angina during the previous year and their year of graduation from medical school were unrelated to their referral decision following a positive test result. In an analysis not shown in Table 3 we also found that for family physicians board certification was not associated with referral decisions.

Table 1. Characteristics of the 370 Responding Physicians

Characteristic	Respondents, %
Specialty	
Family medicine	72
Internal medicine	28
Sex	
M	92.7
F	7.3
Year of graduation from medical school	
1940-1949	12.5
1950-1959	25.9
1960-1969	14.8
1970-1982	46.9
Type of practice	
Academic	9.4
Group	41.3
Solo	49.3
Estimated No. of patients seen in past year with chronic stable angina	
<10	12.2
10-20	22.2
21-49	18.4
50-74	19.2
≥75	28.1
Estimated percentage of patients with chronic stable angina referred to cardiologist	
<10	33.2
10-20	28.9
21-50	24.1
>50	13.8

A referral decision following a negative test result was more likely to be made by family physicians than by internists. Other physician characteristics presented in Table 3 were not associated with the decision to make a referral following a negative test result. The last two columns of Table 3 show that referral decisions were more affected by the ETT results for family physicians than for internists and for more recent graduates than for earlier graduates.

The analyses shown in Table 3 were performed separately for family physicians and internists. The significant results for family physicians were the same as those in the combined sample. One analysis was significant only for internists; those who treated more patients with angina were less likely to refer a patient with a positive ETT result to a cardiologist ($P<.06$).

Not shown in Table 3 is the association between the probability of the patient developing CAD as estimated by the physician following a negative test result and the decision to make a referral. Thirty-nine percent of the 188 family physicians who responded to the question estimated that the probability of the patient developing CAD following a negative test result was greater than 30%. The percentage of these physicians who referred the patient to a cardiologist was 38% compared with only 24% for family physicians who estimated the probability of CAD to be less than 30% ($P<.05$). The estimated probability of CAD following a negative test result was not associated with the referral decision for internists.

PHYSICIAN BELIEFS AND REFERRAL DECISIONS

The reasons that physicians gave for ordering the ETT and the percentage of physicians who believed the reason was very important are listed in Table 4. The only reason associated with physician decision making was ordering the test to assess the need for cardiac catheterization. However, only 66% of the physicians who said that this reason was very important made a referral following a positive test result (34% did not) and 50% of these physicians did not change referral decisions on the basis of the test results.

The reasons that physicians have for referring or not referring patients in their own practice are shown in Table 5. Some of these reasons were related to whether physicians would refer the patient in the case vignette, but none were associated with the likelihood that physicians would change their decision based on the ETT results. The physician attitude that most strongly affected referral decisions was fear of a lawsuit.

Although some of the analyses on reasons for referring were statistically significant for internists, they were not for the combined sample or for family physicians. Internists who referred their patients to cardiologists for coronary catheterization were more likely to change their referral decision on the basis of the ETT result (27% vs 0%; $P<.03$). Internists were less likely to refer the patient to a cardiologist following a positive ETT result if they were concerned about losing patients to the cardiologist (0% vs 45%; $P<.05$), believed that patients with common problems should be treated without help (33% vs 75%; $P<.003$), or were less concerned about the risk and discomfort of catheterization (35% vs 75%; $P<.02$).

Table 2. Referral Decisions*

Referral Decisions	Respondents, %
Refer if ETT result is positive	55
Refer if ETT result is negative	28
Change in referral decisions	
Referral depends on ETT results	42
Refer only if ETT is positive	34
Refer only if ETT is negative	7
Referral does not depend on ETT results	58
Never refer	38
Always refer	20

**All percentages were based on the 234 physicians who answered questions about referral decisions following a positive or negative test result. ETT indicates exercise tolerance test.*

Table 3. Physician Characteristics Associated With Referral Decisions*

Characteristics	Sample Size	Refer If Positive ETT Result, %	Refer If Negative ETT Result, %	Change Decision Based on ETT Result, %
Family doctor	199	61	29	47
vs				
Internist	69	42†	25‡	24†
M	248	57	30	41
vs				
F	20	45	11	42
Private practice	227	59	29	43
vs				
Academic	26	38§	27	29
≤20 patients with angina per year	89	55	34	39
vs				
>20 patients with angina per year‖	179	57	26	43
Graduated before 1970	140	60	31	38
vs				
Graduated 1970 or later‖	115	54	27	47‡

*Since some physicians did not answer some questions, the sample sizes are not constant. The sample sizes are about 5% smaller for column 3 and about 10% smaller for column 4 than the numbers reported. ETT indicates exercise tolerance test.

†$P<.01$.

‡$P<.1$.

§$P<.05$.

‖Although the variable is presented in categories, the significance was tested with the Wilcoxon Rank-Sum Test.

As part of this study we asked physicians to estimate the percentage of patients that they referred to a cardiologist. Family physicians estimated that they referred a higher percentage of their patients with angina than did internists (28.3% vs 19.7%); however, the difference was not statistically significant. Physicians who referred more patients in their own practices were more likely to refer the patient in the case vignette if the ETT result was either positive ($P<.001$) or negative ($P<.001$); and they were more likely to change their referral decision on the basis of the ETT results ($P=.002$). We also found that the referral reason that had the strongest association with the percentage of patients that the physician referred in his or her own practice was the desire for protection from a lawsuit ($P<.001$).

COMMENT

Although the cardiology literature argues against using an ETT as the diagnostic tool of choice for patients presenting with definite or classic angina,[15,16] in practice, most primary-care physicians (family physicians and general internists) choose the ETT over immediate referral for angiography. In our sample only 15% of the respondents indicated that they would refer a patient with classic angina to a cardiologist without performing a noninvasive test. We excluded this group from further analysis because we wanted to focus attention on the factors influencing referral decisions for physicians who did order the ETT.

The most important management decision that should be affected by an ETT for a patient with typical angina is whether to refer the patient to a cardiologist. Our study suggests that most primary-care physicians order an ETT for a patient with typical angina but do not change their referral decisions on the basis of the results. This is similar to the finding that chest roentgenography and ultrasonography were ordered for reasons other than to assist in decision making.[18,19]

Several physician characteristics were examined for an association with referral decisions. Physicians were significantly more likely to refer a patient with angina to a cardiologist if they ordered the test to determine the need for cardiac catheterization or if they were concerned about a lawsuit. However, 50% of the physicians who said that it was very important to order the ETT to determine the need for cardiac catheterization did not change their referral decision on the basis of the ETT results. This suggests that more physicians may recognize the theoretical importance of ordering the ETT to make a referral decision than actually use it for this purpose.

Family physicians were more likely than internists to change their referral decision on the basis of the ETT result. Differences between specialties have been evaluated in previous studies. In some studies internists have been found to order more diagnostic tests than family physicians,[5,7] but there are exceptions.[6] Differences between specialties in referral rates seem to depend on the type of referral.[9] No differences were found between specialties in referral to medical subspecialists, but family physicians were more likely than internists to refer to general surgeons. Since referral to a cardiologist in our study is primarily referral for consideration for surgery, our results may support the later findings.

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The number of years in practice, experience with patients with angina, and board certification were not associated with referral decisions for family physicians although internists who saw more patients with angina were less likely to refer the patient to a cardiologist following a positive ETT result. The results for family physicians contrast with previous findings that a physician's experience and board certification are associated with the use of diagnostic tests.[3,4,6]

Table 4. Association of Reasons for Ordering the Exercise Tolerance Test (ETT) With the Percentage of Physicians Referring to a Cardiologist

Reasons for Test	Believe Reason to Be Important, %*	Refer If Positive ETT Result, %		Refer If Negative ETT Result, %		Change Referral Decision on Basis of ETT Result, %	
		Reason Not Important	Reason Important	Reason Not Important	Reason Important	Reason Not Important	Reason Important
Diagnosis	59	58	54	30	26	42	41
Assess need for catheterization	54	46†	66	23	29	34‡	50
Functional capacity	37	58	55	27	26	42	43
Establishing baseline	30	57	56	28	23	44	40

*Since it was possible for a physician to consider more than one reason as very important, the percentages in this column total to more than 100%.
†P<.05 for differences in referral rates between physicians who believed the reason to be very important and those who did not.
‡P<.01.

The physicians included in this study were not a representative sample of all physicians in the United States, and they may have characteristics and attitudes that are different from other groups of physicians. The lack of a representative sample is true of most studies of physician attitudes and behavior. The assumption underlying these studies is that the relationship between physician characteristics and attitudes is likely to be valid even if the percentage of physicians with a given characteristic is not representative. Since the physicians in this study had diverse views, they were a good sample to study the relationship between physician characteristics and attitudes toward referring a patient with angina to a cardiologist.

The data for this study are 6 years old. However, there are some reasons to believe that the results of this study would be valid today. (1) We found tremendous variations in how the test would be used even though the articles on Bayes' theorem and the appropriate use of diagnostic tests were more common in the late 1970s and early 1980s than they have been in the last few years. (2) New trends in practice patterns should begin with the academic community, but our results suggest that academics were no more likely to change behavior as a result of a diagnostic test than were physicians in private practice. (3) The most important factor affecting physician decision making in our study was concern about lawsuit. Little has changed that would make lawsuits of less concern today.

The results from this study support other research showing a potential problem in physician decision making—ordering diagnostic tests for reasons other than to make referral decisions.[18-20] This problem appeared to be less prevalent among family physicians than internists, and it may partly be due to fear of lawsuits or lack of knowledge about how the test should be used. However, the problem is widespread among physicians with a wide variety of attitudes and backgrounds. Only by addressing the problem directly in medical education is an improvement likely to be seen.

Table 5. Association of Reasons for Referral Decisions With the Percentage of Physicians Referring to a Cardiologist*

Reasons for Referral Decision	Believe Reason to Be Important, %	Refer If Positive ETT Result, %		Refer If Negative ETT Result, %		Change Referral Decision on Basis of ETT Result, %	
		Reason Not Important	Reason Important	Reason Not Important	Reason Important	Reason Not Important	Reason Important
For referring							
Protection from lawsuit	25	53‡	68	24‡	40	40	47
Expertise of cardiologist	19	55	62	26§	38	39	51
Catheterization	76	63	53	31	27	64	58
Against referring							
Losing patient to cardiologist	9	58	43	30	16	41	52
Unnecessary expense	29	58	52	30	25	41	44
Should treat without help	83	68§	55	37	27	40	42
Risk of catheterization	17	55	64	29	26	41	44

*ETT indicates exercise tolerance test.
†Since it was possible for a physician to consider more than one reason as important, the percentages in this column total to more than 100%.
‡P<.05.
§P<.10 comparing referral rates for physicians who believed the reason to be very important with those who did not.

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