Graded Exercise Stress Test Training in Family Practice and Internal Medicine Residencies

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A mail survey of upper Midwest family practice and internal medicine residency program directors was performed to determine the prevalence and characteristics of exercise stress test training. Two mailings provided a 68% response rate for the 184 programs surveyed. Internal medicine programs were significantly more likely to offer exercise stress test training than family practice programs (57% vs 34%). Overall, an estimated 31% of family practice and internal medicine residency graduates are performing exercise stress tests in their practice. Programs provided an average of 7.3 hours of didactic instruction and 32.7 stress tests per resident. A minority (43%) had an established minimum number of exercise stress tests recommended for competency. Programs with and without exercise stress test training did not differ significantly with respect to age, size of program, or size of community. There were some interstate differences in the extent of exercise stress test training provided by family practice residency programs.

Internal medicine programs were more likely to require a minimum number of treadmill tests. Otherwise there were few differences between family practice and internal medicine program instruction in exercise stress test training. Family practice program directors were more likely to believe that their residents should be taught this procedure and to include family physicians in their panel of instructors. Specific guidelines should be created to assure adequate stress test training for interested residents.

Coronary artery disease is the leading cause of death in the United States.[1] Persons likely to develop coronary artery disease can be identified by the presence of risk factors that include hypertension, hypercholesterolemia, diabetes mellitus, smoking history, and family history of coronary artery disease in a first-degree relative.[2] Resting electrocardiography can give additional evidence for the presence of coronary artery disease, but is insensitive.[3] In spite of its recognized limitations, exercise electrocardiography is the most commonly used noninvasive technique to confirm the presence of coronary artery disease and to assess its progress.[4]

The indications for exercise electrocardiography or exercise stress testing include the following: evaluation of patients with chest pain, screening of high-risk asymptomatic individuals, assessments of the severity of disease and prognosis in patients known to have coronary artery disease, evaluation of dysrhythmias, evaluation of functional capacity, and identification of high-risk patients following myocardial infarction.[5-6] Exercise stress tests are used to evaluate patients following coronary angioplasty or surgical coronary artery revascularization[6] and to assess functional capacity in patients with congestive heart failure.[7] An exercise stress test is also useful for identifying those at high risk for death or recurrent myocardial infarction 6 months following an initial infarction.[8]

The risks involved in performing an exercise stress test are small. Rochmis and Blackburn[9] reported a mortality rate of 1 in 10,000 and a morbidity rate of 3 in 10,000. Mead[10] has stated that there was no mortality associated with 22,255 exercise stress tests done through the Seattle Heart Watch program.

Program directors of internal medicine and family practice residencies in seven midwestern states were surveyed to determine how many of these programs were providing training in exercise electrocardiography. Also investigated

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were the type and extent of training provided by residency programs, the differences between the training provided by residency programs, the differences between the training of internal medicine and family practice residents, and some of the factors that influenced whether this training was being provided.

METHODS

A questionnaire was developed to elicit information regarding the training of residents in exercise stress testing and sent to the program directors of all of the internal medicine and family practice residency programs in US Public Health Service Region V, which includes Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, and Wisconsin. In addition to demographic data about each residency, specific details were sought concerning the amount of time spent in didactic sessions, the number of exercise stress tests performed by the residents and their supervision, the location of the training (hospital or outpatient), the specialty of the instructors, and recommended minimum requirements of the program.

Estimates of the numbers of graduates meeting the recommended requirements and performing exercise stress tests in their practice were requested. Also included were two questions concerning respondents' opinions about who should be taught exercise stress testing and who should do the instruction.

An identical follow-up questionnaire was sent to all directors who did not respond to the first survey.

The results were tabulated, based on interpretable responses, and statistical testing was carried out using a chi-squared test with the Yates' correction for dichotomous variables and Student's *t* test for comparison of means of continuous variables. *P* values less than .05 were considered significant. (*P* values greater than .10 are listed as NS.)

RESULTS

Completed questionnaires were received from 125 programs for a response rate of 67.9%. The response rate did not vary significantly between states or by size of the community. Seventy-two percent of responding internal medicine programs classified themselves as traditional, 22% as primary care, and 6% as both.

Exercise electrocardiography training was being provided at 54 (43.2%) of the total responding programs. The programs provided an average of 7.3 hours of didactic training for their residents, with 31% providing at least 8 hours. The average number of exercise stress tests performed by residents in this survey was 32.7 (26.6 with supervision). Only 23 of 54 respondent programs (42.6%) reported having a minimum number recommended for competency. Thirty percent of the programs reported that at least some of the exercise stress tests were done by residents without supervision.

TABLE 1. EXERCISE STRESS TEST (EST) TRAINING BY STATE (all programs)

State	Number of Programs	Programs with EST Training No. (%)
Indiana	9	2 (22)
Ohio	30	9 (30)
Michigan	26	11 (42)
Wisconsin	13	6 (46)
Illinois	33	17 (52)
Iowa	8	5 (62)
Minnesota	6	4 (67)

Regarding the procedural part of the training, 64% of training occurred only in the hospital setting, 1.8% only in the outpatient setting, and 34% in a combination of both. Assigned readings were required in 46% of the programs. Videotapes, formal tests, and other learning methods (seminars, demonstrations, slide programs) were used in 7%, 7%, and 13%, respectively. Cardiologists taught exercise stress tests in 98% of the programs. Family physicians and general internists taught in 18.5% and 29.6%, respectively. Paramedical personnel were utilized in 14.8%. Exercise stress test training was provided only by cardiologists in one half of the programs.

Overall, program directors estimated that 30.6% of residency graduates were performing exercise stress tests in their practices. Twenty-nine percent of the program directors stated that at least one half of their graduates were performing the procedure. There were large differences from state to state with respect to the proportion of programs offering exercise stress test training (Table 1).

The training of internal medicine and family practice residents were compared. More internal medicine than family practice programs were providing this training (56.9% vs 33.8%; $P = .02$). The average amount of time spent on didactic material was not significantly different between the two specialties (8.2 hours for internal medicine vs 6.3 hours for family practice). Program directors at internal medicine residencies were more likely to report a required minimum number of treadmill tests for their residents than were family practice directors (55% vs 28%; $P = .09$). In those programs that stated a minimum requirement, the requirement in internal medicine programs (average 18.8) was slightly higher than that in family practice programs (11.4) but did not reach statistical significance in this small series. It should be noted, however, that the

TABLE 2. EXERCISE STRESS TEST TRAINING BY COMMUNITY SIZE

Program Type	Size of Community <250,000 No. (%)	Size of Community >250,000 No. (%)	P Value
Family practice	11 (50)	14 (27)	.10
Internal medicine	4 (57)	25 (57)	NS
Total	15 (52)	39 (41)	NS

TABLE 3. EXERCISE STRESS TEST TRAINING BY REGION AND SPECIALTY

Program Type	Western States* No. (%)	Eastern States† No. (%)	P Value
Family practice	18 (47)	7 (19)	.02
Internal medicine	14 (64)	15 (52)	NS

** Illinois, Iowa, Minnesota, Wisconsin.*
† Indiana, Ohio, Michigan.

average number of exercise stress tests performed by residents in both groups (internal medicine 39.1, family practice 24.4) was well above average suggested minimums.

As expected, family practice residents were much more likely than internal medicine residents to have been taught by family physicians (40% vs 0%; $P < .001$). Otherwise, both groups of residents had about equal exposure to general internists (internal medicine 31%, family practice 28%), cardiologists (97%, 100%), and paramedical personnel (17%, 12%). When estimates were provided, there was no difference between the percentage of family practice and internal medicine graduates (32%) who were performing treadmill tests in their practices. Comments provided by the program directors indicated that residents were more likely to be pursuing training in exercise stress tests if they were planning to go into general practice or to a rural area.

The effects of several program variables on the likelihood of providing exercise stress test training were investigated. Within each specialty, programs providing exercise stress test training did not differ in size or age from programs that did not offer this training.

In this survey region, family practice programs in smaller communities and in the four westernmost states tended to be more likely to provide exercise stress test training (Tables 2,3). These demographic differences were not found among internal medicine programs. Among internal medicine programs, there was no difference between those designated as primary care or traditional in the likelihood that exercise stress test training was provided. For each specialty, the presence of a training program in the other specialty or in cardiology or both, at the same institution, did not significantly influence the presence of exercise stress test training.

In the programs offering instruction, there were significant differences between internal medicine and family practice program directors in their opinions about who should receive exercise stress test training. Ninety-two percent of family practice directors felt that family physicians should be taught this skill along with cardiologists and general internists. Only 24% of internal medicine directors held this belief ($P < .001$).

Similarly, there were differences of opinion with regard to which specialists should provide exercise stress test training. All of the directors agreed that cardiologists should participate, but family practice directors were more likely to include family physicians (77% vs 0%; $P < .001$). Both family practice and internal medicine directors were equally likely to recommend general internists and paramedical personnel. Fifty-two percent of the internal medicine directors felt that exercise stress test training should be provided only by cardiologists, while 20% of the family practice directors held this opinion ($P = .04$).

DISCUSSION

This survey of upper Midwest residency directors revealed that 34% of respondent family practice programs offer exercise stress test training. The Midwest has been shown to have a high prevalence of intensive care–coronary care unit privileges among recent family practice residency graduates[11] and may, therefore, be expected to be an area of high interest in exercise stress test training.

Most program demographic factors did not appear to influence the inclusion of exercise stress test training in residency curricula. There was a trend toward exercise stress test training being more prevalent in programs of smaller communities, but this trend was not highly significant. Anecdotal comments suggested that residents contemplating rural practice were more apt to seek exercise stress test training.

Reasons for the significantly lower proportion of exercise stress test training in the Indiana, Michigan, and Ohio family practice programs are not clear. The lower prevalence of stress test training in these three states may reflect a regional difference in perceived appropriateness of family practice privileges. The study of Ferentz et al[11] revealed lower prevalences of surgical and obstetric privileges in the Northeast; however, intensive care–coronary care unit privileges were not significantly different among their four national regions.

Significantly more internal medicine than family prac-

tice residencies were offering training in exercise stress testing in this survey population. Again, simple demographic features of the programs could not account for this difference. It may be due to more difficult-to-quantify opinions held by program directors and faculty as to the appropriate curricular material for internal medicine and family practice residents. Evidence for this philosophical difference is provided by the opinions expressed by the internal medicine directors; a majority believe that family practice residents need not learn exercise stress test techniques and that family physicians should not participate in the instruction. Though not studied directly, one might suggest that such beliefs are also held by a large number of internal medicine faculty and may be promulgated to residents and medical students.

Hospitals and their staffs have been under increasing pressure to provide effective privilege delineation processes when evaluating and awarding credentials to applicants for staff membership.[12] In response to these demands, medical organizations have begun to provide guidelines for training and evaluating competency for various procedures. For example, the American Society of Gastrointestinal Endoscopy has provided specific guidelines for training in several endoscopic procedures.[13] The American College of Physicians recently published, in a series of position papers, guidelines for training in four gastrointestinal and four nephrology procedures.[14–22] Similar guidelines for exercise stress test training for primary care physicians have apparently not been published. The American College of Cardiology has provided such guidelines for fellows in cardiology; its members recommend the performance of at least 100 procedures during training.[23]

Zoller and Boyd[24] described their experience with 265 exercise stress tests performed by family practice residents during a 6-year period. These authors found the procedure to be safe and accurate when performed in this outpatient setting. Their overall training program was not described in detail. It should be noted, however, that 42.5% of the graduates of this program were performing exercise stress tests in their practices; only 4% felt that the training was of no benefit.

Clearly a number of family physicians are performing exercise stress tests safely and effectively in their practices. The American Society of Sports Medicine states that any adequately trained, licensed physician may perform exercise stress tests and that this technique need not be restricted to any particular specialty.[25]

In fact, a joint statement by the American Academy of Family Physicians and the American College of Cardiology addressing the core curriculum for family practice residents includes exercise stress test training as an option within the realm of family practice for those residents likely to need it in their future practices.[26] Training criteria, however, are not delineated.

In programs providing training in exercise stress testing, there were few differences between family practice and internal medicine instruction, expectations, or eventual outcomes as measured in this survey. Residents were taught by similar instructors in both types of programs (with the exception that some family practice residents were taught by family physicians) and were likely to receive similar amounts of didactic and procedural training. Directors of internal medicine programs were more likely to define minimum requirements; however, the average number of supervised stress tests performed by both internal medicine and family practice residents was well above average requirements reported by their programs.

Many residents in the programs surveyed were receiving instruction in exercise electrocardiography, but it is clear that graduation from a family practice or an internal medicine residency alone does not assure adequate training in exercise stress testing.

Exercise stress test training should be studied more closely, and specific guidelines should be created that would assure adequate training for those residents who are interested. Finally, based on the opinions of the program directors presented here, training in exercise stress testing should consist of at least 8 hours of didactic instruction and performance, by the trainee, of at least 20 supervised exercise stress tests in addition to experience in reading resting electrocardiograms.

While this survey did not ascertain the specific didactic materials used by programs offering stress test training, they would reasonably include review of the indications, contraindications, risks, and interpretation of exercise stress tests. Alternatives to stress testing should be understood. Videotape programs or demonstrations of the practical aspects of exercise stress tests and precepted readings of actual stress test tracings would be useful. Trainees should be well prepared to handle any emergency arising during exercise stress testing.

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