

Screening Guidelines in a Family Medicine Program: A Five-Year Experience

Ira G. Mandel, MD, Peter Franks, MD, and John C. Dickinson, MD
Providence, Rhode Island, and Rochester, New York

An audit of charts of 112 adult patients at the University of Rochester Family Medicine Program was conducted to determine the effect of screening guidelines introduced into the practice in 1975. Beyond an initial educational effort when the guidelines were introduced and a verbal explanation of the guidelines printed in each patient record given to new providers as they entered the program, no continuous encouragement was offered. Over the next five years, provider compliance fell short of the guideline recommendations for all 10 screening tests. Depending on the test, 10 to 100 percent of patients received no screening over that period. Tests performed by nursing personnel were completed more frequently than those performed by physicians ($P = 0.05$). Frequency of screening by physicians correlated with the frequency of complete physical examination ($P < 0.0001$) and sex ($P < 0.02$), and screening by nurses correlated with complete physical examination frequency ($P < 0.0001$), visit rate ($P < 0.0001$), and patient age ($P < 0.0001$). Awareness of screening recommendations was insufficient to result in provider compliance with them. Strategies for improving screening compliance are discussed.

Over the past quarter century, the routine use of the annual physical examination and indiscriminate use of screening tests have come under critical review.¹⁻⁵ In 1975, Frame and Carlson⁶ offered a more rational approach to early detection and

prevention of disease. They examined the usefulness of screening asymptomatic people for 36 selected diseases using specific criteria involving the significance, incidence, and treatability of each disease; the sensitivity, specificity, costs, and acceptability of diagnostic procedures; and the value of detecting the disease in the asymptomatic stage. With the 16 diseases that satisfied those criteria, they devised a longitudinal "selective screening" program, which they proposed as an alternative to the annual physical examination.

They and others^{7,8} urged the introduction of selective screening into primary care settings. Few

Presented at the Ninth Annual Meeting of the North American Primary Care Research Group, Incline Village, Nevada, March 1981. From the Department of Preventive, Family, and Rehabilitation Medicine, University of Rochester-Highland Hospital, Rochester, New York. Requests for reprints should be addressed to Dr. Ira Mandel, Rhode Island Group Health Association, 530 North Main Street, Providence, RI 02904.

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studies, however, have addressed the acceptability or efficacy of these approaches to prevention in actual practice,⁹ and none in a primary care residency.

This retrospective study examines the results of an attempt to introduce screening guidelines similar to those recommended by Frame and Carlson into the University of Rochester Family Medicine Residency Program (FMP). Rates of compliance and factors associated with increased use of screening are reported. Suggestions for improvement of screening compliance are discussed.

Background

Following publication of Frame and Carlson's recommendations⁶ in 1975, plans were made to introduce selective screening into the FMP (a university-affiliated, community-based graduate training program in family medicine, consisting of 12 residents in each of three years of training). In the first year of implementation, a concerted effort was made through Grand Rounds, distribution of screening manuals, and lectures to educate and motivate the residents, faculty, and nursing staff (nurse practitioners, registered nurses, and nurses' aides) to perform selective screening. In the years that followed, however, the only consistent intervention was that directed toward the residents, who received an introduction to the guidelines (outlined on a grid in each patient's chart) as they entered the residency.

Methods

A 2 percent systematic sample of the active FMP practice population over 17 years of age as of 1979 made up the study group.

Data for the years 1975 to 1979 were abstracted retrospectively from the patients' medical records. Patient demographics (birthdate, sex, race, socioeconomic status, census tract, and insurance coverage), number of visits per year, and number of complete physical examinations per year were recorded. In addition, the performance of 26 specific

screening tests were ascertained for each year of the study (Appendix). Ten of the 26 tests were recommended in the FMP screening guidelines. The remainder were tests often used for screening but did not satisfy Frame's criteria.

For each calendar year in which a given patient visited the practice, each of the 26 tests was classified as (1) not documented in the chart, (2) done for screening purposes (no indications in the progress notes of signs, symptoms, diagnoses, or therapies related to the disease being tested), or (3) done for evaluative purposes (evidence of specific diagnostic or evaluative indication for the test). Provider use or nonuse of the standard screening grid was also noted for each record.

Interrater reliability was calculated by comparison of data extracted on a 10-percent sample of the study population by a second investigator and was expressed as a percent concordance.

Screening rates for all 26 tests were calculated for the entire study population in two ways: (1) mean frequency in patient-years for performance of each specific test for screening purposes,* and (2) percentage of all patients screened at least once during the five-year study period. These were then compared with the rates recommended in the practice guidelines.

For tests performed, outcomes were coded as (1) normal test result, (2) abnormal test result recognized or followed up, (3) abnormal test result not recognized or not followed up, or (4) test ordered but no result recorded in the chart. The determination of normality-abnormality was based on the criteria in the Appendix. Recognition or follow-up of abnormal test results was defined as (1) mentioning the abnormality in progress notes, (2) entering on problem list, (3) repeating of laboratory test, (4) ordering further diagnostic workup, or (5) prescribing treatment. Failure to recognize or follow up abnormalities was defined as the absence of all five of the above. Percentage distributions of the four outcomes were calculated for each test.

*Total number of years all patients were asymptomatic and undiagnosed for the disease tested divided by the total number of tests done for screening. Patient years were calculated by subtracting first year *in* study from last year *of* study (1979).

Table 1. Guideline Screening in Asymptomatic Patients

	Recommended		Actual	
	Percent Patients	Frequency*	Percent Patients	Frequency*
Nurse Performed				
History of				
Smoking	100	**	63	—
Rheumatic fever	100	**	55	—
Blood pressure	100	2	88	1.7
Weight	100	5	90	1.6
			74.0%	
			(SD 17.6)	
Physician Performed				
History of alcohol use	100	**	18	—
Breast examination (female)				
21-49 yr	100	1	67	3.0
> 49 yr	100	2	64	2.9
Stool for occult blood				
40-49 yr	100	2	37	6.7
> 49 yr	100	1	53	4.4
Pap smear (female > 18 yr)	100	2	70	2.5
Sigmoidoscopy (\geq 55 yr)	100	**	0	—
VDRL	100	10	19	10.5
Tine (PPD)	100	10	9	25.1
			37.4%	
			(SD 27.0)	
*Frequency expressed as patient-years per test				
**At least once				

Analyses were performed to determine what factors were associated with overall physician and nurse screening. The frequencies of tests commonly considered the responsibility of the physician (history of alcohol consumption, breast examination, Pap smear, tine test, VDRL, stool examination for occult blood, and rectal examination) and tests considered the responsibility of the nursing staff (history of smoking and rheumatic fever, blood pressure, weight, and urinalysis) were averaged for each patient and were used as the dependent variables in stepwise linear regression analyses. The independent variables examined for their contribution toward physician and nurse screening included patient demographics, number of complete physical examinations, and mean yearly visits. The variance explained (R^2) and statistical significance for each independent variable are reported.

Results

The 112 patients in the study population were from 18 to 82 years old; 60 percent were female and 83 percent were white. Sixty-nine percent were self-paying. The above patient demographics, as well as socioeconomic status, were representative of the adult practice as a whole.

Interrater reliability was 96.2 percent for the number and purpose of specific tests performed and 86.2 percent for all test outcomes. The latter figure rose to 96.2 percent for all test outcomes when smoking history was excluded.

As shown in Table 1, the proportion of patients screened for individual procedures ranged from 0 to 90 percent. Tests considered a nursing responsibility were documented in a higher percentage of patients (74 percent, standard deviation = 17.6) than

were those that were the physicians' responsibility (37.4 percent, standard deviation = 27.0). Using Student's *t* test, this difference was found to be significant ($t = 2.2$, $P = 0.05$). Of physician-performed screening, only breast examination and Pap smear were documented in a percentage of patients and with frequency approaching that recommended in the guidelines. Evidence of testing stool for occult blood was found on fewer than one half of patients in whom it was recommended, with a calculated frequency of less than one third of that recommended. Of the 23 VDRLs performed, 13 were done to comply with externally imposed requirements (ie, premarital examination, employment, or insurance physical examinations) or as part of routine prenatal care. Sigmoidoscopy, recommended once at age 55 years, was not performed on a single patient, including 10 patients who attained that age during the study period. Evidence of use of the screening grid was present in only 12 percent of audited records. Of these, none was complete.

Table 2 presents the level of nonguideline screening documentation at the Family Medicine Practice during the same time period and in the same study population. Fifty-four percent of asymptomatic subjects were noted to have had urinalysis. Other tests recorded on more than 10 percent of patients in the absence of specific indications included gonorrhea culture, rectal examination, stool for occult blood in adults less than 40 years of age, and SMA-12.

Percentages of abnormal test results, shown in Table 3, ranged from 0 percent for both VDRL and gonorrhea cultures to 43 percent for both smoking history and weight. Twelve percent of blood pressure readings were abnormally elevated. Of patients who were asked for history of alcohol consumption and the result recorded, 29 percent reported excessive use. Among guideline screening tests, physicians failed to recognize 19 of 43 patients (44 percent) who were overweight and 2 of 14 patients (14 percent) with elevated blood pressure measurements.

The multiple regression analyses (Table 4) revealed a significant association between mean frequency of physician screening and both the frequency of presentation for complete physical examination and female sex. Mean frequency of nurse screening was associated with frequency of complete physical examination, frequency of visits,

Table 2. Nonguideline Screening in Asymptomatic Patients

	Percent Patients
Urinalysis	54
Gonorrhea culture	38
Rectal examination	36
Stool for occult blood < 40 yr	33
SMA-12	11
Chest x-ray examination	9
Electrocardiogram	8
Prostate examination	7
SMA-6	5
Triglycerides/cholesterol	5
Fasting blood sugar/glucose tolerance	5
Mammography	3
Tonometry	3
Thyroid function tests	1
Acid phosphatase	0

and patient age. None of the other variables made any significant contribution to the regression equations.

Discussion

Preventive medicine has been identified as a major priority for providers and consumers of health care in the 1980s.¹⁰ One of the best-studied preventive strategies, health screening, has been shown to have a significant impact on long-term morbidity and mortality.^{6,11,12} Furthermore, of all possible preventive measures, screening requires the least patient energy or cooperation, depending on provider behavior for effectiveness. It is therefore imperative that primary care graduate education programs address both the content and implementation of appropriate screening activities.

In this study, guideline criteria for acceptable screening performance were minimal, favoring high compliance rates. Yet, both physician- and nurse-dependent screening activities were below or at minimum recommendations in all disease

Table 3. Abnormal Results and Outcomes of Screening Tests

	Abnormal/Total	Percent Abnormal	Percent Abnormal Recognized and Followed Up
Guideline			
History of			
Smoking	30/70	43	100
Rheumatic fever	4/61	6	100
Alcohol use	5/17	29	100
Weight	81/188	43	56
Blood pressure	23/192	14	83
Breast examination	3/68	4	100
Stool for occult blood	1/38	3	100
Pap smear*	4/79	5	100
VDRL	0/24	0	—
Tine (PPD)*	1/8	13	100
Nonguideline			
Gonorrhea culture	0/38	0	—
Urinalysis	9/80	11	82
Hematocrit/complete blood count	4/47	9	75

*Eight percent and 27 percent, respectively, of Pap smears and tine (PPD) tests performed had no results available in the chart and are not included in the table.

Table 4. Effect of Patient Demographics and Visit Frequency on Screening Rates

Variable*	R ² (%)**	P
Physician performed screening		
Frequency of CPE	30.5	0.0001
Sex	3.8	0.02
Socioeconomic level	2.0	NS
Race	0.8	NS
Age	0.4	NS
Frequency of visit	0.2	NS
Payment mechanism	<0.1	NS
Nurse performed screening		
Frequency of CPE	26.4	0.0001
Frequency of visit	12.0	0.0001
Age	7.3	0.0001
Socioeconomic level	0.9	NS
Payment mechanism	0.5	NS
Sex	0.2	NS
Race	<0.1	NS

*Variables are listed in the order in which each entered the stepwise regression equation
**Additional variance explained by each variable
P = probability
NS = not significant

categories. This finding is even more striking when it is realized that patient initiative probably added to the observed screening rates. Performance of screening was associated with the performance of complete physical examinations (usually patient initiated) which incidentally included some screening tests. In addition to errors of omission, both physicians and nurses committed errors of commission in the frequent ordering of nonguideline tests for screening.

The most likely explanation for poor provider compliance and the inappropriate use of screening is that performance of proven screening tests was not adequately reinforced. A single verbal introduction to the guidelines with copies in each patient's chart failed to influence test-ordering behavior. In a recent study of excessive test ordering among medical residents,¹³ a similar strategy failed to produce enduring changes in behavior. Apparently, alternative implementation strategies are required.

One such approach, the use of nonphysician protocols, is suggested by the results of this study. Screening by nurses more closely approximated the recommendations than did screening by physicians and correlated not only with complete physical examinations but also with the total number of patient visits. This finding probably reflects the incorporation of procedures, some of which met screening guidelines, into protocols used by the nurses. Depending on the reason for a visit, various tests were done routinely (eg, weight and blood pressure for noncounseling visits, urinalysis for complete physical examinations, and gonorrhea culture media provided to the physician whenever a pelvic examination was done). The greater the number of visits, the greater the likelihood of a given test being done, resulting in higher rates of compliance. A revision of the protocols would effectively exclude screening tests that failed the screening criteria.

However, if nonphysicians were to perform screening procedures traditionally beyond their training, additional time and energy would be required for education and implementation. In addition, as was demonstrated in this study, physicians are less likely to recognize or follow up abnormal test results arrived at by nonphysicians. A similar finding noted by Kirkwood¹⁴ was attributed to delayed recording of test results into the chart and bias on the part of physicians favoring their own

assessment of patients' health over that of other providers.

Other approaches to compliance with screening guidelines at the level of the primary care provider need to be explored. Reinforcement through weekly chart review sessions¹³ and computer feedback systems^{15,16} have been found to be effective in altering the behavior of house officers. The use of a simplified record system as suggested by Frame and Carlson^{6,9} and a consistent educational program would probably also help to shift initiative for appropriate screening from the patient to the provider and result in greater compliance with this important component of preventive care.

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Appendix
Criteria for Abnormality of Screening Results

Results Outside Laboratory Limits of Normal

Fasting blood sugar, glucose tolerance test

SMA-6

SMA-12

Triglycerides, cholesterol

Thyroid function tests: T₄, T₃, TSH

Acid phosphatase

Positive History or Results

Smoking**

Rheumatic fever* (including any history suggesting rheumatic fever or sequelae)**

Alcohol use* (more than one drink per day, or other than "none" or "social")†

Gonorrhea culture

Stool for occult blood*

Tine test*: Any reaction at 48 hours

Presence of Palpable Mass or Nodules

Breast examination*: Any masses other than fibrocystic disease

Rectal examination: Any mass other than prostate

Palpation of prostate: Any prostatic nodules

Chest x-ray examination: Pulmonary nodules or other suggestion of malignancy

Mammography: Lesions consistent with carcinoma

Sigmoidoscopy*: Lesions consistent with neoplasia

Other

Blood pressure*: ≥ 95 mmHg diastolic

Electrocardiogram: Any changes consistent with ischemia

Hematocrit/Complete blood count: Hct outside 42 ± 5 percent for women and 47 ± 5 percent for men

Pap smear*: Any abnormality other than trichomonas or poor specimen

Tonometry: Intraocular pressure > 25 mmHg

Urinalysis: Any abnormality on dipstick (excluding blood in menstruating women)

VDRL*: $\geq 1:8$ titre

Weight*: > 20 percent above ideal body weight based on height (if available), or 5 ft 5 in for women, or 5 ft 8 in for men

Screening Grid

Any notation of abnormality indicated at any time during study period

*Recommended in Family Medicine Practice screening guidelines

**Documentation of positive history constitutes recognition

†Documentation of excessive alcohol consumption constitutes recognition