the practice are registered as members of families, and all immediate family members are entered in the computer system at the time of enrollment. Each family is assigned to one of four practice groups comprising clinical faculty, residents in each year of training, nurses, and clinical pharmacists. At 3-month intervals, any family without a clinic visit by any of its members within the past 2 years is contacted by registered letter. Families wishing to remain as active members of the practice are retained. Families who cannot be contacted or who decline continued membership in the practice are deactivated. The annual turnover rate of active patients in the population is approximately 15%.

Residents receive training about health promotion in several formats: during orientation to the residency, noon conferences, workshops during family medicine rotations, and through individual precepting with faculty members in the clinic. Medical records of all adult patients included a periodic health examination flow sheet developed by department members in 1977. At the time this study was conducted, the clinic was in the process of adding an updated flow sheet, developed by Frame,[7] to the medical record of all adult patients.

The health promotion guidelines evaluated in this study were fecal occult blood testing, Papanicolaou smears, mammography, serum cholesterol levels, and tetanus immunization. Although there is controversy about the optimal frequency for these health promotion services, the conservative recommendations of Frame,[4–6] with minimal modifications, were chosen for this study. These recommendations are as follows:

1. *Fecal occult blood testing.* Six-slide occult blood test every 2 years between ages 40 and 50 years and annually thereafter
2. *Papanicolaou smears.* Every 2 years on all women aged between 18 and 70 years
3. *Mammography.* Every year for all women after the age of 50 years
4. *Serum cholesterol.* Every 4 years in patients aged 18 to 70 years
5. *Tetanus immunizations.* Every 10 years for all patients after primary immunization series.

Compliance with the five health promotion items within the recommended intervals, as of July 1, 1988, was assessed by review of the computerized medical record. Compliance was defined as completion of the recommended test or procedure.

The department's computer system stores extensive demographic and clinical data. The hardware consists of a Data General minicomputer; the software is written in MIIS, a dialect of MUMPS (Massachusetts General Hospital Utility Multiprogramming System). Computer data on fecal occult blood testing, Papanicolaou smears, and cholesterol measurements only included procedures performed in the Family Medicine Clinic. Data on tetanus immunizations performed elsewhere could be entered into the computer system. A possibility of significant underreporting of procedures performed elsewhere existed; therefore, the accuracy of the computerized health promotion data for these four studied items was confirmed by manual audits of 500 patient records in the months before July 1988. Kappa indices of concordance between the computer data and that from the manual audits were: fecal occult blood testing 0.83, Papanicolaou smear 0.94, cholesterol measurements 0.88, and tetanus vaccine 0.67. Kappa values between 0.61 and 0.80 represent substantial agreement, whereas values between 0.81 and 1.00 represent almost perfect agreement.[40]

Before the initiation of this study, mammography information had not been computerized. To computerize this information, a manual audit was conducted of 1294 records of active female patients who would be at least 50 years of age on July 1, 1988. This information was computerized, and an ongoing mammography database was established. Consequently, essentially 100% accuracy of the computerized mammography database can be assumed for this study.

At the time this study was conducted, the computer system provided reminders for Papanicolaou smears and tetanus immunization. The evening prior to a patient's appointment, the computerized record was screened to assess whether either of these reminders applied. If so, a reminder about the particular procedure was printed next to the patient's name on the physician's appointment list. No reminders were sent to patients.

Demographic and health promotion compliance data were transferred to a microcomputer for analyses using standard database and statistical programs. Demographic data included patient race, sex, age, type of medical insurance, physician practice group, and physician visit frequency. Race was categorized as black, white, or other. Age was categorized by natural divisions lent by the health promotion recommendations: 18 to 39 years, 40 to 49 years, and 50 years and above. Medical insurance was categorized as health maintenance or preferred provider organization (HMO/PPO), other third-party insurance, Medicare or Medicaid, uninsured, or unknown. If a patient had more than one form of coverage, the patient was assigned to the first category on the above list that was applicable. Physician visit frequency was calculated in four ways: total number of visits ever, total number of visits for health promotion ever (*International Classification of Health Problems in Primary Care, Second Edition*, code V70),[41] number of visits in the past year, and number of visits for health promotion in the past year.

Demographic data are presented by simple frequencies

TABLE 1. DEMOGRAPHIC CHARACTERISTICS OF THE PATIENT POPULATION, N = 7397

Characteristics	Number	Percent
Race		
Black	4489	60.7
White	2791	37.7
Other	117	1.6
Sex		
Female	4486	60.6
Male	2911	39.4
Medical insurance		
HMO or PPO	582	7.9
Other third party	2386	32.3
Medicare or Medicaid	1301	17.6
Uninsured	2884	39.0
Unknown	244	3.3
Practice group		
A	1576	21.3
B	1988	26.9
C	1908	25.8
D	1925	26.0
Age (years)	40.0 ± 17.3 (18–109)	

HMO—Health maintenance organization; PPO—preferred provider organization

TABLE 2. COMPLIANCE WITH FIVE HEALTH PROMOTION ITEMS WITHIN RECOMMENDED INTERVAL

Health Promotion Item	Number of Eligible Patients	Percent Compliant
Fecal occult blood*	3033	13.4
Papanicolaou smear†	4056	41.4
Mammography‡	1272	15.6
Cholesterol measurement§	6802	19.7
Tetanus immunization¶	7397	18.7

**Within 2 years for patients 40–49 years old, within 1 year for patients 50 years of age or older*
†Within 2 years for women 18–70 years old
‡Within 1 year for women 50 years of age or older
§Within 4 years for patients 18–70 years old
¶Within 10 years for all patients

and means. Overall compliance with the five health promotion items are presented by simple frequencies. Chi-square analyses were used to compare health promotion compliance by race, sex, type of insurance, age group, and physician practice group; *t* tests were used to compare visit frequencies among compliant and noncompliant patients for each of the health promotion items. Since associations between variables may confound the interpretation of multiple chi-square analyses, log-linear modeling analyses were employed to adjust for these potential associations.

RESULTS

As of July 1, 1988, there were 7488 active patients, aged 18 years or older, in the practice. Ninety-one (1.2%) were excluded, most because they were patients of behavioral science faculty. The final study population consisted of 7397 patients. The demographic characteristics of the patient population are presented in Table 1. Although the population is diverse, the modal patient was black, female, and uninsured.

The degree to which these patients were compliant with the five studied health promotion items is presented in Table 2. A minority of eligible patients had received the studied health promotion item in the recommended interval.

Compliance rates by race, sex, type of medical insurance, physician practice group, and age are presented in Table 3. In these unadjusted analyses, race was significantly associated with compliance only for Papanicolaou smears. Blacks were more likely to be up to date than whites or others. Female patients had higher rates of compliance with all three health promotion items applicable to both sexes: fecal occult blood testing, serum cholesterol, and tetanus immunization. Insurance status was significant for all five health promotion items. In general, patients with health maintenance organization (HMO) or preferred provider organization (PPO) coverage had the highest rates of compliance; those who were uninsured had the lowest rates. Still, only a minority of HMO or PPO patients were up to date on four of the five health promotion items. Physician practice group was also an important predictor of health promotion compliance. In general, patients in practice group B had the highest rates of compliance. Patients in the older age groups were more likely to be up to date on fecal occult blood testing, cholesterol measurements, and tetanus immunization.

The study population had frequent appointments. They had an average of 18.4 ± 27.5 total clinic visits from the time they enrolled in the practice, with 2.0 ± 3.3 visits from July 1, 1987, through June 30, 1988. They also had frequent visits for health promotion: an average of 2.0 ± 2.7 total visits for this purpose, with 0.24 ± 0.59 from July 1, 1987, through June 30, 1988. Patients compliant with any of the five health promotion items had more frequent clinic visits than those who were noncompliant, whether the visit was for any cause or for health promotion. These associations are significant ($P<.01$ by *t* tests), whether the analysis is of visits at any time or limited to visits in the preceding year.

TABLE 3. PERCENTAGE COMPLIANCE WITH FIVE HEALTH PROMOTION ITEMS WITHIN RECOMMENDED INTERVAL,* BY RACE, SEX, TYPE OF MEDICAL INSURANCE, AND AGE

Patient Characteristic	Fecal Occult Blood	Papanicolaou Smear	Mammography	Cholesterol	Tetanus
Race					
Black	15	45‡	17	19	19
White	12	35	14	21	19
Other	11	38	7	17	15
Sex					
Female	15‡	41	16	23‡	21‡
Male	10	—	—	15	15
Insurance					
HMO or PPO	23‡	59‡	40‡	37‡	18‡
Other third party	14	44	22	24	18
Medicare/Medicaid	18	51	14	28	30
None	6	32	9	11	15
Practice group					
A	11‡	46†	11†	19†	17‡
B	18	43	20	23	21
C	9	40	11	19	22
D	15	37	18	18	15
Age (years)					
18–39	—	42	—	12‡	15‡
40–49	10‡	42	—	31	17
50 and over	16	39	16	36	27

**The recommended intervals are the same as those presented in Table 2*
†$P<.01$, by chi-square analysis
‡$P<.001$, by chi-square analysis
Significance tests apply to each group of percentages
HMO—Health maintenance organization; PPO—preferred provider organization

Log-linear modeling analysis was done to assess the independent effects of practice group, type of medical insurance, number of clinic visits in the last year, age group, race, and sex on the five health promotion items. Practice group, type of medical insurance, and number of visits in the last year were significantly associated with all five health promotion items ($P<.05$). Age group was significantly associated only with Papanicolaou smear, cholesterol measurement, and tetanus vaccine compliance ($P<.001$). Race and sex were highly associated with cholesterol compliance ($P<.001$) but did not significantly affect any of the other four health promotion items. The log-linear models, with few exceptions, confirm the unadjusted analyses.

DISCUSSION

This study demonstrates that a minority of enrolled patients are up to date with commonly accepted health promotion items in a university-based family practice. Important predictors of compliance with these items in this setting were increasing patient age, physician practice group, medical insurance coverage, and visit frequency.

Comparison of these findings with those of other studies is difficult, as health promotion compliance is calculated in many different ways. Nonetheless, the degree of health promotion compliance in this population is similar to that reported in studies during the past 10 years in family medicine and internal medicine residency programs.[20,21,24,33,34,37,42–44] In addition, the predictors of health promotion compliance reported here are also consonant with other research.[19,23,28,29,45]

Physician Factors

The observed relationship between patient care group and health promotion compliance is likely a consequence of the particular physicians in each group. For the most part, patients in practice group B had the highest compliance

with health promotion in this study. One of the co-authors (D.G.) is the clinical attending physician in this group. His long-standing interest in practice and teaching about health promotion may be the explanation for the higher rates of compliance in this group.

Physician factors associated with health promotion activity in other studies include sex, method of reimbursement, and continuing medical education,[45] extent of agreement with published health promotion recommendations,[46,47] and degree of confidence in their ability to change patient lifestyles.[12,48,49]

Medical Insurance Coverage

In general, patients with HMO or PPO insurance had the highest rates of health promotion compliance in this study, those with other third-party insurance, Medicare, or Medicaid had intermediate rates, and those without medical insurance had the lowest rates. The particular HMO and PPO plans affiliated with the clinic at the time of the study all paid for health promotion activities. These findings are consonant with the Rand Health Insurance study,[23] the 1982 National Health Interview Survey,[29] and the 1986 Access to Care Survey.[28]

Patient Visit Frequency

The association of patient visit frequency with health promotion compliance suggests that, as the number of physician-patient contacts increases, the opportunity for health promotion activities rises as well. Mandel et al[19] previously have reported an association between frequency of presentation for physical examinations and compliance with health promotion recommendations in a family medicine residency practice.

This study has several important limitations. The health promotion compliance data probably underestimate true compliance rates in the population. A comparison with recent national surveys illustrates this point, particularly for Papanicolaou smears.[27,28,50]

There are several possible explanations for potential underestimation in this study. Data on health promotion compliance were obtained solely from the computerized medical record. Although the validity of the computerized information was confirmed by comparison with the paper medical record, limited information was available on services received outside the Family Medicine Center. In addition, since the policy of the practice is to enroll patients by family, and it is likely that some family members receive medical care elsewhere, the population denominators are probably overestimated. Seventeen percent of the study population had never made a visit to the Family Medicine Clinic, and only 49% had a visit in the 12 months preceding the July 1, 1988, audit date.

Despite these limitations, the findings of this study are important. The study is the first comprehensive, population-based assessment of health promotion compliance in a university-based family practice. Additionally, this study is the first assessment of compliance with Frame's updated health promotion recommendations. The study illustrates that, as of mid-1988, a minority of patients were up to date with commonly accepted health promotion recommendations. A major challenge remains in primary care to improve the degree to which patients receive recommended services.

The findings of this study suggest that interventions designed to change physician knowledge and attitudes about prevention, increased patient visit frequency, and better insurance coverage for preventive services may be effective measures to improve health promotion compliance in family medicine. The authors of this report are currently conducting a clinical trial, designed to evaluate a multi-intervention approach for improving compliance with the five health promotion guidelines reported in this study. These interventions include (1) educational sessions for physicians, (2) practice audits, (3) use of a health promotion flow sheet, (4) computer-generated reminders to physicians about recommended health promotion services at the time of patient visits, and (5) computer-generated reminder letters to patients about recommended health promotion services. It is hypothesized that the first four interventions will improve physician knowledge and attitudes about prevention, while the last will increase patient visit frequency. The study is being supported by the National Cancer Institute and final results are anticipated in 1989.

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