Medical Grand Rounds

HEALTH MAINTENANCE FOR ADULTS

Lynne M. Kirk, M.D.

University of Texas Health Science Center
Southwestern Medical School
April 12, 1984

Introduction

The concept of the importance of maintaining health has been present in the practice of medicine for a long period of time. In a Report of the Sanitary Commission of Massachusetts in 1850, Lemuel Shattuck stated:

> . . . *one of the most useful reforms that could be introduced into the present constitution of society would be that the advice of the physician should be sought for and paid for while in health, to keep the patient well; and not, as now, while in sickness, to cure disease, which might in most cases have been avoided or prevented* (1).

Since that time the medical literature has contained many articles advocating periodic health evaluations of asymptomatic people (2). In 1861, Dobell (3) published an article in London advocating periodic health examinations. The American Medical Association (4) in 1922 adopted a resolution recommending periodic health examinations and in 1925 (5) published a manual of suggestions for the conduct of such. That manual underwent revisions by the AMA in 1932, 1940, and 1947 (6). The 1947 edition of the manual pointed out that good health requires knowledge about exposure to agents such as radium, x-rays, and chemicals. It suggested that physicians might give advice for healthful living such as: "Walk at least 3 miles each day"; "Add an orange and cereal to your breakfast".

Subsequent to 1947 the American Medical Association had not addressed maintaining the general health of patients, but had concentrated its efforts on recommendations on periodic evaluations only with regard to workers in industry (7). However, in 1983 the AMA's Council on Scientific Affairs issued a report on medical evaluations of healthy persons (8).

During the 1930's and 1940's technology was developed for screening for asymptomatic infectious diseases, such as tuberculosis and syphilis. Application of these techniques were undertaken by the public health sector. At the same time physicians in the practice of pediatrics and obstetrics designed patterns of care aimed at monitoring health during the particular periods of life with which they deal (9).

Multiphasic screening utilizing histories, physicals, and laboratory tests was applied to asymptomatic populations in industry and health maintenance organizations beginning in the late 1940's (10). More recently the general public has become aware of the "annual checkup" as a method of being reassured they are in good health. This demand has created quite an impact on the health care system.

Of the $118.5 billion dollars Americans spend on health care each year, $15-20 billion are spent on annual or semiannual check-ups (11). Periodic health examinations are the most common type of examination carried out by the primary care physician, representing between 10 and

20 percent of all patients encountered (12-15). With such a large amount of health care time and money spent in screening measures, their effectiveness and which procedures if any to perform should be scrutinized closely.

Why Examine Healthy People?

While it is generally accepted that selected screening efforts can be used to help maintain the health of our patients and the population in general, the investigations needed to document the benefit of health maintenance examinations require randomized control studies with long term follow-up on large, defined populations. These investigations are long, costly and rare.

In 1921 the Metropolitan Life Insurance Company carried out a study on a sample of their insurees and reported a reduction of the expected mortality by 28% as a result of periodic health examinations (16). The Kaiser Foundation Health Plan conducted a controlled trial of its members offering periodic multiphasic health checkups to over 5000 and following them for 11 years. They were compared to a group who had not been urged to participate in such screening. They found a significant reduction of self-reported disability due to hypertension complications, ischemic heart disease, and back conditions in males age 45-54 who were in the screened group. As a whole the study group had significantly lower mortality due to hypertension complications and colorectal cancer (17). These were two of the diseases for which screening had been done.

Table 1.

Death Rates in Study and Control Groups. 1965-1975
Kaiser Foundation Health Plan

Cause of death	Death rate (per 1000 for the 11-year period) Study	Control	Chi square value
Potentially Postponable Causes	8.6	13.2	5.25
Cancer of colon and rectum	1.0	3.3	6.43
Cancer of breast (women only)	5.0	4.8	0.01
Cancer of cervix and endometrium (women only)	0.4	1.4	1.68
Hypertension, hypertensive cardiovascular disease, and hemorrhagic cerebrovascular disease with hypertension	2.5	4.7	3.44

Much investigation of individual screening procedures for specific populations has been undertaken. Four recent reports (18) have made recommendations concerning periodic health examinations based on this

research. In 1975, Frame and Carlson reviewed 36 diseases that satisifed criteria for health screening. They analyzed the feasibility of screening for each disease and published their recommendations in the then new Journal of Family Practice. In 1977 Breslow and Somers (20) proposed a "Lifetime Health - Monitoring Program". They emphasized the need for cost effective and health effective preventive measures to be integrated into patient care. They divided these into recommendations for ten different age groups. In 1976 the Canadian Task Force comprised primarily of clinicians was formed to develop a lifetime plan for preventive medicine. In 1979 they published their recommendations based on what was currently available in the world literature (21). Not surprisingly they found scanty evidence for some of the screening measures that had been accepted for a long period of time and were further able to delinate areas where research should concentrate in the next few years. In 1980 the American Cancer Society (22) made new recommendations on the cancer-related examination. These took into consideration the morbidity and mortality from the cancers compared to the risks and costs of screening procedures for their detection.

Recent Reviews of Health Maintenance Procedures

1975	Frame and Carlson	Journal of Family Practice
1977	Breslow and Summers	New England Journal of Medicine
1979	Canadian Task Force	Journal of the Canadian Medical Association
1980	American Cancer Society	Ca-A Cancer Journal for Clinicians

These reports differ in specific screening recommendations, but all argue that the examinations should focus on the specific population taking into account for what the group is at greatest risk.

In general these groups had criticisms of the "annual checkup" as it is usually practiced. These criticisms include:

1) There is little relation to the needs of the age group. The same screening procedures are frequently done for a twenty year old as an 80 year old when the disease risks are certainly not the same.

2) There is little evidence for the efficacy of many tests in finding disease.

3) Certain procedures may be performed just as effectively at less frequent intervals than yearly.

4) The yearly physical tends to to be used by more highly educated and motivated members of society who aren't necessarily in the greatest need.

They recommend discarding the "annual checkup" in favor of selected health maintenance packages that consider age, sex, ethnicity, occupation, socioeconomic status, and other factors that put an individual or population at risk for particular disease states (23). This periodic health examination is defined as a group of tasks designed either to determine or reduce the risk of subsequent disease or to identify disease in its early symptomless state (21).

The purpose of health maintenance is the prevention and early detection of specific diseases and the promotion of health. The terms preventive medicine and health maintenance can encompass a wide range of health concerns and practices. For the purpose of this discussion preventive measures that can be incorporated into personal health services will be discussed. These can further be divided into primary and secondary preventive efforts. Primary prevention is preventing the start of a disease, such as immunizations for infectious diseases. Secondary preventive efforts are aimed at discovering diseases at an asymptomatic stage when efforts can be applied to alter their natural history and perhaps cure them altogether.

How to Design a Health Maintenance Program

Although each of their methods differed somewhat the four review groups (19-22) analyzed disease states, populations, and specific procedures to determine the worth of including these procedures in their recommendations for health maintenance examinations. These general methods can be applied by any physician in designing health maintenance examinations for the population to whom he/she is providing care. As outlined by Frame and Carlson the first step is to identify those diseases for which it is worthwhile to screen in the population by the following parameters (19).

1) The natural history of the disease suggests abnormalities are likely to appear prior to the development of symptoms.

2) Early detection makes a difference in the prognosis.

3) The condition must be serious and occur frequently enough to warrant the time and cost of the screening and follow-up process.

4) Available screening techniques must be sensitive enough to make detection likely.

5) The screening techniques must be specific enough to make follow-up to differentiate between false positives and true negatives worth the expense and risk.

The Canadian Task Force (21) applied these criteria to first identify 128 potentially preventable conditions affecting its citizens from the prenatal period to old age. They further selected procedures pertaining

to 85 of these conditions that they recommend to be considered in periodic health examinations.

Once those disease states are identified which fulfill the criteria of having a significant burden on the population and having a maneuver that is available for screening, the effectiveness of the intervention should be evaluated according to the quality of the evidence available in the literature. A grading system outlined by the Canadian Task Force is as follows: (21) I) Evidence obtained from at least one properly randomized controlled trial. II) Evidence obtained from a well designed cohort or case control or analytic studies peripherally from more than one center or research group. III) Opinions of respected authorities, based on clinical experience, descriptive studies or reports of expert committees.

On the basis of these considerations the Canadian Task Force made a recommendation for each condition and screening procedure as to whether it should be specifically considered in the periodic health examination. These recommendations were classified as follows:

A) There is good evidence to support the recommendation that the condition be specifically considered in a periodic health examination.
B) There is fair evidence to support the recommendation that the condition be specifically considered in a periodic health examination.
C) There is poor evidence regarding the inclusion of the condition in a periodic health examination, and recommendations may be made on other grounds.
D) There is fair evidence to support the recommendation that the condition be excluded from consideration in a periodic health examination.
E) There is good evidence to support the recommendation that the condition be excluded from consideration in a periodic health examination.

By applying the above analyses a health maintenance package can be designed which includes specific diseases and screening procedures based on those disease states most likely to be present in the population to be screened.

Current Recommendations for Health Maintenance Examinations

Before outlining specific diseases and recommendations for their screening it is important to remember that these recommendations are the *minimal* screening procedures that should be considered to be applied (24). The health care provider must be cognizant of those conditions which may markedly increase the risk for a disease and apply the recommendations accordingly, possibly starting at an earlier age or including more rigorous screening procedures. A second caution is that

the populations that are referred to are totally asymptomatic individuals without any significant risk for particular diseases.

These recommendations are for the ongoing care of these asymptomatic individuals. They do not address the evaluation of a new patient to a health care system which may involve more rigorous screening to establish a data base for continued care.

Immunizable Infectious Diseases

Tetanus and diphtheria - Immunization against diphtheria and tetanus in childhood is well established (25). The efficacy of continuing these immunizations into adulthood has also been established (26). Half of the cases of clinical tetanus arise with no conspicuous injury (27). Relying upon immunization at the time of injury is not an effective way to prevent the disease. Therefore all adults should be immunized for tetanus and adult diphtheria every ten years once basic immunization has been established, which is usually in childhood (27).

Rubella - Rubella is a mild viral disease and its major risk is that of congenital rubella syndrome. Since 1969 a safe and effective vaccine has been available for rubella and has been used for the vaccination of children. Adult women of childbearing potential who have not been vaccinated as children should have their rubella antibody titer determined. If they are found not to be immune, rubella vaccine should be administered at a time when they will not become pregnant for at least three months (28).

Influenza - Influenza vaccination should be carried out in all persons 65 years of age or older since they are prone to the more severe complications of influenza including death. In addition all persons who are at increased risk of adverse consequences from infections of the lower respiratory tract because of preexisting medical conditions should be vaccinated. These conditions include acquired or congenital heart disease with actual or potential alterations in circulatory dynamics, chronic disorders or conditions that compromise pulmonary function, chronic renal disease, diabetes mellitus or other metabolic disease, severe chronic anemia, and conditions that compromise the immune mechanism (29).

Pneumococcal pneumonia - a polyvalent vaccine for pneumococcal pneumonia has been available in the United States since 1977 and has been shown to have approximately an 80% efficacy for the prevention of pneumococcal pneumonia. In January, 1978 the Public Health Service Advisory Committee on Immunization Practices recommended that the vaccine might be beneficial for certain closed or institutionalized groups, people at increased risk during the localized outbreak of disease from a single pneumococcal serum type, patients at high risk of influenza complications, those with functional or anatomic asplenia, and those with certain chronic illness such as diabetes mellitus and functional impairment of the cardiorespiratory, hepatic, and renal systems (30). Subsequently the vaccine has been recommended by the

manufacturer in the package insert for the above groups and all patients over the age of 50 without underlying medical problems.

There is little scientific evidence to support the general use of pneumococcal vaccine on the basis of age only. In fact a trial performed at the San Francisco Kaiser Permanente Medical Center administered the vaccine to ambulatory non institutionalized participants older than 45 years. 6,782 patients received a 12-valent vaccine and 6,818 patients received a placebo injection. The baseline annual rate of radiologically confirmed pneumonia in this population was from 12 in 1,000 to 17.7 in 1,000. During a 21 month surveillance there was no notable difference in the frequency of all types of pneumonia or of pneumonia associated with pneumococcal sputum isolates of any type or of vaccine specific types. Only serum conversion rates to vaccine types were substantially reduced in the vaccinees (31). Dr. Austrian, a major proponent of pneumococcal vaccine, has recently pointed out the difficulty of undertaking studies to confirm the efficacy of vaccination for asymptomatic individuals and he still promotes this practice (32).

At the present time routine pneumococcal immunization for all patients because of age has not been supported in the literature (33). If anything it should only be considered for healthy patients over 65 years of age who are not likely to have significant reactions to the immunization, in addition to those well established groups with underlying disease. At the current time revaccination is recommended no more than every 5 years and possibly longer because the risk of side effects of revaccination is great with an elevated antibody titer present.

Hypertension

At least 3% of the adult population is at risk for preventable cardiovascular complications of hypertension. The lowering of elevated blood pressure has been shown to reduce the risk of stroke, heart failure and damage to major blood vessels and the kidney. In addition hypertension has been identified as a significant risk factor in ischemic heart disease (34,35). The burden of suffering secondary to hypertension is large, owing to disability and early death.

Primary preventive measures such as restriction in dietary sodium intake and prevention of obesity may be helpful. However, the main thrust in hypertension is secondary prevention by identifying hypertension, lowering blood pressure to normal levels and thus preventing some of its complications.

Blood pressure measurements should be a part of every periodic health examination of adults. The most effective method of obtaining periodic checks of blood pressure in primary care would be to develop a system in which the blood pressure of every adult is measured during each visit to the physician for any complaint. In this manner hypertension detection would not depend upon the patient's compliance with periodic health

examinations (36). At the very least asymptomatic adults without significant family history or other risk for hypertension should have a blood pressure determination at least once every five years between the ages of 25 and 40, every two years between the ages of 40 and 60, and every year after the age of 60.

Carcinoma of the Breast

Cancer of the breast is the most frequent cancer and the leading cause of cancer death in women. An American woman has about a 1 in 11 chance of developing breast cancer during her lifetime. The five year survival for all women with breast cancer is about 65%, but this can vary widely depending on the stage of the cancer at the time of diagnosis. Those cancers diagnosed in local stages have an 85% five year survival rate (22).

There currently are no known primary maneuvers for the prevention of breast cancer although some dietary habits have been linked to breast cancer and its risk increases based on advanced age of beginning child bearing. The efficacy of secondary screening to detect breast cancer at an early stage has been well established and is the basis for recommending the inclusion of breast cancer screening maneuvers in the periodic health examination.

Screening Modalities Currently Available for Breast Cancer

Breast self examination
Breast examination by a health professional
Mammography
Thermography
Ultrasound

Breast examination by a health care professional and mammography have been the most thoroughly evaluated (37-45).

In 1964 the Health Insurance Plan of Greater New York (HIP) initiated a study to examine the effect of annual physical examinations and mammograms on women between the ages of 40 and 65 (37). The women were assigned to a study group in which each was offered these screening maneuvers or a control group with each group consisting of about 31,000 patients. Sixty-five percent of the women in the study group presented for the initial screening and approximately 50% of these received the screening examinations for five years. Three hundred-one breast cancers were discovered in women in the study group. The following table outlines the modalities used to detect these cancers.

Table 2.

Breast Cancers Detected on Screening by Age Group and Modality
New York Health Insurance Plan

Modality*	Total	Age at diagnosis 40-49	50-59	60 or older
		Percent		
Mammography only	33.3	19.4	41.5	30.6
Clinical only	44.7	61.3	40.0	38.9
Clinical and mammography	22.0	19.4	18.5	30.6
Total	100.	100.0	100.0	100.0

A significant finding from the HIP study was that one-third of cancers were detected by mammography alone when the concomitant physical exam was completely normal. This varied depending on age group from a low of approximately 20% in women ages 40-49 to 41.5% detected by mammography alone in women ages 50-59.

An even more important finding was that after ten years of follow-up cancer death were significantly different in the study group compared to the control group as outlined in table 3.

Table 3.

Case Fatality Rates
Among Breast Cancer Cases
By Age at Diagnosis

	Control	Study	(Detected on Screening)
Total	46.7	35.2	
40 - 49	40.9	42	(35.9)
50 - 59	53.5	32.1*	(24.0)*
60+	40.5	32.6	(29.0)

* Statistically significant

It should be noted that the study group presented in this table included the 35% of women in the study group who never presented for screening. The last column shows the case fatality rates of those women who were actually screened. Although there were differences in each of the groups, the differences only reached statistical significance in the 50

to 59 year age group. Overall the number of deaths in the group offered screening was found to be 23% lower than in the control group.

This data from the Health Insurance Plan of Greater New York study lead the Canadian Task Force in 1979 (21) and the American Cancer Society in 1980 (22) to recommend annual mammography and physical examination of the breast for women age 50 to 59. In addition the American Cancer Society recommended breast self examination monthly by all women over the age of 20, a breast physical examination by a health care professional every three years in women age 20 to 40 and every year in women over 40. In addition to yearly mammography in women over the age of 50, they recommended one baseline mammogram between the ages of 35 to 40 and mammography between the ages of 40 to 50 based on consultation with the women's personal physicians.

The findings of the Health Insurance Plan of Greater New York were confirmed and data on screening for breast cancer was expanded by the Breast Cancer Detection Demonstration Project (BCDDP) (38). This project was funded by the American Cancer Society and the National Cancer Institute and involved 29 centers that enrolled more than 280,000 women in breast cancer screening. This was not set up as a randomized controlled trial but rather as a demonstration project. However, the data collected by the projects provides valuable information about screening for breast cancer.

The women entered into the project were between the ages of 35 and 74 with a median age of 49.5. Most (88.3%) of the participants were white and tended to have a higher than average median household income. More than half of the women who entered the program attended screenings for all five years of the project. A total of 4,443 breast cancers were detected during the time of the project. Of these, 3,557 were detected by the BCDDP screening centers and 886 cancers were detected outside the project. The cancer detection rates varied from 1 cancer in 1,000 screenings in women aged 35 to 39 to a rate of 12.9 cancers per 1,000 screenings in women aged 70 to 74.

Table 4 depicts the modalities used for the detection of the cancers in the various age groups. This is compared with the same information that was presented earlier from the New York Health Insurance Plan experience.

Table 4.

Breast Cancers Detected During the Breast Cancer Detection Demonstration Project Compared with the Health Insurance Plan of Greater New York Screening Program

	BCDDP		HIP	
	Ages 40-49 at Surgery	Ages 50-59 at Surgery	Ages 40-49 at Surgery	Ages 50-59 at Surgery
Suspicious Modality	Percent	Percent	Percent	Percent
Mammography only	35.4	42.1	19.4	41.5
Mammography & physical examination	50.0	49.7	19.4	18.5
Physical examination only	13.1	6.7	61.3	40.0
Unknown	1.4	1.5	0.0	0.0
Total	100.0	100.0	100.0	100.0

Overall mammography alone was responsible for detecting 41.6% of the cancers of the BCDDP, compared with 33.3% in the HIP study. In addition mammography was positive in 91.8% of the cancers detected by the BCDDP in the 50 to 59 age group with physical exam alone accounting for only 6.7% of the cancers detected. Among the 40 to 49 age group mammography alone was responsible for detecting 35.4% of the cancers and mammography was positive in 85.4% of the cancers detected in this age group.

Follow-up has not been underway for long enough to determine case fatality rates of the breast cancers detected by the BCDDP. However, data on the types of cancers detected by modality are available and presented in the following table.

Table 5

Breast Cancers Stratified by Lesion Size and Modality Findings

Suspicious Modality	Noninfiltrating Breast Cancers Percent	Infiltrating Breast Cancers <1 cm Percent	Infiltrating Breast Cancers >1 cm Percent	Total Number of Breast Cancers Percent
Mammography only	59.0	52.6	33.7	41.6
Mammography & physical examination	33.0	36.4	55.5	47.3
Physical examination only	5.5	8.4	8.6	8.7
Unknown	2.6	2.7	2.2	2.4
Total	100.0	100.0	100.0	100.0

Those cancers detected by mammogram alone were much more likely to be noninfiltrating or infiltrating breast cancers less than 1 cm in size. As the breast cancers became detectable on physical exam they were more likely to be larger cancers with a worse prognosis. The BCDDP does not have a control group to which it can be compared but the above information would lead one to believe that the cancers detected by mammography are at an earlier and more treatable stage. The BCDDP also noted that those cancers detected by mammography alone were more likely to have negative lymph nodes at the time of surgery regardless of the size of the cancer compared to those detected by mammography and physical exam or physical exam only.

These two studies present a fairly convincing argument for the utilization of physical exams and mammography in detecting breast cancer in asymptomatic women. The efficacy of mammography seems to be greatest in women over 50 years of age, however, the BCDDP data suggest that it may be of benefit beginning in women age 40. The American Cancer Society still feels that this is at the discretion of the physician. Before accepting these recommendations one must consider the risks and costs of the modalities, especially mammography, before applying them to large groups of women. The risks of mammography are primarily of two types. The first is the risk of radiation and its role in causing new malignancy. The second is the morbidity of the biopsies done as a result of suspicion on a screening mammogram.

It has been well documented that high cumulative or single doses of radiation can produce neoplasms after a latent period (46). The risk of

very low dose exposure such as that used in mammography has not been delinated. It is known that breast cancers induced by radiation are related to the age at the first time of exposure (47). This is particularly true for women under age 35 who have radiation exposure. The risk decreases as the age at first exposure increases. Table 6 outlines the added risk to a women of annual mammograms utilizing an annual average midbreast dose of 1 rad.

Table 6.

Lifetime Added Risk to the Individual of Annual Mammographic Screening to Age 75 at Annual Average Midbreast Dose of 1 Rad (Assumes Average Age at Death = 75)

Starting age	% Increase in lifetime risk
25	6%
35	2-3%
45	0.9%
55	0.25%
65	-

For women under age 30 at time of irradiation, assumes risk estimate of 6 cancers per rad per 10^6 persons per year. For women over 40, assumes 3.5 cancers per rad per 10^6 person per year (48).

For women with annual mammography beginning at ages 45 to 55 the risk of annual minimal radiation exposure is markedly decreased compared to younger women. The Health Insurance Plan of Greater New York utilized a computer model to estimate the increased risk of mammography on the women involved in their study. In screening 100,000 women beginning at age 50 for the rest of their lives with yearly mammography, it was estimated that approximately 53 new cases of breast cancer would be caused in addition to the approximately 65,000 natural cases of breast cancer detected. By adding this risk it was shown that the life expectancy of each women who was screened would be increased by 60.2 days vs. 60.5 days if the radiation carried no risk. The conclusion of the HIP group was that although the radiation exposure from mammography does carry some risk this is negated by its advantage in detecting asymptomatic breast cancers and assumes that those cancers caused by the radiation would be detected early by continued screening (39).

The morbidity associated with biopsies performed is also related to the age at which women are screened. Younger women have a higher incidence of benign breast disease and therefore higher biopsy rates, while older women have an increasingly higher incidence of breast cancer. The biopsy rates related to age in the BCDDP are outlined in table 7 (38).

Table 7.

Age-Specific Nonmalignant
To Malignant Biopsy Ratios

Age at Entry	Nonmalignant to Malignant Biopsy Ratio
35-39	16.4
40-44	9.5
45-49	6.5
50-54	5.2
55-59	3.8
60-64	3.4
65-69	3.2
70-74	5.4
Overall average	5.4

The HIP study (37) had similar results although the mammography done at that time had less sensitivity so the rates were lower. The biopsy rates for women under age 50 were 10 non-malignant lesions for every malignant lesion and those in women over age 50 were four non-malignant lesions to every malignant lesion. This increased biopsy rate is another reason for the conservative recommendations in screening women under the age of 50 with mammography.

A final consideration when deciding whether to utilize screening mammography is the cost. In well organized demonstration projects the cost of screening mammography has been as low as $5 to $25 for a 2 view mammogram of both breasts. In actual clinical practice the cost estimate is closer to $50 to $100. A survey of various resources for mammography screening in Dallas revealed a cost ranging from $75 to $115 as outlined in Table 8.

Table 8.

Cost of Mammography

Resource	Bilateral Screening	# Views of each breast
Baylor Hospital	$76.75	2
Dallas Medical and Surgical Clinic	$85.00	2
Medical City	$106.00	2
Miller and Associates at Martin Hospital	$100.00	4
Presbyterian Hospital	$75.00	2
Parkland Memorial Hospital	$115.00	3
White Rock Radiology and at Doctors Hospital	$75.00	2

At $50 per mammogram, if all of the 31,000,000 women over fifty were screened the cost would be about 1.5 billion dollars each year. Therefore each physician's recommendations for screening must be based on some idea of the cost for that physician's patients and the benefit of the screening.

It has been well documented that both mammography and physical examination are important modalities in detecting asymptomatic breast cancer. Each of these independently contributes to the detection of the disease (49). There is strong evidence that screening will affect the outcome of the breast cancers detected and actually prolong life in women with breast cancer. The evidence for combining both modalities in screening is strongest in women over the age of 50 but should be considered in asymptomatic women over the age of 40. These recommendations must be balanced against the relatively high cost of screening mammography.

Hopefully in the near future further refinements can be made on the current recommendations. Other screening modalities such as ultrasound and thermography are being tested but as of yet are not as efficacious as mammography. If the mammogram remains the major detection modality, perhaps subgroups of women who benefit most by mammograms may be identified. This may be those women with larger breasts or who are more obese and are more likely to have lesions that will be missed on physical exam. This data has not yet been obtained.

Carcinoma of the Cervix

Invasive cancer of the cervix accounts for about 3.7% of cancers diagnosed in women in the United States and about 1.5% of cancer deaths among women (50). The incidence of invasive cancer of the cervix is decreasing which is probably related to widespread screening. In the United States, polling has shown that over 60% of women 18 to 34 years old have had a pap smear within the previous year and 82% have had at least one pap smear in their lives (51). The evidence of the efficacy of screening with cervical cytology is indirect but based on the disease's natural history and the observations of the reduction in incidence and mortality with screening, its efficacy is generally accepted by the medical community and the public at large.

The natural history of cervical carcinoma suggests that carcinoma in situ precedes invasive cervical carcinoma by a matter of years. This information has been gained from following untreated women with carcinoma in situ (52-55). It appears that not all cases of carcinoma in situ progress to invasive cervical carcinoma, but probably at least two-thirds do (56,57). However, the period of time required for this progression seems to be an average of between 8 and 30 years between the detection of carcinoma in situ by pap smear and the presence of invasive cervical carcinoma (58-64).

In screening for asymptomatic cervical carcinoma the maneuver used is that described by Papanicolaou of obtaining and screening cervical cytologies. Below is a summary of the sensitivity and specificity of this test for detecting cervical dysplasia, carcinomia in situ, and invasive carcinoma (65,66).

Table 9.

Sensitivity and Specificity of the Papanicolaou Smear

False negative ratio	21%
False positive ratio	5%
Sensitivity	79%
Specificity	95%
Incidence of disease	0.4%
Predictive value positive	5%
Predictive value negative	99%

The controversy in screening for cervical cancer lies in the frequency of performing pap smears in asymptomatic women. In 1980 the American Cancer Society made major changes in its recommendations for screening based on the literature on the natural history of carcinoma in situ (22). It recommended that all asymptomatic women over age 20 and those under 20 who are sexually active have a pap smear annually for two negative examinations and then every three years until the age of 65. They recommended no further screening for cervical cancer after the age of 65. In addition they recommended a pelvic exam be done, regardless

of the pap, as part of the general physical exam every 3 years from age 20 to 40 and annually thereafter. The Canadian Task Force (21) similarly recommended that all sexually active women have two negative pap smears one year apart then pap smears every three years for fifteen years then every five years until the age of 60.

The American College of Obstetricians and Gynecologists (ACOG) strongly disagreed with these two reports and recommended continued yearly screening of all women for cervical cancer (67). The ACOG agreed that the natural history of most cervical carcinoma is a several year interval between carcinoma in situ and invasive cervical carcinoma but felt that in up to 5% of cases this natural history may progress much more rapidly and not be detected by less frequent screenings. In addition they felt that adenocarcinoma of the cervix has a much different natural history and may be overlooked by less frequent screenings.

In 1980 the National Institutes of Health developed a consensus panel consisting of representatives from the American Cancer Society and the American College of Obstetricians and Gynecologists (68). The consensus of this panel was that all sexually active women should have two negative pap smears one year apart and then the pap smear should be repeated at regular intervals of one to three years. The panel did not make more specific recommendations on which women to screen every year and which women to screen every three years.

The risks of the pap smear procedure itself are practically non-existent. The major risk of that is that of an improperly read pap smear and subsequent therapy when no therapy was indicated. It is important for physicians to feel comfortable with the reliability of reports on cervical cytology. The cost of performing a pap smear is probably less than $15 assuming the woman is in her physicians office for other reasons. If a woman visits her physician only to obtain a pap smear, which is the case more frequently with yearly pap smears, the cost is increased to $25 to $40.

Pap smears are an effective way to screen for carcinoma of the cervix and the screening appears to result in decreased mortality from the disease. The frequency of the screening is not well established and each physician should screen their female patients at a frequency of every one to three years depending on the woman's risk, after two negative examinations one year apart to decrease the incidence of false negatives.

Carcinoma of the Colon and Rectum

Colorectal carcinoma is the second most common cancer in the United States and represents 15% of all malignant neoplasms and 15% of all deaths from cancers (50). The overall incidence in the United States is approximately 45 per 100,000 population with a mortality rate of 21 per 100,000. 97% of cases of colorectal cancer occur in persons aged 50 or older. The prognosis of colorectal cancer has not changed significantly over the past 30 years. Although dietary habits and environmental

exposures have been associated with increased colon cancers no methods of primary prevention are currently known and evaluated (69-73). Secondary prevention relies on early detection of colorectal carcinoma which has been shown to decrease cancer deaths. The overall five year survival rate for colorectal carcinoma is 20 to 60% depending on the degree of local invasion. However, for lesions not extending beyond the bowel wall (Dukes' stage A) the five year survival is 95 to 100%. Therefore screening techniques should be aimed at detecting asymptomatic colorectal cancers in early stages and bringing about higher likelihood of cure or decreased mortality.

The main screening maneuvers that have been used and tested for asymptomatic patients pertaining to colorectal carcinoma include digital rectal exams, testing the stool for occult blood, and sigmoidoscopy. Other possible maneuvers for detecting asymptomatic colon carcinoma include barium enema, blood tests for carcino embryonic antigen, colonoscopy, and colonic lavage. These have not yet been thoroughly evaluated as screening procedures and will not be considered in this discussion.

Although it has been long practiced as a method of screening by the medical community no formal studies of the effectiveness of digital rectal examinations have been done. The controlled evaluation of multiphasic screening conducted by the Kaiser Foundation did show a reduction in colorectal cancer mortality in screening patients versus control patients (17). Included in their screening package was a digital rectal examination, blood studies for anemia, and a sigmoidoscopy. Only one third of the screened patients had sigmoidoscopy so a contributor to the discovery of early colorectal cancer may have been the digital rectal examination. The cost of a digital rectal examination done at a visit to the physician for other reasons is negligible and the digital rectal exam is extremely safe. Potential risks in utilizing digital exam alone for screening for cancer are that it may give patients a false sense of security since it has a high false negative rate for colon cancer. Studies comparing digital rectal exams with sigmoidoscopy have shown that only from 3 to 9.5% of the lesions can be palpated on the rectal exam (74-75). Its false positive rate may result in further more costly diagnostic tests. The digital rectal exam therefore should be used along with other screening maneuvers to detect early colorectal carcinoma.

Testing the stool for occult blood is another safe and relatively inexpensive procedure. The method used most frequently for testing the stool for occult blood is the guaiac paper slide test which consists of filter paper impregnated with guaiac. In the presence of hemoglobin in the stool and hydrogen peroxide in the test reagent the guaiac undergoes phenolic oxidation and changes to blue in color. Anything with peroxidase activity can give a false positive test such as fresh fruit, uncooked vegetables and nonhuman hemoglobin present in foods such as meat. Ascorbic acid and other agents that interfere with the oxidation reaction may produce a false negative reaction in the presence of hemoglobin. The sensitivity and specificity of the guaiac impregnated slide is most enhanced by utilizing the methodology presented in the following table (76).

Table 10.

Recommended Methodology
For Fecal Occult Blood Testing

Dietary Restrictions	Meat-Free High Fiber Low Peroxidase
Number of Smears	Six
Type of Slides	Impregnated Guaiac, Immunochemical
Rehydration	Only if Strict Low Peroxidase Diet is Used
Storage Interval	Four Days Maximum
Quality Control	Window or Lab Assay

Several uncontrolled trials (77-82) have supported the efficacy of testing for occult blood in the stool in finding asymptomatic colorectal cancer. A summary of several of these studies is presented in the following table:

Table 11.

Results of Uncontrolled Studies of Stool Guaiac
in Detecting Asymptomatic Colon Cancer

	Total Patients	Positive Guaiacs	Cancer	Polyps
Miller & Knight	2323	39	3	7
Glober & Pescoe	1539	32	4	3
Gnauck	5016	117	13	
Fruhmorgen	5007	144	22	22
Siba	3791	97	6	18
Farrands	2439	121	4	8

Over the past two years a community-wide effort was undertaken in Dallas for massive screening for colon cancer by Hemoccult testing. This was sponsored by Baylor University Medical Center, Eckerd Drug Stores, and television stations KXAS and WFAA. The availability of free Hemoccult slides at Eckerd's Drug Stores and their appropriate use was publicized. Participants sent the Hemoccult slides to Baylor, where they were processed and the results returned to the participant. If the test was positive, the participant was encouraged to report to a physician for further investigation. Extensive effort was made to obtain follow-up data on these cases. The results available at this time are outlined below (83).

Table 12.

Baylor University Hospital Screening Program

Hemoccults distributed	49,277	
Number returned	16,200	(33.1%)
Number positive	563	(3.5%)
No follow-up available	214	
Incomplete follow-up or negative evaluation	102	
Miscellaneous GI diseases	102	
Hemorrhoids	61	
Polyups	36	
Diverticulosis	34	
Carcinoma	14	

Two controlled trials utilizing fecal occult blood testing to detect asymptomatic colorectal carcinoma are currently underway at Memorial Sloan Kettering (84) and the University of Minnesota (85). The study at Memorial Sloan Kettering has enrolled over 22,000 patients over the age of 40. These patients have been divided into groups to compare screening with fecal occult blood testing and its relationship to colorectal cancer mortality compared to a group with no such screening. In preliminary results the study group's compliance with fecal occult blood screening ranged from 70 to 80% which is much higher than general programs in the community. The rate of positivity of Hemoccult II slides was 3.7% with a predictive value for colorectal carcinoma or polyps of 44%. The predictive value was dependent on age ranging from 27% at ages 40 to 49 to 52% at age over 70. At the time of the last report over 71 colon cancers had been detected, 59 of these were in the study group, of which 43 (73%) were detected by Hemoccult. Overall 63% of the cancer detected in the screened groups were staged in situ, Dukes' A or Dukes' B, compared to 12 cancers detected so far in the control group of which only 33% were in situ, Dukes' A or Dukes' B.

Table 13.

Preliminary Results of Memorial Sloan Kettering
Controlled Study on Fecal Occult Blood Testing

Patient compliance	70-80%
Rate of slide positivity	3.7% (1.6%-6.6%)
Predictive Value for neoplasia	44% (27%-52%)
Early Dukes' staging (in situ, A,B):	
Study group	63%
Control group	33%

In the University of Minnesota study 48,000 participants were randomized into those who received Hemoccult slides yearly, those who received

slides every other year, and a control group. So far the overall rate of slide positivity has been 2.4%. Eight hundred seventy-three patients had positive results and underwent diagnostic evaluation which revealed 72 cancers of the colon or rectum. 78% of these cancers detected by screening were Dukes' A or B cancers. The study is now in the rescreening and follow up stage.

Winawer has summarized the results of the previous uncontrolled and the new controlled trials in the use of fecal occult blood testing for detection of carcinoma of colorectal neoplasms.

Table 14.

Fecal Occult Blood Test: Clinical Data

Patient Compliance	
Motivated Groups	80%
Unmotivated Groups	15%
Rate of Positive Slides (Unhydrated)	1% to 5%
Rate of Positive Slides (Hydrated)	Up to 20%
Predictive Value for Neoplasia	18% to 50%
Staging of Detected Cancers (Dukes' A&B)	60% to 80%
False Positivity	
(Unhydrated Slides)	2%
(Hydrated Slides)	Up to 20%
False Negativity for Cancer	
(Hydrated Slides)	9%
(Unhydrated Slides)	31%
False Negativity for Adenomas	60% to 75%
Other	Complements Sigmoidoscopy Minimal Risk Colonoscopy Important in Workup of (+) Patients

From the data that is available in the literature up to the present time it appears that fecal occult blood testing is efficacious for detecting asymptomatic colorectal cancers and those detected by this maneuver are more likely to have an improved prognosis. Frame and Carlson (19) and Breslow and Somers (20) recommending testing the stool for occult blood every two years in all persons age 40 to 50 and every year in those persons over age 50. The Canadian Task Force (21) recommends testing the stool for occult blood in all persons over the age of 40 at intervals no more frequently than yearly. The American Cancer Society

(22) recommends testing the stool for occult blood yearly in all persons over the age of 50.

Sigmoidoscopy is effective for detecting benign and malignant colorectal lesions. Table 15 (82) summarizes several studies utilizing sigmoidoscopic examinations on asymptomatic individuals. The detection rate for malignant disease is from 0 to 8.3% and for benign adenomas 4.3 to 12.3%

Table 15.

Incidence of Benign and Malignant Polypoid Lesions Diagnoses on Routine Sigmoidoscopic Examinations

Author	Total Patients Examined	Percent of Benign Lesions	Malignant Lesions
Browne and McHardy (87)	200	4.8	1.5
Burnikel et al. (88)	5,072	9.9	2.6
Cameron et al. (89)	1,886	6.0	1.2
Christianson et al. (90)	2,226	12.3	0.13
Creek et al. (91)	3,321	7.1	0.69
Crumpacker et al. (74)	5,178	4.3	0.8
Enquist et al. (92)	7.608	11.5	1.0
Grant, R.N. (93)	2,924	5.4	3.3
Hertz et al. (75)	26,126	--	0.45
Knoernschild et al. (94)	18,120	7.3	0.5
Linn et al. (95)	1,405	5.8	0.14
Mandel A. (96)	1,000	6.2	0.2
Mayo Clinic (97)	2,452	7.5	0.0
Miller, C.J. (98)	209	5.4	2.3
Molofsky and Hayashi (99)	7,400	6.4	0.04
Ochsner et al. (100)	2,000	9.1	2.1
Portes and Majarakis (101)	50,000	7.9	8.3
Rasgon (86)	1,900	6.2	0.8
Shallenberger (102)	4,500	10.1	2.6
Smith et al. (103)	1,000	6.2	0.81
Steele and Brown (104)	1,500	5.6	0.33
TOTAL	146,027	6.75	1.42

In addition to being effective for detecting asymptomatic malignant disease of the colorectal area, those malignancies detected in asymptomatic individuals have been show to have an improved prognosis over those detected at the time the patient becomes symptomatic. Hertz (75) showed that asymptomatic patients with malignancy detected on screening had an 88% five year survival compared to patients with symptomatic colon carcinoma who had only a 50% five year survival rate. An experience at a Minnesota detection clinic (105) revealed a 75% survival rate in patients with asymptomatic colorectal cancers at five

years in contrast to 20% for symptomatic colon cancers and 50% for symptomatic rectal cancers. In addition to these positive statistics on the outcome of colorectal cancer detected in screening asymptomatic individuals, it has been shown that subsequent routine examinations of these individuals reveal a lower than expected number of asymptomatic polyps so malignant disease may actually be prevented (106,107).

The major disadvantage of proctosigmoidoscopy is that it can be uncomfortable to the patient which may interfere with patient compliance. There is a risk of perforation that in experienced hands is less than 1 in 1,000 examinations (108). The cost of sigmoidoscopy depends on how the service can be delivered. If done in a primary care physician's office at a health maintenance examination or an examination for other reasons the cost is less than $30 to $40. If it requires referral to a specialist there will be additional costs.

The introduction of the flexible sigmoidoscope in 1976 has contributed a new technique for screening asymptomatic patients. In a recent study Bohlman et al. (109) performed both rigid sigmoidoscopy and flexible sigmoidoscopy in 120 asymptomatic patients. The average depth of penetration for the rigid scope was 20.4 cm compared to a depth of 55 cm using the fiberoptic scope. 39% of examinations with the fiberoptic instrument uncovered chronic pathology compared to only 13% of the same patients examined with the standard proctosigmoidoscope. These lesions included three carcinomas, three malignant polyps and 30 benign polyps with a fiberoptic scope and one carcinoma, one malignant polyps and six benign polyps with the standard scope. Of the 28 lesions not seen the rigid sigmoidoscope 56% were below 27 cm and thus within reach of that device. Wherry et al. (110) examined seventeen patients with flexible and rigid sigmoidscopes. They were able to detect twice as many colonic with the flexible instrument compared to the rigid instrument.

The major problem with the flexible fiberoptic rectosigmoidoscope at this time is its high cost. The instrument costs about $3,000 versus about $50 for the standard scope. Also the primary care physician is generally not proficient in the use of the flexible scope and this screening procedure would need to be done by a subspecialist requiring a special more expensive visit. In the near future further evaluations of the flexible sigmoidoscope and its cost benefits in screening asymptomatic individuals should be available.

Screening for colorectal carcinoma in asymptomatic individuals does improve the outcome of this disease. The current recommendations of the American Cancer Society (22) are that 1) all persons age 40 and over should have a digital rectal exam annually. 2) All persons age 50 and over should have an annual stool guaiac slide testing by the protocol outlined earlier and sigmoidoscopy should be performed every three to five years after two initial negative sigmoidoscopies one year apart. The Canadian Task Force (21) only recommends testing the stool for occult blood in persons age 45 and older, based on its review of the literature.

Other Cancers

Several types of cancer can be discovered on physical examinations of asymptomatic people. These include cancers of the thyroid, testicles, lymph nodes, oral region, skin and ovaries. The sensitivity and specificity for physical exam in detecting these cancers is not known. Studies have not been undertaken evaluating screening by physical exam for these malignancies in asymptomatic persons. However, several of the groups that have recently reviewed health maintenance screening recommend physical exams looking for these malignancies. The American Cancer Society (22) recommends an exam every three years in persons age 20 to 40 and every year in persons over 40 years old. Breslow and Somers (20) recommend one visit between 18 and 24 years, and visits every five years until age 60 and every two years thereafter during which a physical exam is done screening for these malignancies. Frame and Carlson (19) do not recommend any such screening on a regular basis and the Canadian Task Force recommends examination for cancer of the skin as a discretionary measure in high risk patients such as those employed outdoors, and examination of the oral cavity as possibly efficacious on a yearly basis in adults with suggestion for further research in this area.

None of the groups recommend routine screening for carcinoma of the lung. This had been a major consideration in the recommendations by the American Cancer Society. Cancer of the lung does have a significant burden on the U.S. population which would warrant its consideration in the screening of asymptomatic persons. The current available technology for screening is primarily sputum cytology and chest X-rays. The American Cancer Society (21) reviewed several clinical trials done to evaluate lung cancer early detection programs (111-113). Their conclusion was that although the screening procedures allow lung cancers to be detected at an earlier stage, the mortality of the cancer in the screened persons was no different than that in those persons whose cancers were discovered when they became symptomatic. They also reviewed three trials which were underway at the Mayo Clinic (114) Johns Hopkins (115), and Memorial Sloan-Kettering (116). They felt that preliminary results did not document the efficacy of screening.

The groups undertaking the current studies disagree with the American Cancer Society and feel that screening may be beneficial in older persons who smoke (117). At the present time, the final data is not available on the efficacy of these procedures and screening is generally not recommended in asymptomatic individuals without significantly increased risk.

Health Risk Counseling

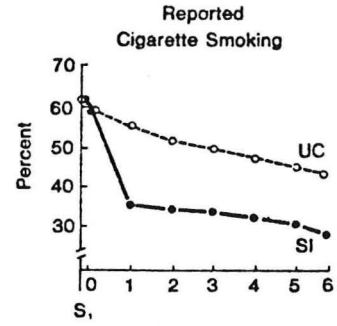
Certain behavioral habits have been shown to be risk factors for disease and mortality. These behavioral factors include alcohol consumption, smoking, dietary habits, sedentary life style and lack of undertaking safety precautions such as fastening seat belts. Although some clear-cut associations of these habits with medical problems are still being delineated, they have been shown to increase risk for morbidity

and mortality from cirrhosis of the liver, cancer, lung disease, heart disease and motor vehicle accidents. Estimates have been made of large savings of medical care cost and of life itself by altering these habits in large groups of the population.

There are two approaches to altering life style habits (118). One approach is mass education with widespread transmission of information about risk factors to large groups of people. The second is most consistent with the medical model and consists of approaching individual persons, identifying their behavioral risk, and then taking steps to reduce the risk factors found. An example of mass education for risk factor modification include the Stanford Heart Disease Prevention Program (119). In the Stanford program, three towns in northern California were identified and prevention programs were focused on hypertension detection and therapy, smoking behavior, and dietary behavior. Baseline risk factor behaviors and a medical examination were obtained on a sample of persons aged 35 to 59 years in each of the three communities. Subsequently, two of the communities were given intensive education including television and radio spots, hour long programming, weekly newspaper columns and advertisements, billboards, posters and printed material. The third community did not receive such intervention. After two years, the improvement in knowledge in the control community was 6% as measured by pre and post tests and in the two communities where the campaign had been conducted, there was 26 to 41% improvement. A small group of participants received intensive instruction and their knowledge improved by 54%. Saturated fat and cholesterol consumption declined 20 to 40% in the campaign communities compared to the control community. Cigarette smoking declined by 7 to 24% in the campaign communities and only 2.5% in the control community. Those who received intensive instruction regarding cigarette smoking had a decrease in cigarette smoking by 42%. Using a Framingham risk assessment protocol (120) for coronary heart disease, the risk increased more than 5% in the control community during the two year period of the study while declining 15 to 20% among participants in the campaign communities.

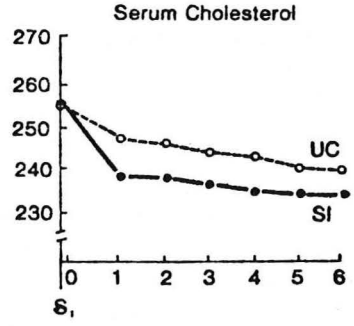
A model of more individualized intervention using the medical model was undertaken in the multiple risk factor intervention trial (MRFIT) (121). After initial evaluation for risk factors, 12,866 men aged 35 to 57 years were divided into two groups and followed for seven years. One of the groups had extensive intervention to reduce risk factors associated with coronary artery disease including hypertension, smoking, and increased blood cholesterol. The second group acted as the control and although they underwent intensive initial evaluation, they were referred to their routine sources of medical care. Regarding cigarette smoking in the study group, each cigarette smoker was counselled individually by a physician to achieve cessation of smoking, then shortly thereafter, a series of weekly groups involving the patient and a spouse or friend were undertaken addressing all three risk factors. Subsequent to this, more individualized counselling was undertaken to encourage smoking cessation. A comparison of the two groups regarding cigarette smoking habits was depicted in the following graph.

Figure 1.



The nutrition intervention program in the study group encouraged the development of lifelong shopping, cooking and eating patterns. Weight reduction was encouraged for those men whose weight was 115% or greater of desirable weight and all participants were counselled on diet containing saturated fat less than 8% of calories and dietary cholesterol less than 250 mg per day. The comparison of serum cholesterol in this group compared to the group receiving usual care is depicted in the following graph.

Figure 2.



These are two examples where counseling seemed to have significant effect to alter individual behavior and therefore reduce risk factors. In addition those men who were not hypertensive and had only smoking and an elevated serum cholesterol as risk factors had significantly decreased coronary heart disease comparing the study group and the control group.

Although intensive efforts at counseling to reduce potentially unhealthy behaviors such as undertaken in the MRFIT program may not be practical in most clinical settings, the identification of these risk factors by a history and individual life counseling efforts at visits for other reasons are certainly reasonable to undertake. It will take further investigation to document that these interventions are efficacious in

changing behavior and subsequently in reducing the incidence of disease associated with these behaviors. These endeavors do not add significant cost to the current interaction between the health care professional and the patient and certainly may benefit the patient. Frame and Carlson (19) recommend screening and counseling for smoking, hypercholesterolemia, obesity, and alcoholism. Breslow and Somers (20) recommend intermittent screening and counseling for hypercholesterolemia, nutritional habits, exercise habits, smoking and alcohol. The Canadian Task Force (21) states that based on the current literature there is poor evidence to support these inclusion of screening and counseling for alcoholism, smoking, hyperlipidemia and accidents. They do recommend further research in these areas.

Other Screening Procedures

There are several other diseases about which the recent review groups have not reached a consensus. The literature does not in general strongly support screening maneuvers for these conditions. However, various groups recommend that there may be a benefit and they should be included in screening until further information is gained.

At the present time in the overall United States population tuberculosis has a relatively low incidence but certain subpopulations have a much higher incidence of tuberculosis. Two groups (19,20) recommend screening the general population for tuberculosis. Frame and Carlson recommend TB skin testing with purified protein derivative in previously negative adults every ten years and Breslow and Somers recommend screening adults with previously negative tests every five years. The Canadian Task Force (21) does not feel that screening is indicated in general populations. However, all groups agree that screening maneuvers should be undertaken more frequently in higher risk populations. For example in our local population screening for tuberculosis if done at all in the North Dallas population should be done infrequently. However, in a population living in West Dallas screening should definitely be done at least every five years in previously negative asymptomatic adults.

Frame and Carlson and Breslow and Somers also recommend screening asymptomatic non-pregnant adults for syphilis with a VDRL every five to six years until the age of 50. The Canadian Task Force feels that based on the current literature there is no evidence of the efficacy of this in the general adult population.

Breslow and Somers recommend adults be screened with a hematocrit, blood sugar, and electrocardiogram every five years beginning at the age of 30. The other resources do not recommend any such screening procedures unless a patient presents with symptoms of possible underlying disease. Breslow and Somers and the Canadian Task Force agree that if facilities exist adults should have periodic checks of their hearing to detect and hopefully correct early hearing loss. Frame and Breslow recommend tonometry every four years over the age of 40 to screen for glaucoma but agree with the other resources that is very little evidence in the literature to support this.

Implementing the Health Maintenance Exam

Based on the above recommendations any physician should be able to analyze his/her own patient population and determine which screening maneuvers should be applied to detect asymptomatic disease and therefore affect its prognosis in that population. Once these protocols have been established for a practice, a system must be instituted whereby they will be carried out. Fortunately the majority of the screening maneuvers can be initiated or carried out by non-physician personnel, therefore reducing their cost. Even for those procedures, such as sigmoidoscopy, that non-physician personnel are not likely to perform, they can at least review the record, determine the need for these procedures and alert the physician. The best maneuver may be a flow sheet outlining the health maintenance recommendations that can be checked off when these are done. Whenever the patient presents to the health care facility for any reason this flow sheet can be reviewed and those procedures which are indicated can be done on that visit or arrangements can be made for them to be done shortly thereafter. The majority of the recommendations would not require a separate visit for health maintenance.

In the few years since the general recommendations for health maintenance examinations have been summarized some physician groups have been studied to determine their compliance with the recommendations. Romm and Fletcher (122) reviewed the performance of 31 North Carolina General Internists in relationship to documentation of the performance of several recommended health maintenance items. Battista (123) interviewed 430 primary care physicians in Canada regarding their compliance with carrying out the recommendations of the Canadian Task Force. A summary of the results of these studies are presented in table 16.

Table 16.

Physician Compliance with Health Maintenance Maneuvers

Screening Maneuver	Romm & Fletcher 31 General Internists			Battista 430 Primary Care
	Patients age 30-39, percent	40-49,	50-59	Physicians percent
History and Counseling				
Alcohol	57	41	47	-
Smoking	72	56	61	-
Exercise	35	23	32	-
Diet	26	18	15	-
Breast Self-exam	-	-	-	96
Blood pressure	99	99	97	-
Breast exam (women)	85	77	78	99
Mammogram	-	-	-	8
Pap smear	68	64	59	91
Stool blood	-	18	21	15
Hearing	28	17	28	-
Chest X-ray (not recommended)	-	-	-	77
Sputum Cytology (not recommended)	-	-	-	41

This table points out several things. One is that when physicians are interviewed they probably over-estimate their compliance with recommendations compared to reviews of their chart. It's interesting to note that those procedures which are best documented in the literature are less likely to be carried out. The North Carolina charts were not even reviewed for mammography because the 31 physicians in general did not practice screening mammography in women over the age of 50 and certainly a minority of the Canadian physicians utilized this procedure. Immunizations every ten years for tetanus and adult diptheria were also not carried out regularly by either the North Carolina or the Canadian physicians.

Once the physician or health care professional is compliant with recommending screening procedures the next step is that the patient must be compliant with having the procedures carried out. As mentioned previously (76) patients' compliance with returning fecal smears for occult blood testing ranges from 15 to 80% with increased compliance in motivated groups. Individual recommendation and counseling from a health care professional tends to put patients in a group with higher compliance than distributing the testing cards to large groups. Compliance with referrals for screening mammography also has a wide range. In one study at a New York breast cancer screening center compliance rates varying from 7.6% to 92.5% (124). Those with the lowest compliance rate were asymptomatic women who had to pay for their own mammograms. If asymptomatic women were offered free mammograms their compliance rate increased to 39.4%. The highest group of

compliance has been in women who had symptoms and signs of breast disease and were not required to pay for the mammography. In the Breast Cancer Detection Demonstration Project (38) the compliance rate with all five yearly screening mammograms was slightly greater than 50%. Compliance with sigmoidoscopy in asymptomatic individuals is also widely variable and somewhat lower. The Kaiser multiphasic screening trial (17) had approximately 33% compliance with sigmoidoscopy which was recommended in all individuals over the age of 50.

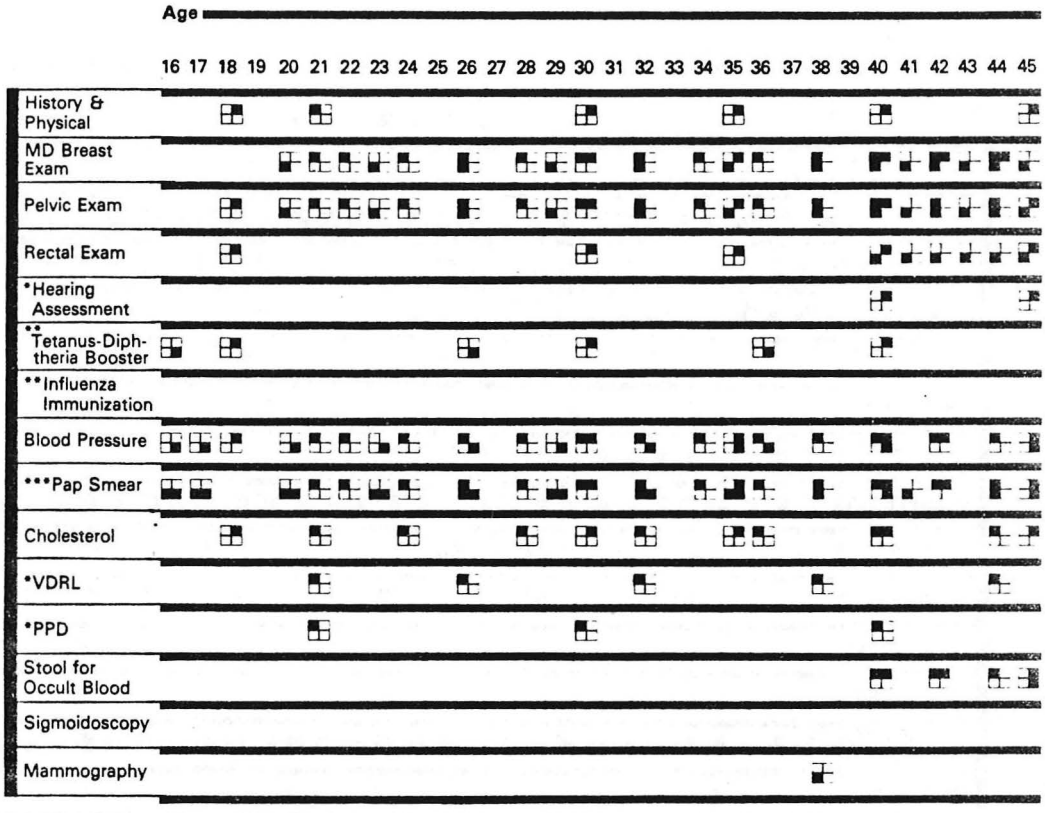
Further investigation in clinical settings must be done to determine which efforts are most likely to insure the highest compliance with screening procedures. Even if the likelihood of a patient complying with a procedure is relatively low, such as with sigmoidoscopy, I believe the procedure and the reasons for its recommendation must clearly be explained to the patient and they must be given every opportunity to decide to comply.

Summary

Recommendations for health maintenance exams for asymptomatic adults have been carefully reviewed over the past several years. Unfortunately good clinical studies to support various maneuvers have not yet been undertaken. However, certain minimal recommendations can be made based on the current literature. The bottom line is that each health care professional must look at his/her own patient population and determine which procedures would be the most efficacious. These procedures must then become a part of the routine care provided in that health care facility.

In general selected health maintenance procedures should be carried out every three to five years in adults age 20 to 39, every other year in adults age 40 to 50 and yearly thereafter. The Medical Practice Committee of the American College of Physicians (18) has graphically summarized the recommendations of the four recent expert groups concerning health screening for adults. These are the recommendations that have been reviewed in detail this morning. This graphic summary of the recommendations is presented on the following two pages for your reference in planning health maintenance examinations for your own patient population.

On the two last pages of this protocol I have outlined the minimal sceening procedures that I recommend for the Parkland General Medicine Clinic patients. This is the patient population with which I deal most frequently. Following this is an outline of the costs of these recommendations for a full pay patient at Parkland. The left hand column assumes the patient is only coming for health maintenance and includes a visit fee. The right hand column shows the add on costs of the heatlh maintenance maneuvers if a patient is visiting the clinic for some other reason.



Summary of recommendations of the four major studies. * = Canadian Task Force recommends that this be done on the basis of clinical judgment. ** = At first visit physician should check past immunization history per Centers for Disease Control recommendations for rubella, mumps, poliomyelitis, diphtheria/tetanus toxoids, pertussis. *** = If sexually active. A blackened square indicates that a study has considered the maneuver and recommended it. Squares left empty do not necessarily indicate that the study considered but did not recommend the maneuver.

F Frame and Carlson
B&S Breslow and Somers
ACS American Cancer Society
CTF Canadian Task Force on the Periodic Health Examination

Recommendations for Health Maintenance Examination
of Asymptomatic Patients in the Parkland
General Medicine Clinic

AGE 20-39

Males and Females
- Td immunization every 10 years.
- Every 5 years:
  - Blood pressure check.
  - Physical exam for cancer of oral cavity, thyroid, lymph nodes, skin, and testicles (males).
  - History and counseling on health risks.
  - PPD

Females
- Establish immunity to rubella
- Every 2 years:
  - Breast exam
  - Pap smear
  - Pelvic exam
- Teach and encourage monthly breast self exam.
- One baseline mammogram age 35-40.

AGE 40-59

Males and Females
- Td immunization every 10 years.
- PPD every 5 years.
- Every 2 years:
  - Blood pressure check
  - Physical exam for cancer of the oral cavity, thyroid, lymph nodes, skin, and testicles (males)
  - History and counseling on health risks
  - Rectal exam and stool guaiac
- Over age 50, sigmoidoscopy every 5 years.

Females
- Every 2 years:
  - Pap smears
  - Pelvic exam
- Yearly
  - Breast exam
  - Mammogram over age 50
- One mammogram 40-50 and 45-50

AGE 60+

Males and Females
- Td immunization every 10 years
- Pneumococcal vaccination no more than every 5 years.
- Influenza vaccine yearly.
- Every 5 years:
  Sigmoidoscopy
- Yearly
  Blood pressure check
  Physical exam for cancer of the oral cavity, thyroid, lymph nodes, skin and testicles (males)
  History and counseling on health risks
  Rectal exam and stool guaiac.

Females
- Every 3 years:
  Pap smear
- Yearly:
  Pelvic exam
  Breast exam
  Mammogram

Cost/Patient/Year

	Visit only for Health Maintenance	Visit for Other Reasons
1.	Age 20-39	
	Males - $13.70	Males - $1.70
	Females - $45.45	Females - $15.45
2.	Age 40-59	
	Males - $32.75	Males - $2.75
	Females - $104.00	Females - $74.00
3.	Age 60+	
	Males - $72.20	Males - $12.20
	Females - $192.00	Females - $132.00

Acknowledgement: I would like to thank Terrie Bernardini for her excellent assistance in the preparation of this Grand Rounds.

Bibliography

1. Shattuck L: Report of the Sanitary Commission of Massachusetts, 1850, Cambridge, Harvard University Press, reprinted p. 6, 1948.

2. Collen MF: Periodic health examainations: Why? What? When? How? Primary Care 3:197-203, 1976.

3. Dobell H: Lectures on the germs and vestiges of disease by periodic examinations. London, J&A Churchill, 1861.

4. Dodson JM: The American Medical Association and periodic health examinations. Amer J Publ Health 15:599, 1925.

5. American Medical Association: A manual of suggestions for the conduct of public health examinations of apparently healthy persons. Chicago, 1925.

6. Periodic Health Examinations: A manual for physicians, Chicago, American Medical Association, 1947.

7. Guiding Principles of Medical Examinations in Industry. Chicago, Department of Environmental, Public, and Occupational Health, American Medical Association, 1973.

8. Medical Evaluations of Healthy Persons. Chicago, Council of Scientific Affairs, Division of Scientific Activites, American Medical Association, JAMA 249:1626-1633, 1983.

9. Breslow L: Benefits and limitations of health monitoring. Amer J Med 67:919-920, 1979.

10. Breslow L: An historical review of multiphasic screening. Prev Med 2:177-196, 1973.

11. Vickery DM and Fries JF: Take care of yourself. Addison-Wesley Publishing Co., duc, 1975.

12. Rosser WW: Periodic health examination. Can Fam Phys 20:84, 1974.

13. Newell HP, Bass MJ, Dickie GL: An information system for family practice: Part 4: Encounter data and their uses. J Fam Pract 3:639,1976.

14. Marsland D, Wood M, Mayo F: A data bank for patient care, curriculum, and research in family practice: 526, 196 patient problems. J Fam Pract 3:25, 1976.

15. Rosser WW: Screening in family medicine: the current situation. J Fam Pract 6:503-509, 1978.

16. The value of periodic medical examinations. Metropolitan Life Ins. Co. Statistical Bull, 2:111-2, 1921.

17. Dales LG, Friedman GD and Collen MF: Evaluating periodic multiphasic health checkups: A controlled trial. J Chron Dis 32:385-404, 1979.

18. Peebles TC, Levine L, Eldred MC and Edsall G: Tetanus-toxoid emergency boosters: a reappraisal. NEJM 32:683-97, 1969.

19. Frame PS, Carlson SJ: A critical review of periodic health screening using specific screening criteria. Part I: Selected diseases of respiratory, cardiovascular, and central nervous systems. J Fam Pract 2:29-36, 123, 129, 189-194, 283-298, 1975.

20. Breslow L, Somers AR: The lifetime health-monitoring program: A practical approach to preventive medicine. NEJM 296:601-608, 1977.

21. The periodic health examination. Canadian Task Force on the Periodic Health Examination CMA J 121:1193-1254, 1979.

22. ACS report on the cancer-related health checkup. Cancer 30:194-240, 1980.

23. Howard RB: The annual checkup. Postgraduate Med 73:19-23, 1983.

24. Fletcher SW: Approach of the Canadian Task Force to the periodic health examination. Ann Int Med 92:253-254, 1980.

25. Ispen J, Jr: Immunization of adults against diphtheria and tetanus. NEJM 251:459-466, 1954.

26. Edsall G: Immunization of adults against diphtheria and tetanus. Am J Publ Health 42:393-399, 1952.

27. Press E: Desirability of routine use of tetanus toxoid. NEJM 239:50-56, 1948.

28. Schoenbaum SC, Hyde JN, Bartoshesky L and Crampton K: Benefit-cost analysis of rubella vaccination policy. NEJM 294:306-310, 1976.

29. Influenza Vaccines, 1983-1984. Morbidity Mortality Weekly Rep: ACIP Recommendation. 32:333-337, 1983.

30. Pneumococcal polysaccharide vaccine. Morbidity Mortality Weekly Rep 27:25-31, 1978.

31. Austrian R: Surveillance of pneumococcal infection for field trials of polyvalent pneumococcal vaccines, report DAB-VDP-12-84. Bethesda, MD, National Institutes of Health, 1980, p. 1-84.

32. Austrian RA: A reassessment of pneumococcal vaccine. NEJM 310:651-653, 1984.

33. Hirschmann VJ, Lipsky, BA: Pneumococcal vaccine in the United States. JAMA 246:1428-1432, 1981.

34. V.A. Cooperative Study Group on Antihypertensive agents. JAMA 213:1143-1152, 1970.

35. Five-year findings of the hypertension detection and follow-up protram. Hypertension Detection and Follow-up Program Cooperative Group. Division of Heart and Vascular Diseases, National Heart, Lung and Blood Institute, National Institutes of Health. JAMA 242:2562-2577, 1979.

36. Hypertension. Periodic Health Examination Monograph, Report of a Task Force to the Conference of Deputy Ministers of Health. Canadian Government Publishing Centre, 1980, p.53.

37. Shapiro S: Evidence on screening for breast cancer from a randomized trial. Cancer 39:2772-2782, 1977.

38. Baker LH: Breast cancer detection demonstration project: Five-year summary report. CA-A Cancer J Clinicians 32:194-225, 1982.

39. Howe GR, Sherman GJ, Semenciw RM and Miller AB: Estimated benefits and risks of screening for breast cancer. CMA J 124:399-403, 1981.

40. Goodman MJ, Gilbert FI, Grove JS, Catts A and Low G: Breast cancer screening in Hawaii 1974-1980: results of a six-year program. Hawaii Med J, 41:150-155, 1982.

41. Thomas BA, Price JL and Boulter PS: Breast cancer population screening by single view mammography with selective clinica examination - a pilot study. Clin Oncol 7:201-204, 1981.

42. Beahrs OH: Early detection of breast cancer: results of a screening programme. Early Carcinoma of the Breast, 38-40.

43. Bland KI, Buchanan JB, Mills DL, Kuhns JG, Moore C, Spratt JS, Polk HC: Analysis of breast cancer screening in women younger than 50 years. JAMA 245:1037-1042, 1981.

44. Tabar L and Gad A: Screening for breast cancer: the Swedish trial. Radiol 138:219-222, 1981.

45. Gohagan JK, Rodes ND, Blackwell CW, Darby WP, Farrell C, Herder T, Pearson DK, Spitznagel EL and Wallace MD: Individual and combined effectiveness of palpation, thermography, and mammography in breast cancer screening. Prev Med 9:713-721, 1980.

46. Milbrath JR, Moskowitz M, Bauermeister D: Breast cancer screening. CRC Crit Rev Diag Imaging 181-218, 1981.

47. Upton AC, Beebe GW, Brtown JM, et al.: Report of NCI ad hoc working group on the risks associated with mammography in mass screening for the detection of breast cancer. J Natl Cancer Inst 59:479, 1977.

48. Feig SA: Low-dose mammography. JAMA 242:2107-2109, 1979.

49. Moskowitz M: Screening for breast cancer: how effective are our tests? A critical review. CA-A Cancer J Clinicians 33:26-39, 1983.

50. Silverberg E: Cancer Statistics, 1984. CA-A Cancer J Clinicians 34:7-23, 1984.

51. Gallup Omnibus: A survey concerning cigarette smoking, health check-ups, cancer detection tests. The Gallup Organization Inc. GO 7695T, 1977.

52. Graham JB, Sotto LS, Paloncek FB: Carcinoma of the cervix. Philadelphia, WB Saunders Co, 1962.

53. Galvin GA, Jones HW Jr, TelLinde RW: Clinical relationship of carcinoma in situ and invasive carcinoma of the cervix. JAMA 149:744-748, 1952.

54. Davis H: Comment on DUB Ashley: the biologic status of carcinoma in situ of the uterine cervix. Obstet Gynecol Surv 22:176-177, 1967.

55. Burghardt E: Early histological diagnosis of cervical cancer. Phildelphia, WB Saunders Co., 1973, p. 263.

56. Peterson O: Precancerous changes of the cervical epithelium in relation to manifest cervical carcinoma. Acta Radiol Suppl 127, 1955.

57. Peterson O: Spontaneous course of cervical precancerous conditions. Am J Obstet Gynecol 72:1063-1071, 1956.

58. Richart RM, Barron BA: Screening stategies for cervical cancer and cervical intraepithelial neoplasia. Presented at the American Cancer Society National Conference on Cancer Prevention and Detection, Chicago, IL, April 17-19, 1980.

59. Dunn JE Jr, Martin PL: Morphogenesis of cervical cancer. Findings from San Diego County Cytology Registry. Cancer 20:1988-1906, 1967.

60. Kashigarian M, Dunn JE: The duration of intraepithelial and preclinical squamous cell carcinoma of the uterine cervix. Am J Epidemiol 92:211-222, 1970.

61. Galliher HP: Optimal screening strategy for cervical cancer. Presentation to the Workshop on Use of Models in Decision-making about Cancer Screening Programs, Michigan Cancer Foundation, August 3, 1977.

62. Albert A, Gertman P, Louis T: Screening for the early detection of cancer. I. The temporal natural history of a progressive disease state. Math Biosci 40:1-59, 1978a.

63. Albert A, Gertman P, Louis T, et al.: Screening for the early detection of cancer. II. The impact of screening on the natural history of the disease. Math Biosci 40:61-109, 1978b.

64. Fidler HK, Boyes DA, Worth AJ: Cervical cancer detection in British Columbia. J Obstet Gynaecol Br Comm 75:392-404, 1968.

65. Barnes BA and Barnes AB: Evaluation of surgical therapy by cost-benefit analysis. Surgery 82:21, 1977.

66. Barnes BA: Papanicolaou cervical smears for screening in asymptomatic women, Primary Care 8:131-140, 1981.

67. American College of Obstetricians and Gynecologists: ACOG report on cancer screening. ACOG Newsletter, 24:2, 1980.

68. Gunby P: Compromise reached on suggested intervals between pap tests. JAMA 244:1411-1413, 1980.

69. McKenna RJ: Applied cancer prevention in practice. Cancer 51:2430-2439, 1983.

70. Willett WC, MacMahon B: Diet and Cancer - an overview. NEJM 310:633-638, 697-703, 1984.

71. Zaridize D: Environmental etiology of large bowel cancer. JNCL 70(3):389, 1983.

72. Graham and Mettl: Diet and colon cancer. J Epidemiol 109(1):1, 1979.

73. Reddy, et al: Metabolic epidemiology of large bowel cancer. Fecal bulk and constituents of high risk North American and low risk Finnish populations. Cancer 45:2832, 1978.

74. Crumpacker EL and Baker JP: Proctosigmoidscopy in periodic health examinations. JAMA 178:1033-1035, 1961.

75. Hertz REL, Deddish MR and Day E: Value of periodic examination in detecting cancer of the rectum and colon. Postgrad Med 27:290-294, 1960.

76. Winawer SJ, Fleisher M, Baldwin M, Sherlock P: Current status of fecal occult blood testing in screening for colorectal cancer. CA-A Cancer J Clinicians 32:100-112, 1982.

77. Miller SF, Knight RA: The early detection of colorectal cancer. Cancer 40:945-949, 1977.

78. Glober GA and Peskoe SM: Outpatient screening for gastrointestinal lesions using guaiac - impregnated slides. Am J Dig Dis 19:339-403, 1974.

79. Gnauck R: Screening for colorectal cancer with the Hemoccult test. Leber Magen Daun 7:32-35, 1977.

80. Fruhmorgen P, Demling L: First results in a prospective field study with a modified guaiac test for evidence of occult blood in the stool. In: Early Detection of Colorectal Cancer, edited by K. Goerttler, Verlag DE, Wachkolz KG, Numberg.

81. Siba S: Experience with haemoccult screening in Hungary a multicenter trial. Hepato-gastroenterol 30:27-29, 1983.

82. Farrands PA, Griffiths RL, Britton DC: The frome experiment - value of screening for colorectal cancer. Lancet 1231-1232, 1981.

83. Kitchens L, Polter, L: personal communication.

84. Winawer SJ, Andrews M, Flehinger B, Sherlock P, Schottenfeld D and Miller DG: Progress report on controlled trial of fecal occult blood testing for the detection of colorectal neoplasia. Cancer 45:2959-2964, 1980.

85. Gilbertsen VA, McHugh R, Schuman L and Williams SE: The earlier detection of colorectal cancers. Cancer 45:2899-2901, 1980.

86. Rasgon IM: The importance of routine sigmoidoscopic examination in asymptomatic patients.

87. Browne DC and McHardy G: Evaluation of routine proctosigmoidoscopy. South M J 41:372-374, 1948.

88. Burnikel RH and Schutte AG: Adenomatous polyps of the rectum and distal sigmoid. Am J Surg SS: 378-383, 1954.

89. Cameron AR and Thabet RJ: Sigmoidoscopy as part of routine cancer clinic examinations with correlated fecal chemistry and colon cytologic studies. Surgery 48:344-350, 1960.

90. Christianonnon, HW and Tenner RJ: Results of sigmoidoscopic examination at a cancer detection center: a two-year study. Am J Surg 11:14-17, 1951.

91. Creek DW: The value of routine proctosigmoidoscopy. Am J Gastroenterol 32:357-359, 1959.

92. Enquist IF: The incidence and significance of polyps of the colon and rectum. Surgery 42:681-688, 1967.

93. Grant RN: Professional education in cancer. In Cancer Control, pp. 127-131. Ann Arbor: The University of Michigan, School of Public Health, 1962.

94. Knoernschild HE: Sigmoidoscopic examination. Routine use for patients in hospital. California Med 102:359-360, 1965.

95. Linn BS, et al: Value of routine proctoscopy. Geriatrics 18:877-878, 1963.

96. Mandel A: Routine sigmoidoscopy. G.P. 28:110-112, 1963.

97. Moertel CG: HIll JR and Dockerty MB: The routine proctoscopic examination: a second look. Mayo Clin Proc 41: 368-374, 1966.

98. Miller CJ, Day E and L'Esperance ES: Value of proctoscopy as routine examination in preventing deaths from cancer of large bowel. New York J Med 50:2023-2027, 1950.

99. Molofsky LC and Hayashi SJ: Proctosigmoidoscopy as a routine part of a miltiphasic program. Am M M Sc 235:628-631, 1958.

100. Ochsner A: Advances in surgery of the colon. Am J Surg SS:685-697, 1954.

101. Protes C and Majarakis JD: Proctosigmoidoscopy-incidence of polyps in 50,000 examinations. JAMA 163:411-413, 1957.

102. Shallenberger PL and Fisher P: Sigmoidoscopic examination: indications, technique and analysis of 4500 consecutive examinations. Gastroenterology 23:612-619, 1953.

103. Smith ET, Stephenson WH and Anderson RM: Value of routine proctosigmoidoscopy. West J Surg 63:628-630, 1955.

104. Steele JJ and Brown CH: Analysis of 1500 "routine" proctosigmoidoscopic examinations. Gastroenterology 12:419-424, 1949.

105. Shahon DB and Wangersteen OH: Early diagnosis of cancer of the gastrointestinal tract. Postgrad Med 27:306-311, 1960.

106. Wainawer SJ: Detection and diagnosis of colorectal cancer. Cancer 51:2519-2524, 1983.

107. Gilbertsen VA and Nelms JM: The prevention of invasive cancer of the rectum. Cancer 41:1137-1139, 1978.

108. Bolt RJ: Sigmoidoscopy in detection and diagnosis in the asymptomatic individual. Cancer 28:121-122, 1971.

109. Bohlman TW, Katon RM, Lipshutz GR: Fiberoptic pansigmoidoscopy. Gastoenterol 72:644, 1977.

110. Wherry DC: Screening for colorectal neoplasia in asymptomatic patients using flexible fiberoptic sigmoidoscopy. Dis Colon Rectum 24:521-522, 1981.

111. Lilienfeld A, Archer PG, Burnett CH, et al.: An evaluation of radiologic and cytologic screening for the early detection of lung

cancer: a cooperative pilot study of the American Cancer Society and the Veterans Administration. Cancer Res 26:2083-2121, 1966.

112. Nash FA, Morgan JM, Tomkins JG: Sough London Lung Cancer Study. Br Med J 2:715-721, 1968.

113. Brett CZ: Earlier diagnosis and survival in lung cancer. Br Med J 4:260-262, 1969.

114. Fontana RS, Sanderson DR, Woolner LB, et al.: The Mayo Lung Project for early detection and localization of bronchogenic carcinoma: a status report. Chest 67:511-522, 1975.

115. Stitik FB, Tockman MS: Radiographic screening in the early detection of lung cancer. Radiol Clin North Am 16:347-366, 1978.

116. Melamed M, Flehinger B, Miller D, et al.: Preliminary report of the lung cancer detection program in New York. Cancer 39:369-382, 1977.

117. Fontana RS: Something old, something new, and something borrowed - The American Cancer Society's report on the cancer-related health checkup. Mayo Clin Proceed 55:459-60, July 1980.

118. Breslow L: Risk factor intervention for health maintenance. Science 200:908-912, 1978.

119. Maccoby N, Farquhar JW, Wood PD, Alexander J: J Commun Health 3:100 (Winter 1977).

120. Stern MP, Farquhar JW, Maccoby N, Russell SH: Circulation 54:826, 1976.

121. Multiple Risk Factor Intervention Trial Research Group: Multiple risk factor intervention trial: risk factor changes and mortality results. JAMA 248:1465-1477, 1982.

122. Romm FJ, Fletcher SW and Hulka BS: The periodic health examination: comparison of recommendations and internists' performance. South Med J 74:265-271, 1981.

123. Battista RN: Adult cancer prevention in primary care: patterns of practice in Quebec. Am J Publ Hlth 73:1036-1039, 1983.

124. Lane DS and Fine HL: Compliance with mammography referrals. NY State J Med 173-176, 1983.