

Patient Education and Multiphasic Screening: It Can Change Behavior

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Two hundred ninety-two residents of Sonoma County, California, underwent multiphasic screening and two sessions of group patient education aimed at reducing risk factors for cardiovascular disease, cancer, and automobile accidents. Approximately one year later all the participants were re-tested. A significant reduction was noted in systolic blood pressure in men and women, ages 50 to 70, cholesterol in men over age 40, and reported alcohol consumption in men. A significant increase was noted in the reported frequency of monthly breast self-examination in women, and in the amount of exercise and percentage of time seat belts were used in both sexes. No change was noted in reported amount of cigarette smoking, weight, fasting blood glucose, and triglycerides. The combined use of health hazard appraisal, multiphasic screening, and patient education can lead to a reduction in cardiac and other risk factors in well-motivated groups.

The question of the value of multiphasic screening and preventive care is of current concern. Recent studies have shown that although numerous abnormalities are found in screening, in the long run very little is done that leads to a new treatment or results in a change in patient behavior.¹ Ischemic heart disease, hypertension, obesity, smoking, drinking, automobile accidents, and drug abuse are some of the major causes of mortality and morbidity in modern society. Their modification depends more on self-control, education, and familial and societal issues than on strictly technical and medical ones. Although great strides have been taken in diagnosis and control of hypertension, other diseases have not as easily lent themselves to community programs. Two recent articles describe community-wide screening pro-

grams—one without any change in risk factors one year after a brief educational program,² the other showing a reduction in self-related disability and mortality from potentially postponable causes of death in middle-aged men.^{3,4} This present study reports on a preventive medicine screening and educational program that has achieved success in the reduction of certain risk factors.

Methods

CommonHealth Club (CHC) was established as a membership controlled, low-cost, comprehensive educational and motivational system for individuals to assess their own health status. CHC is not affiliated directly with any medical group, hospital, or other health organization. It offers multiphasic screening coupled with health education to any adult in many northern California counties. Each participant first attends an introductory health education session before he/she receives any testing. Testing consists of a Health Hazard Appraisal, SMA-12 (cholesterol, calcium,

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Table 1. The Number of Male and Female Participants by Five-year Age Grouping at the First Testing.

		Male	Female	Total
Age of Participants	30-34	9	12	21
	35-39	12	17	29
	40-44	11	13	24
	45-49	9	25	34
	50-54	16	29	45
	55-59	16	29	45
	60-64	19	24	43
	65-69	14	18	32
	70-74	9	10	19
Total		115	177	292

blood-urea nitrogen, uric acid, and liver function tests), triglycerides, CBC, VDRL, complete urinalysis, screening pulmonary functions, electrocardiogram (with wallet size photocopy), PPD, Papanicolaou smear (if female), stool hemocults, weight, and blood pressure. Blood pressure is recorded between 7:00 AM and 8:00 AM at each testing, using the same equipment and the same personnel. Diastolic pressures are recorded as the fifth Korotkoff phase. Cholesterol is determined on morning blood sample following a 12-hour fast by the Liebermann-Burchardt colorimetric method. Triglyceride determinations are made by the lipase degradation enzymatic method following a 12-hour overnight fast. Blood glucose is measured after an overnight fast by the orthotoluidine colorimetric method. Women are instructed in breast self-examination at the time the Papanicolaou smear is taken. Test results are returned two to three weeks later to the individual at an evening group session conducted by a physician and a health educator. Participants must attend this session in order to receive their results, and at this time guidelines for interpreting the results are explained to them. All results are reviewed by a physician, and those with abnormalities are called by a nurse and encouraged to see a physician.

This paper compares the results of 292 residents of Sonoma County, California, all of whom went through this program for the first time in the fall of 1972 or early in 1973, and who then repeated testing approximately one year later. During this interval participants received a short monthly newsletter stressing preventive aspects of health. The

participants were self-selected in that over 90 percent were self-referred, the remainder being physician-referred. The same testing and laboratory procedures were used both times. Because some participants did not return or fully complete the questionnaire, the number of persons reported for exercise, alcohol consumption, cigarette smoking, and breast examinations is 20 to 40 percent less than the total number of participants. All participants had blood pressure, lipids, blood glucose, and weight measured at the two testings. There was no analysis made to see if there were any differences in the group which completed the questionnaire at both testings and the group which did not do so. Participants were not aware that their cumulative data from the two testings was compared. The primary motivation for many participants seemed to be low cost blood screening.

Results

The population tested consisted of 115 men and 177 women. The age distribution is shown in Table 1, ranging from age 30 to 74. The average age of participants was 53 years. This compares to an average age of 31 years in Santa Rosa, California. It is a primarily white, middle-class population. The greatest number of participants were in the 50 to 60-year age group. Although the older group may not be the most appropriate age group to change habits for a long-range reduction in mortality, the increased incidence of cardiac risk factors (such as hypertension, smoking, and hyperlipidemia) and carcinoma of the bowel, lung, and female organs makes this a well-motivated and at-risk population.

Blood Pressure

Table 2 shows average male systolic blood pressure at each five-year age interval; Table 3 shows the female average. The average systolic blood pressure curves from ages 50 to 70, comparing first and second testing results for both males and females, are different at the .10 level of significance (Kolmogorov-Smirnov two-sample test). The continued rise of systolic blood pressure with age is well demonstrated with both groups.

The magnitude of the diastolic blood pressure decrease between the two testings is somewhat less, but also present. The average systolic and diastolic pressures of each age group are within the usually accepted range of normal.

Cholesterol

Cholesterol showed a steady increase with age. This was more striking in females. Above age 55 women had a higher average cholesterol on both testings than men. In the 65 to 74-year age group women averaged 50 mg/100 ml higher. The average cholesterol levels in males at both testings is shown in Table 4. There was an average decrease in cholesterol in men in the 40 to 74-year age group on the second testing of 5.6 percent that was found to be significant at the .025 level (Kolmogorov-Smirnov two-sample test). The reasons for this are not clear, but perhaps relate to exercise and diet, although weight did not change in this age group (see Discussion). Cholesterol in women had not changed significantly at the second testing.

Triglycerides

Triglyceride values did not significantly change over the one-year interval between testings. However, the distribution is interesting. The triglyceride levels for men are highest in the 35 to 50-year age group, but in women the levels are highest above age 65. This observation was also noted in another California population by Wood et al,⁵ who feel this is consistent with the hypothesis that male predominance in coronary disease could be related to higher triglyceride concentrations during the younger years when atherosclerosis is developing.

Fasting Blood Glucose

No significant change was noted in the blood glucose measurements of either sex between the first and second testings.

Exercise

Exercise was subjectively reported using the following guidelines:

Sedentary: Under five flights of stairs or half mile walking and/or comparable daily activity.

Some: Between 5 and 15 flights of stairs or 0.5 to 1.5 miles walking daily or comparable activity.

Table 2. A Comparison of the Average Systolic Blood Pressure of Male Participants at Two Testings, Approximately One Year Apart.

		Testings	
		1st	2nd
Age of Participants	30-34	128	133
	35-39	125	112
	40-44	127	117
	45-49	138	128
	50-54	132	126
	55-59	138	131
	60-64	135	128
	65-69	144	133
70-74	158	147	

Moderate: Programmed exercise four times per week in which activity equals 1.5 to 2 miles of walking or 15 to 20 flights of stairs or comparable activity.

Vigorous: Greater than moderate.

Table 5 shows the number of males and females of each age group reporting their amount of exercise at each testing. Both sexes were found to have an increase in reported exercise at the second testing. This was found to be significant at the .01 level (Chi-square test). The increase is predominantly in the moderate category—37 participants reported moderate exercise in the first testing, 72 in the second testing. This held for all age groups. Correspondingly, there was a decrease of 12 people leading sedentary lives, and a decrease of 16 reporting some exercise.

Alcohol

Drinking behavior was subjectively reported by the participants using the following scale:

Nondrinker: No recent or regular consumption of alcohol.

Infrequent or Occasional Social: One to six drinks per week.

Heavy Social: Seven to 24 drinks per week.

Heavy-High Risk: More than 25 drinks per week.

Table 3. A Comparison of the Average Systolic Blood Pressure of Female Participants at Two Testings, Approximately One Year Apart.

		Testings	
		1st	2nd
Age of Participants	30-34	112	112
	35-39	113	115
	40-44	118	114
	45-49	130	130
	50-54	130	125
	55-59	133	125
	60-64	143	128
	65-69	148	138
	70-74	147	145

A decrease in the amount of heavy social drinking was noted in males (Table 6). This was determined to be significant at the .01 level (Chi-square test). This was mainly due to a reduction in reported alcohol consumption in the over-50 age group. Although 15 percent of the men reported themselves to be nondrinkers, 37 percent of women said they were nondrinkers on the first testing. Additionally, fewer women reported infrequent or occasional social drinking on the second testing than on the first, bringing the percentage of nondrinkers in women to 42 percent on the second testing.

Smoking

The number of packs of cigarettes smoked per day was asked of the participants at each testing (Table 7). A high percentage of the participants were nonsmokers, 85 percent of women and 78 percent of men. The number of smokers may be low in this group for two reasons: the greater numbers of people in the older age groups who smoke less, and the fact that this tested group may be concerned about their health, with many ex-smokers in the nonsmoking group. In any case, it is striking that no change in smoking behavior is noted.

Breast Examination

Women were asked whether they had breast examinations—both yearly by a physician and at monthly intervals by themselves. The data are presented in Table 8. The number of women reporting yearly breast examinations by a physician decreased by 11 percent but, more noticeably, the number reporting monthly self-examinations increased from 53 percent to 78 percent. This is significant at the .001 level (Z-test for proportions). In the important 50 to 74-year age group, only 46 percent reported breast self-examinations initially; a year later 72 percent indicated they were examining themselves.

Seat Belt Use

The wearing of seat belts is almost totally effective in preventing automobile deaths in accidents under 60 miles per hour. Participants were asked to estimate the percentage of time they wore seat belts either as a driver or a passenger. The results are noted in Table 9. A relatively high percentage of the participants were seat belt users—on the average indicating they used seat belts 55 percent of the time. This increased to approximately 70 percent on questioning a year later. This is significant at the .01 level (Kolmogorov-Smirnov two-sample test). There is relatively little variation with age, but men wore seat belts slightly less often than women.

Weight

A high percentage of Sonoma County residents were overweight as defined by the percent overweight compared to the medium-frame weight tables of the Metropolitan Life Insurance Company. Males and females averaged approximately 15 percent overweight. There is a slight increase in percent overweight with age. The females of most

age groups had a slightly lower weight on the second testing. The data are shown in Table 10. This was not a significant change. Males had no change in weight over the year's period.

Discussion

Any preventive medicine program must aim for reduction of the major risk factors for coronary artery disease—smoking, blood pressure, and cholesterol. This study found that a modest amount of health education combined with health hazard appraisal and “standard” multiphasic screening seems to have a small but definite effect on systolic blood pressure in both sexes in the 50 to 70-year age group, and cholesterol level in men in the 40 to 70-year age group. No effect was noted on smoking or cholesterol level in women. The reduction in blood pressure at the second-year testing could be accounted for by the following factors: (1) previously known or unknown hypertensives being found to be uncontrolled and referred for more appropriate treatment, (2) improved compliance in previously known hypertensives, or (3) change in living style (with an increase in exercise).

Of other risk factors, no change was noted in triglycerides, blood glucose, or weight in either sex. Changes in behavior or living style, although encouraged in the education program, were not examined.

In this study a significant increase in the reported exercise in both sexes was noted. Morris et al⁶ found that middle-aged men who reported weekend vigorous exercise had one third the relative risk of developing coronary disease as comparable men who did not. Paffenberger and Hale⁷ found that longshoremen who worked in high activity jobs had a significantly lower coronary death rate. Cooper⁸ has noted that the level of physical fitness by treadmill testing correlated inversely with body weight, systolic blood pressure, and serum levels of cholesterol, triglycerides, and glucose. The increase in reported exercise may be the final common pathway to explain the noted reduction in systolic blood pressure and cholesterol. Increasing the level of exercise through health education may, then, be an effective way to reduce major coronary risk factors.

Table 4. Average Cholesterol Levels in mg/100 ml at Both Testings in Males

		Testings	
		1st	2nd
Age of Participants	30-34	212	233
	35-39	235	256
	40-44	235	221
	45-49	233	232
	50-54	253	243
	55-59	241	238
	60-64	249	245
	65-69	255	221
	70-74	268	225

Of the other major causes of mortality, a reduction in risk for automobile accidents was found because of two variables—a significant reduction in alcohol consumption in those men classified as heavy social drinkers and an increase in seat belt use for both sexes. As far as the authors are aware, this is the first report of reduction of risk factors for motor vehicle mortality through the use of a “medical model” of screening and health education.

Lastly, a significant increase in the number of women reporting monthly breast self-examination was noted. Of all cancers in women, breast cancer is the leading cause of death. It is stated that self-examination is the way 90 percent of breast malignancies are detected.⁹ Although breast cancers are missed by self-examination, especially in women with large or nodular breasts, self-examination is recommended as an appropriate and inexpensive method to improve survival from breast cancer.

It is important to note that these results apply to a specific subset of the population who are: (1) well motivated—the tested population was to a great extent self-selected and had to pay a fee of \$25 for each testing; and (2) older than the general population. This offers an advantage in that they would have a higher incidence of most risk factors. It is not known that the long-term effect of a reduction in some cardiac risk factors such as blood lipids, in the middle and elderly age groups is worthwhile. However, there is agreement that

Table 5. Number of Participants, by Sex, Reporting Amount of Exercise at Each Testing.

	Sedentary		Some Testings		Moderate		Vigorous	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Males	17	12	23	19	16	30	16	11
Females	39	32	40	28	21	42	17	15

Table 6. Number of Men Participants Grouped by Their Reported Amount of Alcohol Consumption at the First and Second Testing.

	Non-Drinker		Infrequent Moderate and Occasional Social Testings		Heavy Social Increased Risk		Heavy Social High Risk	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Total	12	15	29	36	36	26	2	2

a reduction in incidence of or mortality from carcinoma of lung, bowel, breast, and cervix; stroke; hypertensive cardiovascular disease; cirrhosis of the liver; complications of diabetes mellitus; and, deaths due to automobile accidents can be accomplished through appropriate testing or control of risk factors at all ages.²

A major concern is that of the six items in which a significant change was noted, four are subjective and are self-reported. Unfortunately, there was no other way to get most of these data. Participants came voluntarily, and all were encouraged to fill out the health data accurately and with the knowledge that the information would be kept confidential. There was no advantage to a person being dishonest in his or her reporting except to achieve a slightly lower Health Hazard Appraisal age or to continue a denial process instead of coming to grips with the behavior. The answers from year to year are relatively consistent for many reported variables. For instance, no change was noted in smoking behavior. If any area would show a self-reported bias due to publicity, knowledge, or self-blame, without a change in real behavior, one would suspect it would show up here.

Aronow et al² reported recently on a similar but larger program in Long Beach, California, in which no reduction in coronary risk factors was found one year after earlier testing and education. However, there are some readily identifiable differences from the present study. First and foremost, the Long Beach educational program consisted almost entirely of mailing American Heart Association pamphlets to the participants. A lecture on reduction of cardiac risk factors was attended by less than nine percent in the educational group. Additionally, the Health Hazard Appraisal was not included. On the other hand, the CommonHealth Club educational program had essentially 100 percent acceptance for a participant had to go to the two sessions to get the results, and the results were given directly to the participants. Follow-up of abnormal blood pressure, blood lipids, and other laboratory tests was encouraged through additional telephone calls.

The major work in the evaluation of the multiphasic screening was carried out by the Kaiser-Permanente Medical Group in Oakland, California.^{3,4} The Oakland group compared their experience over a seven-year period with over

Table 7. Numbers of Male and Female Participants Grouped by Reported Packs of Cigarettes Smoked Per Day at Each Testing.

	Nonsmoker		0-1 Pack Per Day Testings		More Than 1 Pack Per Day	
	1st	2nd	1st	2nd	1st	2nd
	Males	71	73	6	5	14
Females	109	110	6	8	15	12

Table 8. Numbers of Women and Percentages Reporting Monthly Breast Self-Examination and Yearly Examination by a Physician at Each Testing. (The Total Number of Women Responding is less than the Number of Female Participants.)

	Yearly Palpation By Physician Testings				Monthly Self-Examination Of Breast Testings			
	1st		2nd		1st		2nd	
	no	yes	no	yes	no	yes	no	yes
Total	26	60	35	51	38	43	18	63
%yes	70		59		53		78	

5,000 enrollees in the Kaiser Health Plan who received annual multiphasic health checkups with a control group of equal size who did not receive the checkups. They found a favorable impact on health in the group of men 45 to 54 years of age. The mortality rate from causes of death that were defined as potentially preventable was significantly less than in the control group. They also found lower disability rates in the middle-aged, screened men, and concluded that there was an \$800 per man net cost saving over the seven-year period in these men. Similar savings were not noted for women or younger men. The most notable results in the present study were also in middle-aged men, ie, a significant reduction in cholesterol, systolic blood pressure, and alcohol consumption, and a significant increase in reported exercise.

Other studies have not found multiphasic screening to be of much benefit. Olsen et al¹ examined the long-term (13 months) outcomes on health

facility utilization, morbidity, health status, and attitudes, and found no difference between screened and control groups. Bates and Yellin¹¹ found that only about 20 percent of the screened population ended up with a new medical management. In these studies the results were sent to the participant's physician and the participant was urged to see his doctor. No other education was undertaken. Physician and patient indifference to the results is a problem reported by the above authors. Thus, in most instances, general population multiphasic screening (usually involving a computerized medical history print-out and common laboratory tests) is productive, can be of relatively low cost, but results in few new medical managements and in little long-term measurable change.^{12,13}

For multiphasic screening to be of benefit in changing risk factors it needs to be combined with an effective patient education program. In order to

Table 9. Averaged Estimate of Percent of Time Participants Wore Seat Belts, by 5-Year Age Groups, at Each Testing. No Figures are Reported for the 65-74 Age Groups as Many Participants in These Groups do not Drive.

		Testings	
		1st	2nd
Age of Participants	30-34	62	90
	35-39	58	76
	40-44	61	63
	45-49	47	67
	50-54	64	75
	55-59	41	68
	60-64	63	97
	65-69		
70-74			

be effective a program should have the following attributes:

1. Despite the fact that patient motivation is the bane of many practitioners and probably one of the most understudied variables in medicine, a program is going to be more successful when the participants have a desire to improve their health and change their own behavior. Screening and education may provide or ignite this in additional participants.

2. Screening should be combined with the Health Hazard Appraisal or other risk analysis to emphasize for what diseases the participant is at risk, and what he can do to prevent them.

3. As one of the key factors for success, the results of testing should be given to the participants with adequate explanation, thus emphasizing the responsibility the participant has for his own health. Sending the results to physicians implies that the physician has the responsibility.

4. The educational program itself can be accomplished in a variety of ways. CommonHealth Club found group discussion with a health-care professional, including opportunities to ask questions, more helpful than a lecture format. Many other techniques have been tried, and many of these look promising and need further study.

Meyer and Henderson have compared the effectiveness of behavior modification with other educational methods in reducing cardiovascular risk factors.¹⁴ They found that behavior modification produced greater changes in health habits and these improvements were more lasting. Individual counseling over nine sessions by a health educator was less effective but superior to a single short session with a physician. Unfortunately, the number of participants was small and the time spent with the participants was much greater with behavior modification. Gotto et al¹⁵ recently described success in lowering plasma triglycerides with relatively extensive dietary counseling by a physician and a dietician. Garfield¹⁶ describes using a nurse practitioner for health education in an ambulatory medical care facility to promote patient independence and decrease medical facility utilization. Stanford University Heart Disease Prevention Program has reported preliminary success with mass media programs (radio and television announcements, newspaper columns and advertisements, billboards, and direct mailings), combined with individual counseling to reduce coronary disease risk factors in two California towns.¹⁷ Whatever the most effective educational tool, and it is likely to be different for different

Table 10. Average Percent Overweight of Female Participants at Each Testing, by 5-Year Age Groups.

		Testings	
		1st	2nd
Age of Participants	30-34	10	7
	35-39	4	7
	40-44	21	10
	45-49	15	13
	50-54	10	9
	55-59	19	12
	60-64	30	27
	65-69	16	13
	70-74	18	18

populations or diseases, it will probably involve more than individual physician office visits, for the physician is a costly teacher and tutor. While the physician must play a special role in helping the individual patient apply knowledge to a specific disease situation, the physician should be supplied with some assistance to promote better communication of information to the patient and to lower the labor cost.

This combining of interdisciplinary multiphasic screening and health education is one way to provide a feedback loop to make both processes more effective.

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