Interrelationship of Preventive Actions in Health and Other Areas

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PREVENTIVE health behavior is defined by Kasl and Cobb as "any activity undertaken by a person believing himself to be healthy, for the purpose of preventing disease or detecting it in an asymptomatic stage" (*1*). Increased emphasis is being placed on preventive behavior in the health care delivery system. Indeed, prevention is a key element in health maintenance organizations, which are based on a prepaid annual fee and therefore benefit from keeping people well. However, preventive behavior is voluntary. A person can be encouraged to take the appropriate action, but he does or does not do so on the basis of his own decision. Past studies have indicated that the level of preventive health behavior is quite low, with many people not taking the opportunity to perform actions which can prevent disease or detect it early (*2*). Thus, there is a need to learn why some people behave preventively and to use this knowledge to influence others to do so.

Currently there is no adequate explanation of why people behave preventively. The major theory of preventive behavior is based on health beliefs, but the empirical evidence supporting this theory is moderate and is often difficult to interpret because of retrospective designs or other drawbacks (*3–5*). Nevertheless, health beliefs, basic personality characteristics, and social status factors are likely to be involved in taking preventive actions; an important task is to sort out the contribution of these and other factors. To develop an explanation of preventive behavior, it is also necessary to uncover factors which are associated with a wide variety of preventive actions. A characteristic of previous studies of the motivation for preventive behavior is that they have dealt with single actions, although the intent is to explain preventive behavior in general.

An important step toward understanding the dynamics of preventive behavior is determining how the various actions are interrelated. For example, if preventive behaviors are unidimensional, all intercorrelated at a high level, their explanation may lie in factors, such as socioeconomic status or personality traits, which are constant within the same person. Indeed, in studies which attempt to explain preventive behavior in terms of personality or social status, investigators implicitly assume that the behaviors are unidimensional. If behaviors are unidimensional, the explanation for any one behavior should explain preventive behavior in general. If the behaviors are related moderately or not at all, attention can be given to factors such as beliefs about illness which can vary within the same person from disease to disease, and efforts can be made to isolate factors which account for a wide variety of preventive actions. If preventive behavior consists of several statistically independent dimensions, examination of these dimensions is likely to lead to hypotheses as to why the behaviors are patterned in these ways. Different theories may be needed to account for the various dimensions.

Knowledge of why preventive behavior does or does not occur can be applied in health education programs, although such programs can also benefit from knowledge about the interrelationships alone. If the behaviors are not unidimensional, we will learn which behaviors go together and which do not; which behaviors, if any, go with many of

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the other behaviors and indicate a preventive orientation, and which are solo actions unrelated to others; and whether or not all preventive actions related to the same disease go together or are performed by different people. This information can aid in identifying populations in need of health education programs, and it may indicate which behaviors should be treated together in such programs as well as the treatment techniques to be used.

The empirical information on how preventive behaviors are related is limited, being based on only some possible behaviors. It indicates that preventive health behaviors tend to be interrelated at statistically significant levels, but the magnitude of the relationships is not large. For example, Haefner and co-workers (*2*) examined behavioral consistency in relation to toothbrushing practices, medical and dental checkups, and screening tests for tuberculosis. They concluded that these behaviors were interrelated, but only moderately.

Green (*6*) reported moderate relationships among the variables of children's diphtheria, pertussis, and tetanus immunizations; children's poliomyelitis immunizations; children's smallpox vaccinations; well-baby care; mothers' prenatal care; mothers' preventive dental care; mothers' poliomyelitis immunizations, mothers' possession of a fever thermometer; and mothers' possession of medical books. He concluded, "The assumption of unidimensionality of preventive health behaviors does not hold. Although the various measures or criteria of preventive health behavior are relatively collinear, there is enough unique variance in each to warrant a separate analysis of the relationships between socioeconomic status and each of the different forms of preventive health behavior."

There are, to be sure, considerations which suggest that preventive behaviors are not unidimensional. For example, preventive behaviors differ in significant ways. The basic way in which they can differ, reflected in the definition of the concept, is that some of the actions prevent disease from occurring (primary prevention), while others are designed to determine if one has the disease in an early stage (secondary prevention). In the first instance, the person is actively attempting to avoid contracting the disease; in the second, he is confronting the possibility that he may have the disease. The dynamics of these two types of behavior and the people who perform them may be fundamentally different.

Preventive behaviors can differ in other ways as well. Some behaviors require daily repetition (toothbrushing), others are of a sporadic nature (checkups), and still others are one-time-only behaviors (immunizations). Health actions also differ in terms of convenience or effort involved—the time they take, availability, cost, discomfort, and travel factors. Since preventive behaviors can differ in all these ways and many more, it cannot simply be assumed that those who take one action will take others. These differences among preventive behaviors suggest that there may be several dimensions of preventive behavior. If so, the patterns of behavior may be interpretable in terms of some of the systems of categorization mentioned earlier.

The concept of prevention need not be restricted to health. That is, preventive behavior requires some action now—which may entail minor effort or discomfort or inconvenience—in order to avoid a more major negative consequence later. With this definition, the concept of prevention can be extended to accidents (use of seat belts), financial loss (insurance), loss of property (locking car doors), and loss of time (calling to confirm appointments). We must also consider risk-taking behaviors which apply to health (smoking) and to hazardous avocations, such as parachuting, motorcycling, ski-mobiling, and mountain climbing. In short, the question is whether or not there is a general trait of prevention that includes health behaviors.

The two studies described here were undertaken to determine systematically the extent to which a broad range of preventive behaviors are interrelated, to discover whether a general preventive syndrome exists which includes health behaviors, and, if not, to determine which behaviors are related and which are not and whether there are several independent dimensions of preventive behaviors.

Methods

In the first study (study A), a telephone survey was conducted on a sample of 182 women aged 35–54 years who reside in a suburb of Boston. A random sample of names, representing 20 percent of all the women in this age group, was drawn from the town directory. Telephone numbers were available for 172 women. They were sent a preliminary letter stating that the Medical Foundation was attempting to determine levels of health practices in the population and that this information was to be used eventually in designing health edu-

cation programs for residents of Massachusetts. Telephone calls were made 2 or 3 days after the letters were mailed.

The 10 women for whom telephone numbers could not be obtained were sent a letter explaining the study, a questionnaire, and a stamped return envelope. If they did not respond within 10 days, a second questionnaire was mailed. This procedure was also carried out for any of the 172 women who could not be reached or who refused to answer questions by telephone.

The interview schedule contained 27 questions related to preventive behavior; it was designed to include a sampling of all types of such behavior. The items were separated as follows according to whether they were primary or secondary prevention in areas of disease, accidents, or loss of property or money.

Actions which reduce susceptibility to disease: self-rated adequacy of sleep during the past week; ever had shots or oral vaccine for poliomyelitis; number of days formal exercise was undertaken during past month; extent of physical activity during course of an ordinary day; frequency of limiting calories for weight control; number of times brushed teeth after meals on previous day.

Actions which increase susceptibility to disease: obesity; smoking more than 10 cigarettes daily.

Actions which reduce seriousness of disease: tuberculosis test on regular basis; Papanicolaou test on regular basis; medical checkup on regular basis, even when feeling all right; regular dental checkup, even when teeth not bothering. (Medical and dental checkups could also be categorized under actions which reduce susceptibility to disease.)

Actions which reduce susceptibility to accidents: frequency of signaling for turns when driving a car; frequency of keeping safe distance from car in front of you when driving.

Actions which increase susceptibility to accidents: general risk-taking (number of chances taken compared with others); frequency of driving after drinking; frequency of speeding.

Actions which reduce seriousness of accidents: frequency of seat belt use; possession of fire extinguisher in house; possession of fire extinguisher in car; having flares in car; having handy list of emergency telephone numbers; having good knowledge of first-aid techniques.

Actions which reduce susceptibility to financial loss, loss of property, or other eventualities: possession of a will; having a safe place for important papers; frequency of taking along rain apparel (umbrella, rubbers, rainhat) when there is a chance of rain; frequency of locking car door.

The data were analyzed originally by means of Pearson correlations. All coded information was used in computing these correlations. For example, the responses "never," "once in a while," "often," "almost always" were scored on a 1 to 4 scale. The exception to the rule of using all information was in the obesity index, where height and weight values were converted to Ponderal index scores (7), and those scoring above 12.3 were classified as obese. In this scheme, women are considered obese if they are 5 feet 2 inches and weigh more than 128 pounds, 5 feet 5 inches and more than 148 pounds, or 5 feet 8 inches and more than 169 pounds. Unfortunately, for women there is no information, such as for men, concerning at what point mortality begins to increase in relation to Ponderal index scores.

Factor analysis was also used to determine if and how preventive behaviors are interrelated. The first factor from a principal components analysis bears directly on the unidimensionality question. If all the variables load highly on this factor and a sizable proportion of total test variance is explained, it can be concluded that there is a general trait of prevention. Subsequently, factors

Table 1. Percentages of people in three samples who performed preventive actions

Preventive action	Study A women	Study B	
		Women	Men
Signal for turns when driving	99.3	.....	.....
Keep safe distance when driving	96.5	.....	.....
Safe place for important papers	95.7	.....	.....
Handy list of emergency telephone numbers	86.3	.....	.....
Brush teeth after at least one meal	75.7	56.8	31.0
Not obese	74.4	.....	73.2
Poliomyelitis immunization	74.2	.....	.....
Adequate sleep	73.8	.....	72.6
Dental checkup every 6 months	67.8	41.0	34.9
Knowledge of first aid	67.7	.....	.....
Papanicolaou test yearly	67.1	48.5	.....
Never drink and drive	65.5	.....	.....
Medical checkup yearly	61.7	51.3	35.0
Do not smoke	57.5	75.8	66.3
Take few chances	52.3	43.1	39.3
Have a legal will	51.9	.....	.....
Carry rain apparel	45.9	.....	.....
Physically active	44.3	.....	.....
Limit calories	44.3	.....	32.6
Lock car	42.8	.....	.....
Fire extinguisher in home	41.6	.....	.....
Never speed when driving	39.3	.....	.....
Have flares in car	37.0	.....	.....
Tuberculosis test every 2 or 3 years	33.1	.....	.....
Exercise	29.3	.....	37.5
Use seat belts	29.3	17.8	23.0
Fire extinguisher in car	11.6	.....	.....
Limit cholesterol intake	.....	.....	31.4

NOTE: Leaders indicate that percentages were not available.

were rotated by the Varimax method to allow further interpretation of any existing patterns of behavior.

In study B, questionnaires were mailed to mothers and fathers of ninth grade students at a high school in a suburb of Boston. The students had completed questionnaires focusing on dental health, and parents received questionnaires concerning various kinds of preventive health behavior. The mother's questionnaire covered the following preventive behaviors also included in study A: regular dental checkup, toothbrushing, regular medical checkup, smoking, regular Papanicolaou test, use of seat belts, and general risk-taking. Scoring and analysis of these items were handled the same way as in the first study.

For men, information was collected on all variables except "Pap" tests, plus some others included in study A: sleep, exercise, limiting calories, and obesity. For obesity, a 12.1 Ponderal index cutoff was used, corresponding to the point on the index at which mortality tends to increase sharply (7). One other variable, cholesterol control, was also included. Again, Pearson correlations were used, based on all coded information. In addition, a principal components factor analysis was carried out on nine of these variables, concentrating on health behaviors related to heart disease.

Results

In study A, 161 of the 179 eligible members of the sample responded, for a response rate of 90 percent. There were 149 responses by telephone and 12 by mail. Three persons of the original sample of 182 had moved out of town. In study B, responses were received from 240 of the 367 mothers (65 percent) and from 193 of the 319 fathers (60 percent). The ages of mothers ranged from 33 to 61, with a mean of 43.2; for fathers the ages ranged from 35 to 67, with a mean of 47.

Level of preventive behavior. Information on the level of preventive behavior in the three samples is presented in table 1. In table 1 and in later analyses, those who had had cancer were eliminated from questions on medical checkup, smoking, and Papanicolaou test on the assumption that for these people the behaviors listed are not so voluntary anymore. Similarly, those with a history of heart disease were excluded from the questions on medical checkup, exercise, limiting calories and cholesterol, obesity, and smoking. Those with no teeth were excluded from questions on toothbrushing and dental checkups. Those who had had tuberculosis, or who were required to have tuberculosis tests, were excluded from the question on tuberculosis tests. Those who said they were underweight were eliminated from the question about limiting calories. Only a few people were in any of these categories.

The criteria for deciding what constituted preventive behavior were set on an arbitrary basis in some instances, although public health guidelines were used whenever possible. The study A population showed the highest level of preventive behavior, and women in both samples showed a higher level of performance than men (table 1). Preventive behaviors reported infrequently in two samples were use of seat belts and exercise. Men, but not women, reported low levels of toothbrushing, medical and dental checkups, and limiting calories, and they were also low on cholesterol control. Tuberculosis tests, included only among study A women, were also performed infrequently.

Trait of prevention. Evidence regarding the question of whether there is a trait of prevention was examined in both studies. The first factor from the principal components analysis in study A accounted for 12.9 percent of the variance in the 22 variables included. (Of the original 27 variables, five were eliminated because almost everyone did or did not carry out the particular behavior. These included having a safe place for important papers, having a handy list of emergency telephone numbers, having a fire extinguisher in the car, signaling for turns, and keeping a safe distance from other cars when driving.) Eight of the items had loadings of 0.44 or more in the predicted direction, but 11 had loadings of less than 0.30, and three (speeding, chances, drive after drinking) had small loadings in the opposite direction, as shown in the following list.

Variable	*Factor loading*
Papanicolaou test	+.67
Medical checkup	+.60
Limit calories	+.58
Dental checkup	+.55
Seat belt usage	+.49
Exercise	+.46
Tuberculosis test	+.45
Have a legal will	+.27
Sleep	+.26
Toothbrushing	+.26
Physical activity	+.25
First-aid knowledge	+.24
Poliomyelitis immunization	+.22
Fire extinguisher in house	+.21
Lock car	+.19
Flares in car	+.12

Variable	*Factor loading*
Exceed speed limit	+.11
Rain apparel	+.06
Chances	+.04
Drive after drinking	+.00
Smoking	−.24
Obesity	−.44

The first factor from the principal components analysis performed on men in study B accounted for 24 percent of the variance of the nine variables. Six of the nine variables had loadings of +.40 or better on this factor, and all loaded in the predicted direction, as shown:

Variable	*Factor loading*
Cholesterol	+.67
Limit calories	+.64
Exercise	+.59
Seat belt usage	+.57
Dental checkup	+.45
Sleep	+.40
Medical checkup	+.22
Obesity	−.28
Smoking	−.38

Dimensions of preventive behavior. Since the behaviors in neither study were unidimensional, the factors were rotated to determine if there are interpretable patterns of prevention. The first five factors resulting from rotation in study A are presented as follows:

Factor 1	
Papanicolaou test	+.85
Medical checkup	+.84
Dental checkup	+.40
Factor 2	
Exercise	+.79
Limit calories	+.63
Tuberculosis test	+.62
Factor 3	
Rain apparel	+.65
Seat belts	+.62
First-aid knowledge	+.50
Lock car	+.48
Sleep	+.42
Factor 4	
Have a legal will	+.68
Fire extinguisher	+.67
Factor 5	
Risk taking	+.81
Speeding	+.79

A correlation of ±.40 was set as the criterion for inclusion of a variable.

Two of these factors are readily interpretable. Factor 1 is a checkup factor, and factor 5 indicates risk taking. Factor scores based on the variables with high loadings were computed for each variable and were interrelated. Checkup factor 1 was positively associated (+.39, $P < .01$) with factor 2 (exercise, limit calories, tuberculosis test), but there were no other statistically significant associations between factors. Three of the five factor scales were associated with Hollingshead occupational status and education. These were the checkup scale (+.20, $P < .05$ with occupation and +.21, $P < .01$ with education), the exercise-limit calories-tuberculosis test scale (+.29, $P < .01$ and +.34, $P < .01$), and the have will-fire extinguisher scale (+.33, $P < .01$ and +.34, $P < .01$).

When factors were rotated in study B, the following three main factors resulted.

Factor 1	
Cholesterol control	+.83
Limit calories	+.80
Factor 2	
Medical checkup	+.83
Dental checkup	+.71
Factor 3	
Sleep	+.88
Exercise	+.56

Factor 1 involves dietary behaviors related to heart diseases. Factor 2 concerns checkups. Factor 3 consists of sleep and exercise. When factor scores were computed for individual persons, factors 1 and 3 were positively associated (+.32, $P < .01$). The checkup factor scale was correlated with Hollingshead occupation (+.24, $P < .01$) and education (+.27, $P < .01$).

Interrelationships of individual preventive health behaviors. Factor analysis indicated that some of the variables studied were interrelated, and some were not. In general, behaviors with high loadings on the first principal components factor were significantly associated with the largest number of other variables; behaviors with low loadings showed few significant associations. Table 2 shows intercorrelations of health behaviors in the three samples. Seat belt usage was also included in this table. Limiting calories, seat belt use, and Papanicolaou test were correlated with the majority of the other preventive behaviors in each sample. Toothbrushing, smoking, and poliomyelitis immunization had the fewest associations.

Table 2 also shows that toothbrushing and dental checkup were nonsignificantly correlated in all three samples. Of the six preventive behaviors related to heart disease (medical checkup, smoking, exercise, obesity, limiting calories, cholesterol control), only five of the 15 possible associations were statistically significant (limiting calories and obesity, cholesterol control, exercise, and smoking; and exercise and cholesterol control). Self-re-

ported risk taking, not included in table 2, was not correlated with any preventive health behaviors in any of the populations studied.

Discussion

The results showed a great variation in the extent to which different preventive behaviors were performed and that the three samples differed considerably in level of prevention. There was some tendency in study B for women to practice preventive behaviors more frequently than men. Study A women were far more likely than study B women to report taking most of the preventive actions; this cannot be accounted for by age or educational differences. The most likely explanation is that information was collected by telephone

Table 2. Interrelationships of preventive behaviors in three samples

Preventive behavior and sample	Medical check	Dental check	Tooth-brushing	Smoking	Papanicolaou test	Sleep	Exercise	Limit calories	Obesity	Tuberculosis test	Poliomyelitis	Cholesterol
Seat belt use:												
Women, A	+.09	[1] +.21	[2] +.19	−.06	[1] +.22	[1] +.24	+.08	[1] +.30	[3] −.15	+.11	+.04	.....
Women, B	[1] +.19	[2] +.16	−.05	−.08	[1] +.20	.....	.....	.....	.....	.....	.....	.....
Men, B	[2] +.16	[1] +.28	−.02	[1] −.24	.....	[2] +.15	[1] +.25	[1] +.23	[2] −.15	.....	.....	+.11
Medical checkup:												
Women, A	.....	[1] +.23	+.10	−.03	[1] +.64	+.10	[3] +.15	[2] +.16	−.12	[1] +.24	[3] +.14	.....
Women, B	.....	[1] +.38	+.02	−.05	[1] +.54	.....	.....	.....	.....	.....	.....	.....
Men, B	.....	[1] +.28	.00	+.02	.....	.00	+.01	+.01	+.04	.....	.....	+.10
Dental checkup:												
Women, A	.....	.....	+.07	+.03	[1] +.32	[3] +.14	[3] +.15	[2] +.20	[1] −.24	[2] +.16	+.06	.....
Women, B	.....	.....	+.02	+.03	[1] +.22	.....	.....	.....	.....	.....	.....	.....
Men, B	.....	.....	+.03	[2] −.15	.....	[3] +.13	+.07	[3] +.15	−.02	.....	.....	[2] +.16
Toothbrushing:												
Women, A	.....	.....	.....	−.01	+.05	−.12	+.09	+.05	−.13	+.08	+.12	.....
Women, B	.....	.....	.....	−.04	.00	.....	.....	.....	.....	.....	.....	.....
Men, B	.....	.....	.....	−.03	.....	[2] +.17	+.13	+.07	−.03	.....	.....	+.05
Smoking:												
Women, A	.....	.....	.....	.....	−.12	−.04	[3] −.14	[1] −.22	−.01	−.02	−.10	.....
Women, B	.....	.....	.....	.....	+.06	.....	.....	.....	.....	.....	.....	.....
Men, B	.....	.....	.....	.....	.....	−.07	[3] −.13	[2] −.17	−.05	.....	.....	−.09
Papanicolaou test:												
Women, A	.....	.....	.....	.....	.....	[2] +.19	+.13	[1] +.21	[1] −.24	[2] +.18	+.13	.....
Women, B	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sleep:												
Women, A	.....	.....	.....	.....	.....	.....	+.12	+.09	−.07	−.07	+.01	.....
Men, B	.....	.....	.....	.....	.....	[1] +.22	+.05	+.01	.....	.....	.....	[1] −.24
Exercise:												
Women, A	.....	.....	.....	.....	.....	.....	[1] +.33	[2] −.16	[1] +.27	+.08	.....	.....
Men, B	.....	.....	.....	.....	.....	.....	[1] +.21	[3] −.12	.....	.....	.....	[1] +.34
Limit calories:												
Women, A	.....	.....	.....	.....	.....	.....	.....	[3] −.17	[1] +.27	.00	.....	.....
Men, B	.....	.....	.....	.....	.....	.....	.....	[1] −.21	.....	.....	.....	[1] +.44
Obesity:												
Women, A	.....	.....	.....	.....	.....	.....	.....	.....	−.14	.00	.....	.....
Men, B	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	−.11
Tuberculosis test:												
Women, A	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	+.09	.....
Poliomyelitis immunization:												
Women, A	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

[1] $P<.01$. [2] $P<.05$. [3] $P<.10$.

in study A and by mail in study B. Telephone interviews are similar to personal interviews in producing more socially desirable responses than mail surveys (*8,9*). Since most people know what the appropriate preventive actions are, social desirability factors may have been operating in these surveys in which data were collected by self-report.

A factor such as social desirability would increase behavioral consistency. However, evidence from our study indicates that there is no general preventive behavior syndrome, conceiving of preventive behavior in its broadest sense, or limiting the conception to health behaviors. The 13 percent variance explained by the first factor in study A is small. In study B, when, with the exception of seat belts, preventive behaviors were limited to those from the health realm, 24 percent of the variance was accounted for, indicating moderately strong interrelationships, but not unidimensionality. Had seat belt use been excluded and toothbrushing included in study B, the percentage of variance explained would have been lower. Preventive health actions were not unidimensional, and not all health behaviors were interrelated at moderate statistically significant levels, as suggested by previous studies based on a limited number of variables. In both studies some health behaviors were interrelated at statistically significant levels, while others were not.

Factor rotation was carried out to isolate and facilitate the interpretation of patterns of preventive behavior. Two of the factors in study A were interpretable on the basis of the behaviors themselves, one being a checkup factor and the other a risk-taking syndrome. Factor 3 (rain apparel, seat belt use, first-aid knowledge, lock car, and sleep) appears to be a cautiousness-preparedness factor, and factor 4 (have will and fire extinguisher) can best be interpreted as a protection of property factor. The factor scale consisting of exercise, tuberculosis test, and limiting calories is uninterpretable on the basis of the combinations of behaviors involved. However, the behaviors involved in this factor are linked to high socioeconomic status, which accounts partly for their clustering. The same situation occurred in the case of the checkup scale and the have will and fire extinguisher scale. The factor scales cut across the primary-secondary prevention distinction.

In study B, two factors were interpretable. As in study A there was a checkup factor associated with socioeconomic status; the other interpretable scale involved behaviors related to diet. The third scale in study B (sleep and exercise) represents personal health maintenance habits, but has no clearcut focus. This scale was associated with the cholesterol control and limiting calories scale which also includes personal health maintenance.

Thus there were several dimensions of preventive behavior, most of them independent. Since people who take preventive actions in one of these dimensions do not necessarily take actions comprising another dimension, the dynamics of each pattern may be different. For example, it was shown in the study that socioeconomic factors were associated with some of the dimensions, but not others. The importance of personality factors and health beliefs may likewise vary, or different beliefs and traits may be more involved in one dimension than in another.

In study A, health variables showed more interrelationships than did accidents and miscellaneous items, with the exception of seat belt usage. This situation may reflect in part the difficulties in specifying and interpreting behaviors indicating a preventive orientation in nonhealth areas. For example, it must be recognized that a question such as locking a car door has limitations in that it does not apply equally to everyone. A person who takes his car into areas where cars are often stolen will be more likely to lock it. Unfortunately, better questions for use in a telephone interview could not be constructed.

Consistent results were generally obtained in the three samples in instances where comparable data existed. The discrepancies which did occur were not attributable to any particular variable or sample.

Health actions varied in the degree to which they were related to other health actions. For example, those who reported that they frequently limited calorie intake tended to carry out most of the other actions, and this variable is the best indicator of a general preventive health orientation. Seat belt usage, an accident-related item, also indicates a preventive health orientation. This information can be used as a means of identifying persons most or least in need of health education. On the other hand, behaviors such as toothbrushing were related to few other actions.

The pattern of intercorrelations of specific behaviors has definite implications for preventive health programs. In general, there is a lack of correlation between going to a physician for a checkup and practicing certain preventive behav-

iors. For example, medical checkups were not correlated with not smoking, getting an adequate amount of sleep, exercising, limiting cholesterol intake, and not being obese, thus indicating to some extent that physicians do not attempt or are not successful in getting their patients to practice these behaviors. It is also of interest that several of the six variables related to heart disease (medical checkup, smoking, exercise, obesity, limiting calories, and cholesterol control) were not intercorrelated. Regarding dental health, regular dental checkups were not correlated with regular toothbrushing; this seems to indicate that dentists do not attempt or are not successful in getting their patients to brush regularly.

In terms of specific behaviors which need attention, exercise and seat belt usage were least frequently performed. Use of seat belts by drivers will be mandatory eventually, so this action need not be of primary concern for health educators. However, exercise programs should be stressed.

This was an initial study in investigating the interrelationship of preventive behaviors. Studies with different samples, including different behaviors, with different means of assessing the behaviors, might well produce different results. Such additional studies are needed to establish the nature and patterning of preventive behavior. This knowledge can then be used as a guide in investigating the dynamics of taking preventive actions and in planning health education programs.

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WILLIAMS, ALLAN F. (Medical Foundation, Inc.), and WECHSLER, HENRY: *Interrelationship of preventive actions in health and other areas. Health Services Reports, Vol. 87, December 1972, pp. 969–976.*

Two studies were undertaken to determine systematically the extent to which preventive actions associated with health, accidents, property and financial loss, and other factors are interrelated. It was determined that neither preventive behaviors in general, nor health behaviors alone, were unidimensional. Instead, there were several dimensions of preventive behavior, most of them independent. These dimensions were interpretable on the basis of the behaviors themselves (for example, medical checkups, risk taking, dietary behaviors), or in terms of their association with socioeconomic status. Information on the patterning of preventive behaviors has important implications for investigations of the dynamics of taking preventive actions.

The information collected on preventive behaviors and their interrelationships also has implications for the planning of health education programs. For example, few people use seat belts or exercise regularly. However, those who use seat belts and those who limit calories perform many of the other preventive actions and are generally oriented toward prevention. Other behaviors, such as toothbrushing, were solo actions related to few if any other preventive behaviors. In some instances behaviors associated with the same condition (for example, toothbrushing and regular dental checkups) were uncorrelated. This information can aid in identifying populations in need of health education and behaviors in need of attention and provides clues concerning how to structure educational campaigns.