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Development and Validation of Measures of Psychosocial Factors Influencing Fat- and Fiber-Related Dietary Behavior[1]

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Background. Understanding factors influencing food choices is likely to enhance the effectiveness of strategies to promote healthy eating patterns. This article describes the process used to develop measures of psychosocial factors related to eating patterns in the Working Well project.

Methods. Working Well is a multicenter controlled trial of worksite health promotion interventions, including a nutrition intervention aimed at promoting low-fat, high-fiber eating. The process for developing measures included several steps. First, we defined three domains of psychosocial factors influencing dietary behavior: predisposing, enabling, and change-related factors. We then reviewed large-scale survey findings, compiled a catalogue of items, and developed and refined a 65-item questionnaire for pretesting in a working population.

Results. Based on frequency distributions and interitem correlations, the item pool was reduced to 24 items. The 24 remaining items were included in a pilot survey of 652 employees (response rate = 80%). On the basis of pilot data analyses, we eliminated one item and made minor modifications to other items. Factors most strongly associated with dietary intake were self-rated diet, past success at change, and motivation to eat low-fat foods.

Conclusions. Analyses of the cross-sectional pilot data suggest directions for analyses of the final survey. The measures and the development process yielded an instrument and process that can be useful to other researchers.

INTRODUCTION

Excessive consumption of dietary fat and low intake of fiber-rich foods, fruits, and vegetables contribute to increased risk for chronic diseases, particularly some cancers and cardiovascular diseases (CVDs). Dietary modifications can reduce the risk of premature morbidity and mortality from these diseases (1, 2). Increasingly, government and health organizations are promulgating recommendations for dietary improvements throughout the U.S. population (2–4). The National Cancer Institute (NCI) has established these specific dietary objectives for the year 2000: (a) reduction in average consumption of fat from about 37 to 30% or less of total calories and (b) increase in average consumption of fiber to 20–30 g

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per day (4). In addition, increased consumption of fruits and vegetables is both a means of achieving these goals and a guideline in its own right (5). The design and evaluation of interventions to improve eating patterns are important and challenging areas of research and practice in preventive medicine and health promotion.

Programs to improve health through promotion of desirable eating patterns are more likely to be effective when they are based on an understanding of factors influencing food choice and a familiarity with established theory and research on changing health-related behaviors (6, 7). Once behavioral and social determinants of food selection are identified, they can provide a foundation for developing effective strategies for change. In addition, measuring these variables makes it possible to evaluate change in mediating factors in addition to the major endpoints of food consumption (8).

Previous research on why people choose the foods they eat has been based on theories of health-related behavior drawn primarily from social psychology and clinical psychology (9). Although limited research has focused on the determinants of selecting low-fat and high-fiber diets in defined populations, recent investigations of psychosocial factors have examined behavioral endpoints, including "desirable dietary changes" (10); adherence to healthy eating patterns (11); low-calorie, low-fat eating behavior during a weight-loss course (12); and health-oriented beverage consumption (13). Government-sponsored surveys over the past decade have examined awareness and attitudes about nutrition and heart disease, with special attention to the dietary contributors to hypertension and high serum cholesterol levels (14). Currently, research that examines predictors of selecting low-fat diets (8, 15, 16), increasing dietary fiber (17), and eating low-fat and high-fiber foods (18) is emerging.

A number of theoretical frameworks have been operationalized in past research. No single theory is dominant. Of particular interest for designing interventions to promote healthful dietary change are constructs derived from social learning theory (SLT)/social cognitive theory[3] (10, 13, 18), the SLT construct of self-efficacy (11, 12), the theory of reasoned action (8, 15, 17), consumer information processing (17), the health belief model (10, 18), and the stages of change (16). Several studies have tested combinations of variables based on more than one model.

One practical problem with adapting measures from the above-mentioned studies to field studies of health promotion programs concerns the length of measurement tools used. Previous researchers have developed scales with from 20 to 80 or more items to assess single concepts or sets of concepts (e.g., self-efficacy, subjective norms, selected variables from SLT). The majority of these studies have addressed only one type of behavior (eating) or at most two kinds of behavior (e.g., eating plus exercise). In some cases, telephone interviews were used. However, many large-scale evaluations must rely on self-administered (mailed)

[3] Social cognitive theory is the dominant contemporary formulation of social learning theory (SLT). It is derived from earlier formulations of SLT by Rotter, Bandura, and others. Bandura adopted the new label of social cognitive theory, or SCT, in his current version, which emphasizes the role of cognitions in behavior (21).

questionnaires. The length of these scales makes it impractical to include them in large studies with multiple survey administrations. There is a need to carefully and systematically develop brief measures of psychosocial determinants of eating behavior that can be used for evaluating health promotion intervention programs in the community, whether they are single-focus (nutrition) or multiple risk factor oriented.

This article describes the process of developing practical measures of psychosocial factors related to cancer risk-reducing eating patterns for the evaluation of a large multicenter controlled trial of worksite health promotion interventions. We describe our methods for identifying and selecting questionnaire items, initial pretesting and reduction of the item pool, and tests of predictive validity in a pilot survey.

METHODS

The Working Well Study

The Working Well project, a 5-year cooperative agreement funded by the National Cancer Institute (NCI), is testing the effectiveness of worksite health promotion interventions in achieving individual and organizational changes to reduce cancer risk. Working Well is a randomized, prospective field experiment with 114 worksites and 37,291 workers (19, 20). The study includes companies and workers with broad geographic and industrial diversity. Four project study centers, a coordinating center, and the NCI are collaborating on common elements of design, data collection and analysis, and intervention standards.[4]

All Working Well study centers are targeting nutrition and at least one other prevention component (smoking, cancer screening, occupational health, or physical activity). The intervention is based on the concept of participatory strategies, in which employees are involved in the development, promotion, and implementation of intervention activities. The Working Well intervention model also incorporates a number of other theoretical frameworks, including SLT (21), diffusion of innovations (22), and the stages of change model (23). The intervention model is described in detail elsewhere (19, 20).

Evaluation of the impact of the Working Well program includes assessment of change at both individual and worksite levels. Individual assessments are being conducted by repeated surveys using self-administered questionnaires. The survey instrument has common core components and additional sections tailored for each study center's setting. Core items include respondents' sociodemographic

[4] The participating study centers and the respective principal investigators are as follows: Brown University School of Medicine/The Miriam Hospital, David B. Abrams, Ph.D.; University of Florida, Jill Varnes, Ed.D.; Dana–Farber Cancer Institute and The University of Massachusetts Medical School, Glorian Sorensen, Ph.D., M.P.H.; University of Texas M. D. Anderson Cancer Center, Michael Eriksen, Sc.D. (1989–1991), Bryant Boutwell, Dr.P.H. (1992–onward); and Fred Hutchinson Cancer Research Center (Coordinating Center), James Grizzle, Ph.D. The Program Director is Jerianne Heimendinger, Sc.D., of the Division of Cancer Prevention and Control, National Cancer Institute.

characteristics and knowledge, attitudes, and behaviors related to nutrition, smoking, and cancer detection.

Preliminary Development of Psychosocial Measures

The measures of psychosocial factors related to nutrition that would be included in the employee health survey had to: (a) be consistent with the conceptual bases of the interventions and their hypothesized means of achieving change, (b) be brief enough that they would not compromise the need to achieve high response rates to the survey, and (c) be worded at an appropriate reading level for the respondents.

A team of investigators was convened to focus on the process of developing these measures. The group followed a logical series of steps to develop the psychosocial measures related to eating patterns for inclusion in the Working Well survey, described in detail below. The steps were as follows: First, we identified the domains to be measured and the related hypotheses. Next, we reviewed recent national and large-scale survey findings related to nutrition knowledge, attitudes, and practices. We then compiled a catalogue of available items from completed surveys and categorized the items by domain. We selected a subset of possible items to include from the catalogue and created additional items where necessary. A 65-item questionnaire was then pretested in a working population, and following item analyses the measures were reduced to 24 items for inclusion in the Working Well pilot survey.

Selection of domains to be measured. The domains to be measured were derived from the theoretical frameworks that were the foundation for the Working Well intervention. For a domain to be included it had to meet (or clearly be hypothesized to meet) these three criteria: (a) be a recognized determinant of healthy food choice; (b) be modifiable or amenable to change by our interventions; and (c) be a possible mediating factor, i.e., a sensitive indicator of exposure or reaction to our interventions that might be a precursor to dietary improvement. A reduced set of domains was chosen and was organized within a framework similar to the classic model described in the work of Andersen (24) on factors affecting health services utilization: predisposing factors, enabling factors, and change-related factors (See Table 1). The domains incorporate concepts from social learning theory, the stages of change model, diffusion of innovations, the health belief model, the theory of reasoned action, and social support theory. For example, an item for assessing the concept of subjective norms from the theory of reasoned action was "At my workplace, it is easy to eat a healthy diet." One item based on the theory of reasoned action as well as the stages of change model asked, "Over the next 6 months, do you plan to eat more fruits and vegetables?"

Review of surveys and catalogue of items. We identified all available large-scale surveys of knowledge, attitudes, and nutrition practices conducted during the preceding 5-year period through journals, government publications, investigators' prior work, and colleagues doing similar work. We reviewed reports of the results and original instruments whenever possible. A catalogue of more than 200 items was compiled and categorized according to domain. We further indexed items that did not fit within our identified domains to examine their usefulness.

TABLE 1
DOMAINS FOR MEASURES OF PSYCHOSOCIAL FACTORS INFLUENCING DIETARY BEHAVIOR[a]

Predisposing factors
Belief in diet–disease connection
Perceived benefits of healthy diet
Knowledge (identification of high- and low-fat/ -fiber foods)
Enabling factors
Perceived barriers to healthful diet
Social support
Perceived norms for healthful eating
Change-related factors
Self-rated diet[b]
Motivation, interest in changing diet
Behavioral intentions to change diet
Self-efficacy for changing diet
Reported eating habit changes: attempts, success
Experience with weight loss attempts

[a] "Dietary change," "healthy eating," etc., refer to adherence to low-fat, high-fiber eating patterns which include regular consumption of fruits and vegetables.

[b] "Self-rated diet" involves an individual's belief that his/her eating pattern is low in fat or high in fiber and is included for two reasons: because recognition of the value of dietary change rests on an accurate perception of one's own diet; and as part of determination of the stage of change of an individual, based on the present eating pattern.

Item selection and development of measures for pretest. In compiling the above-mentioned catalogue of items, we recognized a great deal of overlap and found that some question formats were unsuitable for our use (designed for use in telephone surveys, wording excessively complex, etc.). Many items were therefore eliminated and some were reworded to fit our needs. In a few cases, we created additional items that could not be found in the catalogue, for example, items querying self-efficacy for reducing fat intake and increasing fruit and vegetable consumption. Our goal was to use 3–4 items per construct in a pretest instrument, with the hope that pretest findings would indicate the best items for a more parsimonious measure that would be feasible for use in the larger study survey. This process yielded a 65-item questionnaire for pretesting.

Pretest in a working population. The 65-item questionnaire, along with items on sociodemographic factors and a short questionnaire estimating percentage calories from fat and fiber intake (25), was tested on employees at two worksites in Washington State (which would not be included in the main study). The survey was mailed to workers at Site 1, where a 74% response rate was obtained. At Site 2, the survey was completed by volunteers during a health fair, so no response rate could be calculated. The 91 respondents were non-professional employees, largely white (85.4%), with a mean age of 39.6 years, and slightly more than half (54.4%) were females.

Pretest analyses completed for item selection included frequency distributions, interitem correlations (within constructs), and correlations with percentage calories from fat and fiber intake, as measured by the short questionnaire. Selections were based on a combination of three main factors: strength of association with fat

TABLE 2
ITEMS FOR MEASURING PSYCHOSOCIAL FACTORS INFLUENCING FAT- AND FIBER-RELATED DIETARY BEHAVIOR

Domain	Concept/item	Response options
Predisposing factor	Belief in Diet–Disease Connection	
	Eating a lot of fruits and vegetables decreases my chances of getting serious diseases like heart disease or cancer.	1 to 5 [1 = strongly agree (SA) to 5 = strongly disagree (SD)]
	Eating a lot of fried foods increases my chances of developing serious illnesses like heart disease or cancer.	1 to 5 = SA to SD
Enabling factor	Perceived Barriers To a Healthy Diet	
	It's hard for me to get fruits and vegetables when I'm at work.	1 to 5 = SA to SD
	There is so much advice about healthy ways to eat, I don't know what is good or bad.	1 to 5 = SA to SD
Predisposing factor	Perceived Benefits of a Healthy Diet	
	What I eat is one of the most important things for my health.	1 to 5 = SA to SD
	Low-fat foods taste good.	1 to 5 = SA to SD
Enabling factor	Perceived Norms for Healthy Eating	
	There is a lot of information on healthy eating where I work.	1 to 5 = SA to SD
	At my workplace, it is easy to eat a healthy diet.	1 to 5 = SA to SD
Enabling factor	Social support	
	How much encouragement for eating low-fat foods do you get from your co-workers?	1 to 5 (1 = very much to 5 = none)
	How much encouragement for eating low-fat foods do you get from close friends and family?	1 to 5
Change-related factor	Motivation (personalized importance)	
	How important to you is eating low-fat foods?	1 to 5 (1 = extremely important to 5 = not important)
Change-related factor	Self-efficacy for change	
	How confident are you that you will decrease the amount of fat in your diet during the next 6 months?	1 to 5 (1 = extremely confident to 5 = not confident)
	How confident are you that you will eat more fruits and vegetables during the next 6 months?	1 to 5
Change-related factor	Self-rated diet	
	How high in fat is your overall diet?	1 to 5 (1 = very high to 5 = very low)
	(If low or very low) For how long have you followed a diet that is low in fat?	1 to 4 (1 = <1 month to 4 = ≥1 year)
	How high in fiber is your overall diet?	1 to 5 (1 = very high to 5 = very low)
	(If high or very high) For how long have you followed a diet that is high in fiber?	1 to 4 (1 = <1 month to 4 = ≥1 year)
Change-related factor	Behavioral intentions to change diet [This section introduced by: "The following questions ask about changes you may have made, or may make, in the way you eat."]	
	Over the next 6 months, do you plan to cut down on fats?	1 to 5 (1 = definitely yes to 5 = definitely no)
	Over the next 6 months, do you plan to eat more fruits and vegetables?	1 to 5
Change-related factor	Reported eating habits changes: Attempts, success	
	Have you tried to make any changes to lower the fat in your diet in the past 6 months?	Yes/no

TABLE 2—*Continued*

Domain	Concept/item	Response options
	(If yes) How successful were you in making those changes?	1 to 5 (1 = extremely successful to 5 = not successful)
	Have you tried to make any changes to increase the fiber in your diet in the past 6 months?	Yes/no
	(If yes) How successful were you in making those changes?	1 to 5 (1 = extremely successful to 5 = not successful)
Change-related factor	Weight loss experience	
	Have you ever tried to lose 10 pounds or more?	Yes/no
	(If yes) Think about your most recent effort to lose weight. How would you describe the results?	1 = Lost all I wanted to an kept it off 2 = Lost part of the weight I wanted to and kept it off 3 = Lost weight, but gained some of it back 4 = Lost weight, but gained all of it back 5 = Didn't lose any weight 6 = Still on a diet now 7 = Other
Predisposing factor	Knowledge: Low-fat, high-fiber [These items preceded by: "If you were trying to choose more (low-fat/high-fiber) foods, which food in each of the following pairs would you select because it was (lower in fat/higher in fiber)?"]	
	Low-fat	
	Saltines/soda crackers or Ritz crackers	One choice, "either one," or "don't know"
	Margarine or butter (Neither one)	
	Potato chips or pretzels	
	High Fiber	
	Chili with beans or spaghetti and meat balls	One choice, "either one," or "don't know"
	Bran muffin or bowl of bran cereal	
	Canned pears or stewed prunes	

Note. Correct answers are underlined. Scoring was correct or incorrect/don't know.

and fiber intake, interitem correlations within constructs, and a goal of no more than two items per construct. An additional consideration was to include items referring to both fat and fiber/fruits and vegetables. Based on the pretest analyses and these selection criteria, the set of items to measure psychosocial factors for the pilot baseline survey was reduced to 24 items. Most concepts were measured by only two items due to practical constraints on the length of the questionnaire.

Pilot Survey

Each of the four Working Well study centers conducted the pilot survey with approximately 200 employees. Administration of the survey was by mail (for three centers) or in group meetings (for one center) and either on workers' personal time (for two centers) or on company time (at two centers).

The survey instrument was a self-administered questionnaire with common core components and additional items to meet the needs of individual study centers. Core questions included respondents' sociodemographic characteristics; knowledge, attitudes, and behaviors related to nutrition, smoking, and cancer detection; perceptions of worksite characteristics; and a set of items asking respondents to evaluate the questionnaire. (These included the 24-item psychosocial nutrition measures. See Table 2 for a list of items.) Two versions of the pilot survey were used in a test of total questionnaire length on response rates: one version used a short 22-item "screener" for fat and fiber intake [adapted from (26)] and the other used an 88-item food frequency questionnaire (FFQ) with portion sizes (176 items total) that asked about a wide variety of foods [adapted from (27)]. Within each study center's pilot survey, half the respondents were randomly assigned to receive the shorter questionnaire and half received the longer questionnaire. The two versions of survey booklets were similar in appearance.

A total of 652 respondents completed and returned the pilot survey, for an 80.3% response rate. This included 329 questionnaires with the shorter dietary assessment and 323 questionnaires with the longer FFQ. Respondents were 55% male, 88% white, and averaged 41 years of age; 85% were high school graduates and approximately two-thirds (69%) were paid on an hourly basis.

Statistical Methods

We present means, standard deviations, and distribution of responses (%) on the pilot survey for each item across the 5-point response scales. For knowledge items, we give the mean, standard deviation, and distribution of the number of items answered correctly. We present correlation coefficients between items within constructs, which we calculated to assess the internal consistency of items used to assess constructs. For the second set of analyses, we used either *t* tests or analysis of variance to test for differences in item means by sociodemographic characteristics. Finally, we used correlation coefficients, partialed for age, sex, and smoking status, to describe the associations of psychosocial items with nutrient variables calculated from either the short food frequency (fat grams and fiber grams) or the complete food frequency (percentage energy from fat and grams of fiber). In these analyses, age was coded as a continuous variable and smoking was coded as a dummy variable indicating smoking currently versus not smoking.

RESULTS

Frequency Distributions

Table 3 gives the means and distributions of responses for all items in the questionnaire. With the exception of only four items, all items were within the mid-range of the response distributions (between 2.0 and 3.9 on a scale of 1.0 to 5.0) with standard deviations greater than 0.80. The distributions for both the belief items (belief in diet–disease connection) and the benefits item, "What I eat

TABLE 3
MEANS AND DISTRIBUTIONS OF ITEMS FOR MEASURING PSYCHOSOCIAL FACTORS INFLUENCING FAT- AND FIBER-RELATED DIETARY BEHAVIOR

Item[a] (r)[b]	Mean (SD)[c]	Distribution (%)[d] 1 (strongly positive)	2	3	4	5 (strongly negative)	n
Belief (0.39)							
Fruits/vegetables	1.90 (0.80)	32.7	49.0	14.2	3.8	0.3	639
Fried foods	1.83 (0.81)	36.2	50.0	9.2	3.6	0.9	640
Barriers (0.14)							
Fruits/vegetables	3.07 (1.20)	11.0	26.8	15.4	37.8	8.9	637
Advice	2.81 (1.12)	10.3	39.1	14.1	32.5	4.1	640
Benefits (0.14)							
Taste	2.79 (0.94)	5.3	37.5	33.7	20.2	3.3	640
Health	1.84 (0.75)	32.3	55.3	9.2	2.4	0.8	638
Norms (0.27)							
Information	3.93 (0.82)	0.9	5.5	15.5	56.0	22.1	638
Easy	3.30 (1.15)	3.9	28.3	17.8	34.3	15.7	636
Social support (0.32)							
Co-workers	4.22 (1.02)	1.1	5.9	18.6	18.8	55.6	640
Family	3.23 (1.24)	8.3	21.4	30.8	17.5	21.9	639
Motivation							
Important	2.66 (1.07)	13.7	31.0	38.5	8.7	8.0	641
Intentions (0.65)							
Lower fat	2.31 (1.09)	28.3	31.6	22.8	15.9	1.4	636
Increase fruits/vegetables	2.11 (1.04)	34.6	33.1	30.4	10.7	1.3	619
Self-efficacy (0.61)							
Lower fat	2.52 (0.82)	14.3	38.5	38.9	12.1	1.2	519
Increase fruits/vegetables	2.34 (0.99)	21.8	36.2	30.6	9.0	2.4	536
Self-rated diet (−0.35)							
Fat	3.03 (0.86)	3.7	19.4	52.3	19.4	5.2	597
Fiber	2.99 (0.82)	4.2	19.3	52.1	22.3	2.1	570
Success (0.54)							
Lower fat	2.79 (0.92)	7.6	28.0	46.3	14.1	4.0	447
Increase fiber	2.80 (0.92)	7.6	27.7	45.7	15.4	3.6	357
		0	1	2	3		
Knowledge (0.34)							
Fat	1.23 (0.92)	26.3	31.6	35.3	6.8		617
Fiber	1.37 (1.05)	26.3	27.4	29.6	16.7		624

[a] See Table 2 for full text of items.
[b] Correlation between items within construct.
[c] Standard deviation.
[d] See Table 2 for definition of response categories. In general, 1 indicates a strongly positive and 5 a strongly negative response. For knowledge items, scale is number of correctly answered items.

is one of the most important things for my health," were highly skewed toward strong agreement. For the knowledge items, there was a fairly even distribution across zero to two items, and relatively few respondents could correctly answer all three knowledge items about either fat or fiber.

TABLE 4
MEAN OF PSYCHOSOCIAL ITEMS BY GENDER, AGE, EDUCATION, OCCUPATION, AND SMOKING STATUS

	Belief		Barriers		Benefits	
	Fruits/ vegetables	Fried foods	Fruits/ vegetables	Advice	Taste	Health
Gender						
Male	1.89	1.86	2.85	3.18	2.90***	1.89
Female	1.92	1.77	3.03	3.16	2.65	1.78
Age (years)						
<35	1.96	1.91[a]***	2.91	3.15	2.85	1.86
35–49	1.87	1.81[ab]	3.00	3.19	2.78	1.79
50+	1.80	1.63[a]	2.75	3.19	2.70	1.76
Education						
<H.S.	1.96	1.85	2.87	3.33[a]***	2.83	1.87
Some college/ vocational	1.81	1.79	2.94	3.07[ab]	2.79	1.80
Assoc degree or higher	1.90	1.80	3.11	2.88[b]	2.67	1.81
Occupation						
Blue collar	1.93	1.85	2.84*	3.26*	2.84*	1.86
White collar	1.85	1.75	3.06	3.00	2.68	1.79
Smoking						
Current smoker	2.09***	1.99**	2.90	3.30	2.86	1.91
Nonsmoker	1.82	1.77	2.94	3.15	2.75	1.81

Associations with Sociodemographic Characteristics and Smoking Status

Table 4 presents the means of all items by gender, age, education, occupation, and smoking status. In general, scores on psychosocial items tended to indicate agreement with more healthful attitudes among women, older persons, and nonsmokers. An important exception was the association of gender with perceived support, about which women reported less social support to eat a low-fat diet in their workplaces. Believing that diet is important to one's health and past success at changing diet were not associated with any of the sociodemographic characteristics measured. For all other items there were statistically significant differences within one or more sociodemographic characteristics.

Correlations with Fat and Fiber Intake

Table 5 gives the correlations, partialed for age, sex, and smoking status, of psychosocial items with dietary fat and fiber intake. We also examined education and occupation as potential confounding variables, but found no association of these characteristics with dietary intake once age and sex were controlled. Results are presented separately for the two types of dietary assessment instrument, the short, 22-item food frequency and the complete 88-item frequency. We focus on the results of the complete food frequency because we believe it gives a better characterization of diet. The strongest associations of dietary intake were with

TABLE 4—*Continued*

	Norms		Social support			Intentions	
	Information	Easy	Co-workers	Family	Motivation importance	Lower fat	Increase fiber
Gender							
Male	3.80*	3.19**	4.40***	3.14*	2.80***	2.52***	2.29***
Female	4.10	3.43	3.99	3.36	2.49	2.02	1.86
Age (years)							
<35	4.04	3.37	4.38*	3.34	2.93[a]***	2.49[a]**	2.23*
35–49	3.99	3.36	4.11	3.30	2.60[b]	2.22[ab]	2.05
50+	3.86	3.14	4.11	3.02	2.32[b]	2.08[b]	1.94
Education							
<H.S.	3.93	3.26	4.22	3.27	2.71	2.34	2.14
Some college/ vocational	3.91	3.31	4.20	3.20	2.59	2.22	2.05
Assoc degree or higher	3.94	3.38	4.25	3.19	2.69	2.42	2.18
Occupation							
Blue collar	3.92	3.23	4.37***	3.27	2.74*	2.40**	2.17
White collar	3.95	3.39	4.00	3.19	2.53	2.14	2.01
Smoking							
Current smoker	3.88	3.23	4.27	3.36	2.94***	2.52*	2.27*
Nonsmoker	3.95	3.32	4.20	3.18	2.55	2.22	2.05

self-rated diet, previous success at changing diet, and motivation to eat low-fat foods. Belief, barriers, norms, perceived social support, and knowledge were inconsistently or weakly associated with dietary intake of fat and fiber.

DISCUSSION

The test of questionnaire items to measure psychosocial factors influencing fat- and fiber-related dietary behavior in the Working Well pilot survey helped us to further evaluate three important characteristics of our measures: first, the distribution of responses to the items and their potential for detecting change; second, their associations with workers' demographic characteristics and the likely need for statistical adjustment in future analyses; and third, the consistency of association of the items with reported dietary behavior in a cross-sectional survey.

Frequency Distributions

Overall, responses to the items were well distributed across response categories in this sample. The distributions for three items related to believing that diet is important to health were highly skewed toward strong agreement. These items are not likely to be useful for study evaluation, because there is little room for change in the direction expected due to intervention. Previous national surveys [e.g., (28)] have found widespread agreement that eating patterns affect health and disease, so the skewed response to "belief" items is not surprising. The "social support" item "How much encouragement for eating low-fat foods do you get

TABLE 4—*Continued*

	Self-efficacy				Success			
			Self-rated diet				Knowledge	
	Lower fat	Increase fruits/ vegetables	Fat	Fiber	Lower fat	Increase fiber	Fat	Fiber
Gender								
Male	2.65***	2.46**	3.00	2.95	2.80	2.84	1.05***	1.30
Female	2.37	2.20	2.94	3.02	2.79	2.75	1.47	1.46
Age (years)								
<35	2.54	2.47	3.13[a]***	3.17[a]***	2.80	2.96	1.17	1.05[b]**
35–49	2.52	2.28	3.00[ab]	3.00[ab]	2.77	2.72	1.26	1.39[a]
50+	2.46	2.33	2.78[b]	2.79[b]	2.82	2.83	1.25	1.61[a]
Education								
<H.S.	2.52	2.31	2.99	3.02	2.86	2.84	1.13[b]***	1.35
Some college/ vocational	2.50	2.32	2.99	2.93	2.73	2.72	1.26[b]	1.34
Assoc degree or higher	2.60	2.53	2.86	3.03	2.68	2.86	1.58[a]	1.50
Occupation								
Blue collar	2.63**	2.35	2.95	2.98	2.80	2.75	1.08***	1.32
White collar	2.37	2.30	3.00	3.00	2.77	2.87	1.48	1.48
Smoking								
Current smoker	2.68*	2.51*	3.01	3.18***	2.78	2.91	1.06**	1.23*
Nonsmoker	2.47	2.27	2.95	2.91	2.79	2.76	1.29	1.42

Note. Means with different superscripts indicate significant differences ($P < 0.01$) using multiple range tests.

* $P < 0.05$.

** $P < 0.01$.

*** $P < 0.001$.

from your co-workers?" was very skewed toward "none," and it may be a good item for detecting change in worksite-based social support for dietary change. The knowledge items also worked well.

Associations with Sociodemographic Characteristics and Smoking Status

Scores on psychosocial items tended to indicate agreement with more healthful attitudes among women, older persons, and nonsmokers. For most of the items the statistically significant differences with one or more sociodemographic characteristics suggest that analyses using these psychosocial items will require statistical control.

Interitem Correlations within Constructs

The magnitude of the correlations for items within constructs ranged from 0.14 to 0.65. Thus, internal consistency is stronger for some constructs (especially intentions to change, self-efficacy for change, and success at changing: 0.65, 0.61, and 0.54, respectively). An internal consistency of 0.50–0.60 or greater is desirable for scale construction in behavioral research; however, there is little empirical literature on internal consistency of dietary constructs. These findings suggest

TABLE 5
CORRELATIONS (PARTIALED FOR AGE, SEX, AND SMOKING) BETWEEN PSYCHOSOCIAL ITEMS AND INTAKE OF FAT AND FIBER

	Short food frequency (N = 304–318)		Complete food frequency (N = 281–296)	
	Fat (g)	Fiber (g)	% Fat	Fiber (g)
Belief				
Fruits/vegetables	0.15	−0.11	0.10	−0.21*
Fried foods	0.43***	−0.01	0.08	−0.08
Barriers				
Fruits/vegetables	0.01	−0.10	0.00	−0.03
Advice	0.03	−0.12	0.20*	−0.14*
Benefits				
Taste	0.24*	−0.12	0.27*	−0.14
Health	0.15	−0.12	0.02	0.05
Norms				
Information	0.05	0.09	−0.22*	0.09
Easy	0.01	−0.08	−0.07	0.03
Socal support				
Co-workers	−0.04	0.18	−0.12	−0.05
Family	0.39***	−0.00	0.13	−0.19*
Motivation				
Important	0.37***	−0.26*	0.35***	−0.24*
Intentions				
Lower fat	0.29***	0.03	0.14*	−0.19*
Increase fiber	0.16*	−0.02	0.17*	−0.19*
Self-efficacy				
Lower fat	0.42***	0.01	0.33**	−0.29*
Increase fruits/vegetables	0.27*	−0.07	0.19*	−0.16
Self-rated diet				
Fat	0.37***	−0.22*	0.36***	−0.09*
Fiber	0.27*	−0.35**	0.28*	−0.13*
Success				
Lower fat	0.26*	−0.04	0.31**	−0.20*
Increase fiber	0.16	−0.30*	0.32**	−0.18*
Knowledge				
Fat	−0.03	0.22*	−0.08	0.08
Fiber	−0.11	0.06	−0.01	0.06

* $P < 0.05$.
** $P < 0.001$.
*** $P < 0.0001$.

that some of our constructs are not unidimensional and would not be suitable for use in composite indexes. Further, this underscores the psychometric limitations imposed by constraints on the number of items we could use.

Correlations with Dietary Fat and Fiber

Results of the correlations with dietary fat and fiber suggest that, at least cross-sectionally, respondents' perceptions of past dietary change, present diet, and intention to change diet are consistent with their reported dietary behavior. How-

ever, associations of attitudes and perceived norms are inconsistently associated with dietary intake. Analyses of these psychosocial variables in a larger survey sample, and later in the context of a randomized dietary intervention, will allow us to examine whether these constructs are affected by dietary intervention and whether their change is associated with behavior change.

Modification of Measures for Main Study

Based on the pilot survey, we made only a few minor changes to our measures for the survey used in the larger study. We decided to eliminate one knowledge item (whether canned pears or stewed prunes had more fiber) due to some respondents' voluntary remarks that they would not substitute one for the other. Also, we modified the time frames in the items asking about past and anticipated changes in fat and fiber intake in order to measure individuals' past or planned changes more sensitively. We decided to retain the skewed items about belief in the importance and benefits of diet, because one of our study objectives is to foster near-universal strong agreement with these statements.

CONCLUSION

In the early stages of a multicenter prospective controlled study of worksite health promotion including nutrition intervention, we used a systematic process to develop measures of psychosocial factors affecting food choice that are practical, theoretically meaningful, relatively brief, and able to detect change following an intervention. It is important to measure mediating factors in this evaluation, to evaluate change in these factors prospectively, and also to consider them as covariates. The measures we have developed not only will be useful in our study, but can provide a tool with identifiable conceptual foundations and known measurement properties for other investigators as well.

In the development of these measures, we have established face validity of the measures and have found support for the concurrent validity of many of the items as correlates of eating patterns. Use of these measures in the larger Working Well study will allow us to better understand their psychometric properties and their predictive validity. Our control worksites will also enable us to evaluate the natural history of these factors longitudinally.

Our conclusions are somewhat limited because we used a single cross-sectional survey and because only a modest sample of employees completed the comprehensive food frequency questionnaire. The small number of items for assessing each concept is an additional limitation, but a constraint that is inescapable in large field studies of health promotion interventions.

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