TABLE 5.—Continued

Behavior	Adjusted odds ratios		
	Former smokers relative to never smokers	Current smokers relative to never smokers	Former smokers relative to current smokers
Other			
Use ST	0.73	0.46[a]	1.53
Use seatbelt	1.03	0.62[a]	1.63[a]

NOTE: BRFSS=Behavioral Risk Factor Surveillance System; ST=smokeless tobacco.

[a]$p<0.01$.

[b]$0.01<p<0.05$.

[c]BMI=body mass index.

[d]Met. Life=Metropolitan Life height and weight tables.

SOURCE: Samet and Wiggins, unpublished analyses of the 1987 BRFSS.

Physical Activity

Evidence from the 1985 NHIS, the 1987 BRFSS, and other cross-sectional studies suggests that smokers are less likely than nonsmokers to make regular exercise part of their lives (Goldbourt and Medalie 1975; Schoenborn and Benson 1988; Martin and Dubbert 1982). These differences may be the consequence of cessation and result partly from changes in physiologic function, such as lung function, that make exercise more pleasurable or tolerable for former smokers compared with current smokers (Castro et al. 1989). They also may reflect the former smokers' efforts to maintain abstinence. Blair and colleagues (1980) found mixed results in their studies of workers in a South Carolina company. Among men living within a 0.5 mile of work, current smokers were less likely than never smokers to walk to work. Among women, former smokers were more likely than either never smokers or current smokers to walk to work. (Mean duration of abstinence for former smokers was not reported.) There were no significant differences between smoking categories in other measures of physical activity, such as time spent sitting, use of stairs versus elevator, level of leisure time versus physical activity, and participation in a company exercise program. However, many measures for former smokers were between those of current smokers and never smokers.

The 1985 NHIS used 2 measures of physical activity, the perception of being less physically active than others and a more rigorous definition of sedentary behavior based on subjects' reports of participation in 23 leisure activities during the preceding 2 weeks (Schoenborn and Benson 1988). The perception of being less physically active was significantly more common among current smokers than former smokers and never smokers (Table 3). When separated by sex, these differences appear to be greater for men than for women. Men who were former smokers were significantly less likely to report being sedentary than current smokers and not significantly different from never smokers. Among women, former smokers were significantly less likely than current smokers and never smokers to be sedentary.

In two studies among Navy personnel, Conway and Cronan (1988a,b) studied the relationship among smoking, exercise, and physical fitness. The first study (Conway and Cronan 1988a) included 3,045 Navy personnel randomly selected from a group who volunteered to participate in an evaluation of physical fitness and health. Both

TABLE 6.—Summary of data from 1987 BRFSS, behaviors of former smokers aged 18 and older by duration of abstinence

Behavior	Adjusted odds ratios by duration of abstinence		
	13–24 mo relative to 1–12-mo quitters	25–60 mo relative to 1–12-mo quitters	≥61 mo relative to 1–12-mo quitters
MEN			
Alcohol consumption			
Any alcohol/mo	1.01	1.02	1.09
≥5 drinks/episode	1.03	1.05	0.95
≥60 drinks/mo	1.00	1.26	1.09
Drinking and driving	1.27	1.14	1.17
Weight/diet/exercise			
Obese (BMI)[b]	1.51[a]	1.46[a]	1.43[a]
Obese (Met. Life)[c]	1.45[a]	1.38[a]	1.39[a]
Trying to lose pounds	1.02	1.18	1.08
More exercise	0.85	1.06	0.86
Eating fewer kcal	0.92	1.46	1.37
Physical activity	0.98	1.13	1.25[a]
Sedentary	1.02	0.88	0.80[a]
Preventive care			
Cholesterol test	0.94	1.03	0.98
Flu shot past month	0.88	0.96	0.95
Other			
Use ST	0.64[a]	0.97	0.74[a]
Use seatbelt	1.02	1.09	1.22[a]
WOMEN			
Alcohol consumption			
Any alcohol/mo	1.02	1.28[a]	1.22[a]
≥5 drinks/episode	0.97	1.03	0.83
≥60 drinks/mo	1.30	1.03	1.15
Drinking and driving	1.55	0.60	0.72
Weight/diet/exercise			
Obese (BMI)[b]	1.28	1.31[a]	1.42[a]
Obese (Met. Life)[c]	1.07	1.16	1.30[a]
Trying to lose pounds	1.17	1.15	1.04
More exercise	0.97	1.10	0.98
Eating fewer kcal	1.10	1.01	0.90
Physical activity	1.05	1.06	1.11
Sedentary	0.95	0.95	0.90
Preventive care			
Cholesterol test	0.89	1.05	0.88
Flu shot past month	1.26	0.97	1.04

TABLE 6.—Continued

Behavior	Adjusted odds ratios by duration of abstinence		
	13–24 mo relative to 1–12-mo quitters	25–60 mo relative to 1–12-mo quitters	≥61 mo relative to 1–12-mo quitters
Other			
Use ST	0.49	0.27	1.07
Use seatbelt	1.28[a]	1.14	1.24[a]

NOTE: BRFSS=Behavioral Risk Factor Surveillance System; ST=smokeless tobacco.

[a]Significantly different from 1–12-mo quitters ($p<0.05$). There were no significant differences among the three categories of cessation >1 yr.

[b]BMI=body mass index.

[c]Met. Life=Metropolitan Life height and weight index.

SOURCE: Samet and Wiggins, unpublished analyses of the 1987 BRFSS.

never smokers and former smokers engaged in significantly more exercise sessions per week than did current smokers. Current smokers exercised for significantly less time per session and had significantly lower overall physical fitness scores compared with never smokers or former smokers. In a second study, the same authors examined the association between physical fitness and smoking among 1,357 Navy men (Conway and Cronan 1988b). Again, current smokers had poorer levels of physical fitness with lower scores than former smokers or never smokers on tests of cardiorespiratory and muscular endurance. Overall, never smokers performed better than former smokers and current smokers. In both studies, participants were young, with an average age of 26 years (study 1) and 28 years (study 2), suggesting that both decrements associated with smoking and improvements associated with quitting can appear at an early age.

A cross-sectional study of 781 runners found that as mileage increased, the percentage of self-defined former smokers also increased (Macera, Pate, Davis 1989). These investigators suggested that high-mileage runners seemed to quit smoking at a higher rate than low-mileage runners. Although the sample size was probably too small to show significant differences and the data were cross-sectional, the results support both empirical and anecdotal data about the relationship between abstinence from smoking and increased participation in exercise. Gordon and Polen (1987) studied 1,061 men and women who participated in smoking cessation clinics at Kaiser Permanente medical facilities from 1980 to 1983. Men and women who had increased their exercise after program participation were more likely to be abstinent from smoking 7 to 12 months later. These studies suggest that increasing exercise may be part of a former smoker's efforts to remain abstinent, a direct consequence of cessation, or both. The study by Gordon and Polen (1987) lends support to the first hypothesis.

The 1987 BRFSS allows a comparison among current smokers, never smokers, and former smokers on a range of health practices (Table 5). Two measures of physical activity were used. One asked a very general question about any physical activity in the past month, including nonaerobic activities, such as gardening, as well as major aerobic activities. The second identified sedentary lifestyle as the lowest category on

a complex scale of life activities. On both measures, men and women who had quit smoking were more active than never smokers, who were in turn more active than current smokers. Among men, those who had been smoke-free for more than 5 years were significantly more active and less sedentary than new quitters, those who had been abstinent less than 1 year. This difference was not significant among women.

Prospective investigations of changes in physical activity after smoking cessation have indicated either no change or an increase in activity (Chapter 10). An additional prospective study focusing on exercise specifically, rather than weight changes, also found increased exercise among quitters. In a 1-year study of a large worksite population, Orleans and associates (1983) found that 72 recent ex-smokers (mean abstinence, 7 months) significantly increased their self-rated levels of activity compared with 347 continuing smokers ($p<0.01$) and that the ex-smokers achieved significant increases ($p<0.01$) from a prequitting baseline in the frequency of activities involving moderate exertion, such as walking or climbing stairs. Gordon and Cleary (1986) analyzed data from the 1979–1980 National Survey of Personal Health Practices and Consequences and found a more limited positive relationship. Aerobic exercise increased for women who tried to quit smoking but was not related to successful quitting in the last year among women or to any change in smoking behavior among men.

More studies are needed to clarify the effects of smoking abstinence on the level of physical activity. The relationship between increased physical activity and smoking abstinence may be a consequence of cessation, may reflect more successful quitting among smokers who have a higher level of prequitting physical activity, may be evidence that former smokers use exercise as a strategy to avoid smoking, or as a way to deal with the possible adverse effects of weight gain, or may be due to some combination of these possibilities. The cross-sectional nature of the data available do not permit a conclusion with regard to these alternatives.

Dietary Practices

Cross-sectional data from NHIS, BRFSS, and other studies present a mixed picture of the dietary practices of smokers, former smokers, and never smokers. Schoenborn and Benson (1988), reporting on the 1985 NHIS, found that current smokers are more likely to skip breakfast than never or former smokers (Table 3). This finding is consistent with the 1987 NHIS data showing that both former and never smokers are more likely than current smokers to eat no more than or no less than three meals a day (Schoenborn and Boyd 1989) (Table 4). As shown in Table 4, whether former smokers are more likely, less likely, or equally likely to eat three meals than are never smokers depends on gender and whether the day is a weekday or weekend day. Two NHIS surveys present contradictory results on snacking. The age-adjusted 1985 study indicated that among women, former smokers are the most likely to snack, but that there was no significant difference among men (Table 3). Raw percentages in the 1987 NHIS data show that among men, former smokers avoid snacks more than either never or current smokers, but that among women, there is essentially no difference (Table 4).

BRFSS data (Table 5) indicate that former smokers are the most likely group to be "trying to lose weight," although no more likely than never smokers to be obese.

Similarly, the 1987 NHIS data show that former smokers of both sexes are the most likely to report that they have changed their diet for the sake of their health (Table 3). In these same NHIS data, not controlled for age, men who are former smokers are more obese than never smokers, although women who are former smokers and never smokers are equally likely to be obese. Among the 10,000 Israeli men in Goldbourt and Medalie's 1975 study of Government employees, former smokers (duration of abstinence not noted) consumed fewer calories and were more likely to be on some sort of special diet for weight loss, diabetes, heart disease, hypertension, or ulcers. Former smokers surveyed for all three of these data sets may have initiated special diets or quit smoking following the diagnosis of illness. However, the Israeli data demonstrate that among those individuals who had experienced heart attacks or peptic ulcers, former smokers were more likely to report themselves compliant with their diets than current smokers (Goldbourt and Medalie 1975).

Former smokers often report retrospectively that they increased food consumption when they quit smoking (Carmody et al. 1986). The first part of this Chapter and a review by Hughes, Higgins, and Hatsukami (1990) indicate that increased hunger and appetite are common smoking withdrawal reactions, often extending beyond the initial 4-week withdrawal period. However, most longitudinal studies of changes in dietary practices after quitting have examined only short-term changes (Chapter 10). The majority of these studies have found evidence for increased dietary intake, especially of sweet foods and simple carbohydrates, after quitting. In a prospective study Orleans and coworkers (1983) found approximately a 6-pound weight gain at 1-year followup over baseline for 72 former smokers who had been abstinent from cigarettes for an average of 7 months. These researchers also found evidence for significant ($p<0.01$) improvements in overall nutritional practices for former smokers.

Better dietary behavior among former smokers when compared with current smokers may reflect changes made by former smokers in their efforts to remain abstinent, a response to their concerns regarding possible weight gain, or an overall desire to be healthy that is motivated by smoking cessation. Adequate data are not available to permit an assessment of these alternative hypotheses.

Use of Other Substances

Other Tobacco Products

In data from the United Kingdom, the cessation of cigarette smoking has been linked to the increased use of other smoked tobacco products, including pipes and cigars, by men (Jarvis 1984). These researchers noted that many of the alleged gender differences in cigarette smoking cessation rates are due to the adoption of pipe and cigar use by men. Comparable analyses have been performed on data from the 1987 NHIS Cancer Epidemiology and Control Supplement (Schoenborn and Boyd 1989) (Volume Appendix). When former cigarette smokers who used any other forms of tobacco were reclassified as smokers, the difference in cessation rates between men and women decreased.

Data from the 1987 NHIS indicate that the overall prevalence of the use of smokeless tobacco products and cigars or pipes is low; the prevalence of use ranges from 3.0 to 5.2 percent for men and from 0 to 0.5 percent for women; former cigarette smokers are more likely than never cigarette smokers to be current smokers of pipes or cigars (Table 7). Because the prevalence of pipe or cigar smoking increases as a function of age, it is important to use age adjustments in future investigations of the relationship between cigarette cessation and pipe or cigar smoking.

Alcohol

Smokers are more likely than nonsmokers to drink alcohol and use other drugs (Istvan and Matarazzo 1984; US DHHS 1988). Cross-sectional data from the 1983 NHIS (Kovar and Poe 1985) show a strong association between smoking status and daily alcohol intake (Figures 3 and 4); former smokers tend to be heavier drinkers than are never smokers, and daily alcohol intake increases with heavier smoking (Kozlowski and Ferrence 1990). The drinking and smoking scales differ for men and women to compensate for the relative rarity among women of very heavy drinking and heavy smoking; at the same levels per day as men, fewer drinks per day are required for women than for men to be placed in the "heavy drinking" category.

In the 1987 NHIS, alcohol consumption was divided into beer, wine, and liquor consumption. Published data report on the proportion of respondents consuming "5 or more drinks per week" and "3 or more drinks on days you drank" for each category. These data are generally consistent with the 1983 (Figures 3 and 4) and the 1985 age-adjusted NHIS data (Table 2) and with the age-, education-, and ethnicity-adjusted data from the 1987 BRFSS (Table 5) in showing lower alcohol consumption among former than among current smokers but higher than among never smokers. These data regarding alcohol consumption of former smokers are also consistent with data presented previously in this Chapter on the short-term effects of smoking abstinence on alcohol consumption (Hughes and Hatsukami 1986; Olbrisch and Oades-Souther 1986; Puddey et al. 1985).

In the 1987 BRFSS survey, two measures of alcohol were used: the amount consumed and whether drinking and driving occurred together (Tables 5 and 6). Men and women who had quit smoking drank significantly more than never smokers and were significantly more likely to drink and drive. However, former smokers drank significantly less than current smokers and were significantly less likely to drink and drive.

The intermediate position of former smokers seen in the 1987 BRFSS and the 1985 NHIS is paralleled in the 1987 NHIS by the percentage of both sexes who drink five beers or more per week, the percentage of women who drink three glasses or more of wine when they drink wine, and the percentage of men who drink three drinks or more when they drink liquor (Table 4). In the 1987 NHIS, male former smokers are significantly less likely than either comparison group to have three beers or more when they drink beer or three glasses or more of wine when they drink wine. Although a very small percentage of adults drink wine or liquor five times or more per week, men who are former smokers are more likely than current or never smokers to drink this often. Female former smokers are more likely than current or never smokers to drink wine

TABLE 7.—Percent distribution of persons aged 18 and older by tobacco product and use status, according to gender and cigarette smoking status, United States, 1987

Tobacco product and use status	Both genders				Men				Women			
	Total	Never smokers	Former smokers	Current smokers	Total	Never smokers	Former smokers	Current smokers	Total	Never smokers	Former smokers	Current smokers
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Chewing tobacco												
Never	93.8	96.7	89.8	92.0	87.6	92.5	83.5	85.3	99.3	99.3	99.2	99.2
Former	4.2	1.8	7.3	5.8	8.4	4.1	11.9	10.6	0.4	0.3	0.6	0.6
Current	2.0	1.5	2.9	2.2	4.0	3.4	4.6	4.1	0.3	0.4	0.2[a]	0.2[a]
Snuff												
Never	95.9	93.3	94.3	94.8	92.3	94.6	90.9	90.5	99.2	99.0	99.2	99.4
Former	2.4	1.1	3.8	3.5	4.7	2.4	6.1	6.4	0.4	0.3	0.5	0.5
Current	1.7	1.6	1.9	1.6	3.0	3.0	3.0	3.1	0.5	0.7	0.3[a]	0.1[a]
Pipe												
Never	91.1	97.4	79.3	89.7	81.5	93.9	85.9	80.5	99.7	100.0	99.2	99.5
Former	7.3	1.7	18.5	7.9	15.2	4.4	30.4	15.1	0.3	0.0[a]	0.8	0.4
Current	1.6	0.8	2.2	2.3	3.3	2.2	3.7	4.4	0.0[a]	—[a]	0.0[a]	0.2[a]
Cigars												
Never	91.1	97.0	80.5	89.7	81.7	92.5	87.8	80.8	99.6	99.8	99.4	99.2
Former	6.4	1.8	16.3	6.2	13.1	4.4	26.9	11.5	0.3	0.1[a]	0.6	0.6
Current	2.5	1.2	3.2	4.1	5.2	3.1	5.3	7.8	0.1[a]	0.0[a]	0.0[a]	0.1[a]

[a]Data do not meet standard of reliability or precision (more than 30% relative standard error in numerator of percentage or rate).

SOURCE: National Health Interview Survey (1987); Schoenborn and Boyd (1989).

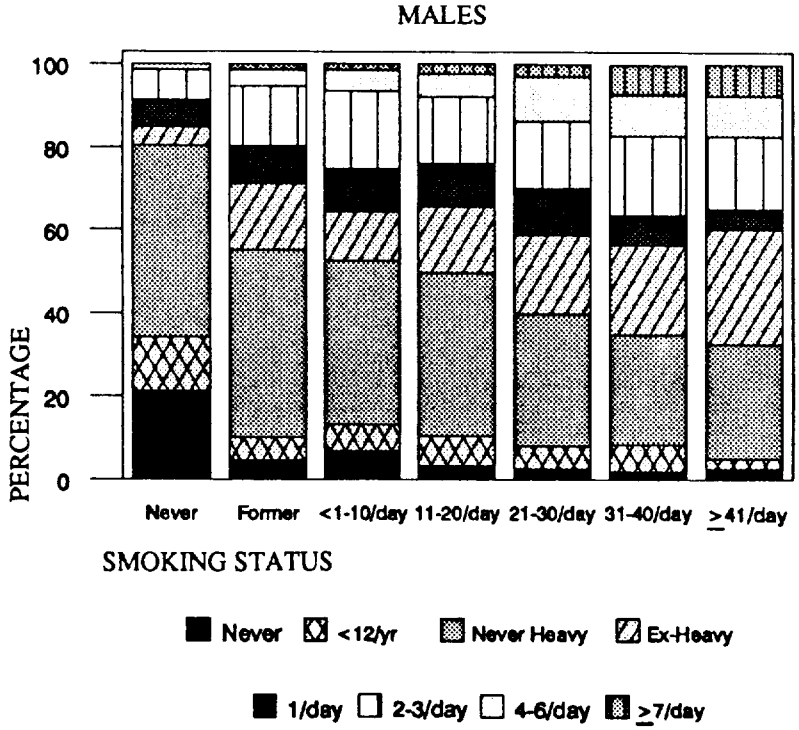

FIGURE 3.—Drinking relative to smoking status for men, 1983 NHIS (Kovar and Poe 1985)

NOTE: Samples for each category are, from never smoker to heaviest smoker, 1,397, 874, 295, 653, 263, 190, 57. NHIS=National Health Interview Survey.

SOURCE: Kozlowski and Ferrence (1990).

five times or more per week; they are as likely as current smokers to drink liquor this often. However, this represents a very small proportion of women. Female former smokers are less likely than current smokers and no more likely than never smokers to drink three beers or more when they drink beer or to have three drinks or more when they drink liquor.

These cross-sectional data are consistent with other cross-sectional data that demonstrate a relationship between alcohol use and smoking status (Istvan and Matarazzo 1984). However, the contribution of tobacco cessation to alcohol and drug use by individuals with alcohol and drug problems is unknown (Sobell et al. 1990). The majority of smokers consume approximately 1 pack per day, and most smokers do not have serious alcohol problems. The most significant effects might be seen in those few individuals who both smoke very heavily, more than 40 cigarettes per day, and use drugs or alcohol heavily (Kozlowski and Ferrence 1990). Bobo (1989) and Miller, Hedrik, and Taylor (1983) reported data that indicate that smoking cessation does not

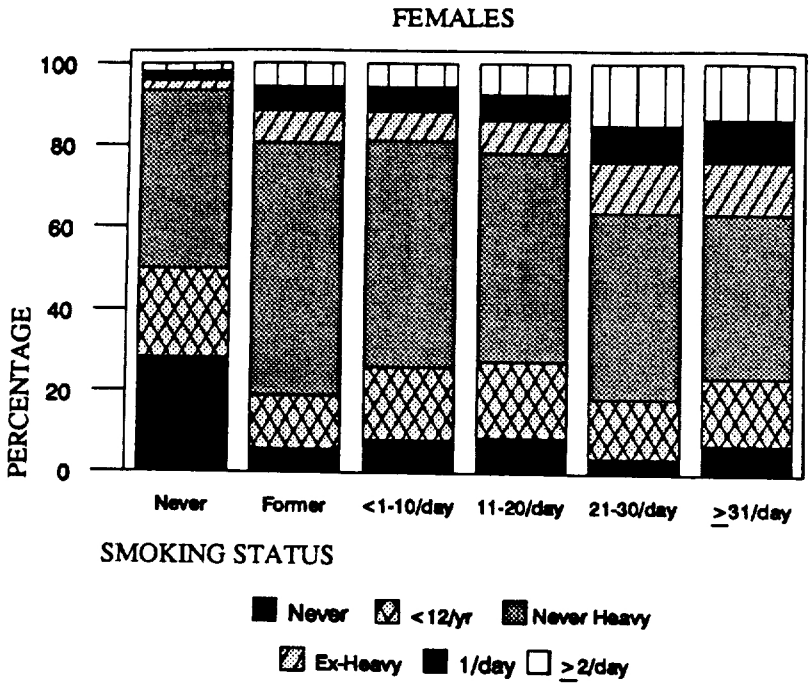

FIGURE 4.—Drinking relative to smoking status for women, 1983 NHIS (Kovar and Poe 1985)

NOTE: Samples for each category are, from never smoker to heaviest smoker, 2,661, 789, 505, 786, 205, 176. NHIS=National Health Interview Survey.

SOURCE: Kozlowski and Ferrence (1990).

impair the course of treatment for alcohol problems and may be associated with better outcomes.

Studies of Multiple Health Habits

It is of interest to examine not only single behaviors, such as diet or exercise, in relation to smoking cessation, but also combinations of behaviors. Use of alcohol and other substances, use of other tobacco products, coffee consumption, physical activity, and diet have been the health behaviors studied most widely in conjunction with smoking and smoking cessation.

Schoenborn and Benson (1988) reported on the following eight unhealthy behaviors surveyed in the 1985 NHIS: sleeping 6 hours or less, skipping breakfast, snacking daily, being less physically active than other persons of the same age, being sedentary in terms of leisure-time sports activities, being significantly overweight (10 percent or more based on the 1983 Metropolitan Life Insurance Company standards), drinking heavily

(an average of two drinks or more/day), and having five drinks or more on 10 days or more. The authors used age-adjusted percentages to eliminate age as a confounding factor. With the exception of snacking and being overweight, current smokers engaged in unhealthy habits at significantly higher rates than never smokers (Table 2). Former smokers more closely resembled never smokers than current smokers. Fewer former smokers and never smokers than current smokers slept 6 hours or less, never ate breakfast, were less physically active, or were sedentary. However, former smokers tended to snack daily and be overweight in slightly higher percentages than current smokers, which is concordant with the previously noted findings regarding dietary practices and smoking abstinence.

Marsden, Bray, and Herbold (1988) examined substance use and other health practices in a large cross-sectional study of more than 17,000 military personnel. These researchers found the number of positive health practices inversely related to use of alcohol, illicit drugs, and tobacco. On the basis of a very preliminary retrospective study of 35 heart disease patients, Finnegan and Suler (1985) concluded that former smokers (mean duration of abstinence, unspecified) were more likely to maintain diet and exercise changes. Former smokers may have represented a particularly adherent subgroup of patients, but the authors postulated that success in maintaining diet and exercise changes may have been influenced by the psychological effects of attempting cessation.

Maron and colleagues (1986) examined seatbelt use in a sample of high school students and found modest but significant negative effects of smoking, frequency of getting drunk, and illicit drug use (cocaine and marijuana), and positive effects of "heart-healthy nutrition" and physical activity on seatbelt use. In a study of 874 community college students, Castro and associates (1989) found that moderate-to-heavy smokers had exhibited more unhealthy behaviors than nonsmokers. As in some of the other cross-sectional studies reported here, these investigators did not distinguish former smokers from never smokers.

Among males, former smokers interviewed as part of the 1987 BRFSS (which examined multiple health behaviors) were more likely than current smokers but less likely than never smokers to use seatbelts. However, among females, never smokers and former smokers were equally likely to use seatbelts, and both were significantly more likely to use seatbelts than current smokers (Table 3). Long-time quitters were more likely than new quitters (<1 year) to use their seatbelts, although this association was small and significant only for men who had been abstinent from smoking cigarettes for 5 years or more and for women abstinent for 1 to 2 years and for 5 years or more (Table 5).

Among Multiple Risk Factor Intervention Trial (MRFIT) participants, Schoenenberger (1982) found that smokers who had quit between baseline and a 3-year followup survey made successful changes across a number of dimensions. Former smokers were more likely to avoid gaining weight, to lower their serum cholesterol, and, if hypertensive, to lower their blood pressure. Supporting the conclusions of Schoenenberger (1982) regarding MRFIT participants, Tuomilehto and associates (1986) studied a random sample of 2,119 Finnish subjects at 2 points in time and found that both men and women who had quit smoking between baseline and the 5-year followup reduced

their fat intake, increased their physical activity, and made more attempts to reduce body weight than did current smokers. Baseline differences suggested that these quitters (duration of abstinence not specified) may have been more health conscious at the outset.

Orleans and colleagues (1983) performed a prospective analysis of health behavior changes experienced by 72 employees quitting smoking between baseline and year one. As part of the "Live for Life" program they included baseline health behavior values, age, and sex as covariates. Their findings indicated an overall positive shift in healthy lifestyle with improvements in subjective health status, emotions, and well-being. New ex-smokers (average abstinence, 7 months) showed improvements over baseline in resting pulse, perceived personal control over preventable illness, knowledge of health risks, overall nutrition practices, regular moderate exercise, and seatbelt use. The only negative changes were body mass and weight changes associated with slightly less than a mean 6-pound weight gain, which took place along with an improvement in overall nutrition, and declines in job satisfaction measured by satisfaction with growth opportunities and personal relationships on the job.

Summary

In the absence of more systematic longitudinal research, data from cross-sectional and longitudinal studies suggest that abstinence from smoking is related to improvements in other positive lifestyle behaviors contributing to overall good health. These behaviors may be used by the former smoker to prevent relapse (e.g., exercise), to cope with adverse withdrawal symptoms (e.g., increased food intake as a response to increased appetite), or as part of a commitment to a healthier lifestyle. Exercise may help new quitters to remain abstinent and to avoid or minimize weight gain. The data from the MRFIT (Schoenenberger 1982) and other large data bases (Friedman et al. 1979) confirm that former smokers often take active steps to lower their disease risks. These studies should alleviate concerns that smoking cessation may result in unhealthy lifestyle shifts through unwanted symptom substitution.

Given the strong association between smoking and other kinds of substance use, it is important to know if smoking cessation impairs the ability to stop other drug use. The limited evidence suggests that this is not the case (Bobo 1989; Miller, Hedrik, Taylor 1983). How multiple drug use and multiple drug withdrawal may interact with cigarette smoking and its cessation is an area requiring study.

PARTICIPATION OF FORMER SMOKERS IN HEALTH-SCREENING PROGRAMS

The literature presented earlier in this Chapter suggests that former smokers are more likely than current smokers to engage in a variety of health-enhancing behaviors, such as regular physical activity. Another area in which improvement may occur for individuals who stop smoking is participation in, or benefits from, health-screening programs. Participation in programs of health screening by those who are presumably healthy and asymptomatic is a health-enhancing or health-protective behavior, much

like wearing seatbelts or performing regular exercise. This participation is to be distinguished from health screening sought for diagnostic purposes. Calnan and Rutter (1986) cautioned, however, that there are important conceptual differences between behaviors such as not smoking or regular flossing and utilization of screening. In the first case, the emphasis is on the individual performing the recommended action. In the second, the individual makes a decision to use the service, but a professional performs the procedure. Smokers exhibit a decreased propensity to use preventive services in contrast to nonsmokers. The data suggest that former smokers occupy an intermediate position between current and never smokers in their seeking of health screening.

Data from the large Johnson and Johnson "Live for Life" worksite trial discussed earlier showed that current smokers were less willing than former or never smokers to complete health risk assessments (Shipley et al. 1988). A survey of randomly selected nonrespondents to the "Live for Life" health screening found that significantly more nonrespondents reported ever having smoked cigarettes and significantly more female nonrespondents currently smoked (Settergren et al. 1983). Additional support for the position that smokers may have lower response rates to health risk appraisals is provided by Seltzer, Bossé, and Garvey (1974), who found current smokers significantly less likely than never smokers to respond to a health questionnaire.

One source of data about the health-screening practices of former smokers consists of results from a 1988 nationwide randomized survey of American Association of Retired Persons (AARP) members aged 50 and older to assess differences among current smokers, former smokers (abstinent for 1 week or longer with a mean duration of 19.3 years), and never smokers (Rimer et al. 1990). In addition to the usual quitting-related variables, respondents were asked about their use of health services, including routine cardiovascular and cancer screening. Questionnaires were received from 3,129 persons, a 54-percent response rate. In this older population for whom health screening is especially important, the never, current, and former smokers differed significantly on utilization of screening (Table 8). The results suggest that smoking may act as a deterrent to appropriate use of screening services for older smokers and possibly for younger smokers as well, or that there is a general unhealthy approach taken by smokers. That former smokers were more likely to avail themselves of preventive checks and services than current smokers suggests that former smokers may have a more preventive health orientation than current smokers, may participate in screening as an approach to maintain abstinence, or may be concerned about the effects of smoking on their health. As with exercise and other health promotion practices, the data are retrospective; therefore, it cannot be determined if the former smokers were always different from current smokers in their health screening habits or if they changed as a result of cessation.

The results of the AARP survey suggest that with time former smokers may resemble never smokers in their use of screening services. Maintaining health was the primary reason for quitting among former smokers who responded to the AARP survey; perhaps the subset of smokers who quit was more health conscious at the outset. Or having quit, former smokers may be more willing to take a proactive stand to maintain their health. It is also possible that having admitted vulnerability to the harms of smoking and

TABLE 8.—Physician visits and medical tests within the past year among AARP members aged 50 and older, by smoking status

	Current smokers (N=339) 11%	Former smokers (N=1489) 47%	Never smokers (N=1316) 42%	Overall (N=3147) 100%	p-value[a]
Physician visit (≥1)	77	88	86	86	<0.001
Complete physical or checkup	50	60	60	59	<0.001
Blood pressure check	79	90	87	87	<0.001
Electrocardiogram	41	52	45	48	<0.001
Stool blood test	28	38	36	36	<0.001
Digital rectal examination	23	34	30	31	<0.001
Mammogram (women only)	24	41	36	36	<0.014
Pap smear (women only)	33	43	39	40	<0.006

NOTE: All rates are age adjusted. AARP=American Association of Retired Persons.
[a]Current smokers vs. former or never smokers.
SOURCE: Rimer et al. (1990).

experiencing the benefits of quitting, former smokers are more amenable to adopting other health-enhancing behaviors. This would be consistent with the tenets of the Health Belief Model (Janz and Becker 1984) and with preliminary findings about the increased value of health expressed by self-defined former smokers (Tipton and Riebsame 1987).

In two measures of disease prevention assessed in the 1987 BRFSS data, male former smokers appeared to be more health conscious than current smokers and at least as much as never smokers (Table 5). These individuals are significantly more likely than never smokers to have had their cholesterol tested in the past year; never smokers, in turn, are more likely than current smokers to have had this test. Although former smokers were slightly more likely than never smokers to have had a flu shot in the past month, this difference was not statistically significant. Both former smokers and never smokers were significantly more likely to have had the shot than were current smokers. Female former smokers were more likely to have had their cholesterol tested than were never smokers, but were not significantly different from current smokers. Women in all three smoking categories were similar, indicating no statistically significant differences in their probability of having received a flu shot in the past month. Among former

smokers, length of time since cessation did not predict any differences in either of these behaviors among men or women.

The 1987 NHIS data show higher rates of preventive care among former smokers than among never or current smokers (Table 4). Women who had quit were significantly more likely to report ever having had a digital rectal exam, a stool blood test, and a proctoscopic exam. Women who had stopped smoking were also significantly more likely to have had a Pap smear or a breast examination within the past year and to ever have had a mammogram. However, women did not differ by smoking status in their practice of monthly breast self-examination. These data did not control for age and may reflect the greater number of former smokers in the higher risk ages, in addition to the unavoidable problems inherent in cross-sectional data such as not being able to determine the order of smoking cessation and preventive care.

A study of participation among 600 female members of a health maintenance organization showed that female smokers were less likely than former smokers or never smokers to complete a health risk assessment or to obtain mammograms (Rimer et al. 1988, 1989). When residents of a large retirement community were surveyed about their health habits, Chao and colleagues (1987) found differential use of several screening tests, including blood pressure, fecal occult blood tests, mammograms, and Pap tests among current smokers, former smokers, and never smokers, with former smokers having the highest rates of screening. Macrae and colleagues (1984) studied 581 individuals who completed health questionnaires before being offered fecal occult blood tests. These researchers found that whereas smokers were not less likely to decline the initial offer, they were significantly less likely to comply, that is, to follow through with the test. These same investigators suggested that smokers may have been more susceptible to interpersonal pressure publicly, but later succumbed to a strategy of defensive avoidance. Although Macrae and associates (1984) did not distinguish the screening behavior of never smokers and former smokers, other studies reported here suggest that these groups would have been similar.

The suggestion that former smokers are more oriented to prevention and early detection is also consistent with Verbrugge's (1982) conclusions that smokers have poorer health, increased risks due to smoking, and are more oriented to remedial as opposed to preventive health actions. As smokers move toward maintenance of nonsmoking, they appear to value their health more highly (Tipton and Riebsame 1987; Horwitz, Hindi-Alexander, Wagner 1985). This finding is consistent with the greater utilization of screening found among AARP former smokers (Rimer et al. 1990). These findings undoubtedly are affected by the relationship between socioeconomic status (SES) and preventive care utilization. That is, lower SES is associated with less use of preventive services (Dutton 1986). To the extent that they are represented disproportionately among those of lower SES, current smokers will be at risk for underuse of age-appropriate prevention and early detection services.

The literature about the health screening practices of former smokers is suggestive but inconclusive. It appears that former smokers are more likely than current smokers, but perhaps less likely than never smokers, to seek regular cardiovascular and cancer screening.

SUMMARY

The data suggest that as the duration of abstinence lengthens, former smokers begin to resemble never smokers in their utilization of health screening and their participation in a variety of health-enhancing behaviors, such as physical activity. However, it is not clear if former smokers are different from current smokers at the outset, if the method of cessation affects these outcomes, or if the reason for quitting affects subsequent health practices. There is reason to believe that former smokers, especially those who quit while they are healthy, come to value their health more and take health-enhancing action as an extension of this valuing (Tipton and Riebsame 1987). These conclusions are consistent with the Health Belief Model (Janz and Becker 1984) and the Protection Motivation Theory (Prentice-Dunn and Rogers 1986). Longitudinal, prospective studies would make an important contribution to understanding these issues.

Increased participation in screening and other health-enhancing behaviors also may result from enhanced self-esteem and an increased sense of self-control. Ockene and colleagues (1988) concluded that successful behavior change is likely to promote a perception of general self-efficacy. The perception of oneself as capable may generalize to other areas of one's life. Kronenfeld and associates (1988) stressed that it may be difficult for most people to change multiple habits simultaneously. Having gained a sense of mastery from stopping smoking, former smokers may attempt to improve other health practices. However, some studies suggest that former smokers seem to undertake a number of health-enhancing steps proximally, if not simultaneously (Schoenenberger 1982; Friedman et al. 1979; Gerace et al., in press). For example, quitters in MRFIT (baseline smokers who were biochemically verified ex-smokers at the sixth annual visit) reported a greater decrease in their number of alcoholic drinks per day and sucrose consumption than nonquitters (Gerace et al., in press).

CONCLUSIONS

1. Short-term consequences of smoking cessation include anxiety, irritability, frustration, anger, difficulty concentrating, increased appetite, and urges to smoke. With the possible exception of urges to smoke and increased appetite, these effects soon disappear.
2. Smokers who abstain from smoking show short-term impairment of performance on a variety of simple attention tasks, which improves with nicotine administration. Memory, learning, and the performance of more complex tasks have not been clearly shown to be impaired. Whether the self-reported improvement in attention tasks upon nicotine administration is due entirely to relief of withdrawal effects or is also due in part to enhancement of performance above the norm is unclear.
3. In comparison with current smokers, former smokers have a greater perceived ability to achieve and maintain smoking abstinence (self-efficacy) and a greater perceived control over personal circumstances (locus of control).
4. Former smokers, compared with current smokers, practice more health-promoting and disease-preventing behaviors.

References

ABRAMS, D.B., MONTI, P.M., PINTO, R.P., ELDER, J.P., BROWN, R.A., JACOBUS, S.I. Psychosocial stress and coping in smokers who relapse or quit. *Health Psychology* 6(4):289–303, 1987.

ADESSO, V.J. Some correlates between cigarette smoking and alcohol use. *Addictive Behaviors* 4:269–273, 1979.

AMERICAN PSYCHIATRIC ASSOCIATION. *Diagnostic and Statistical Manual of Mental Disorders*, Third Edition, revised. Washington, D.C.: American Psychiatric Association, 1987, pp. 165–168.

ASHENBERG, Z.S., MORGAN, G.D., FISHER, E.B. Psychological stress and smoking recidivism: A prospective assessment. Paper presented at the SBM Fifth Annual Conference, Philadelphia, Pennsylvania, 1984.

BACKON, J. Prostaglandins, depression and not smoking. (Letter.) *American Journal of Psychiatry* 140(5):645, May 1983.

BAER, J.S. Patterns of relapse after cessation of smoking. Unpublished doctoral dissertation, University of Oregon, Eugene, 1985.

BANDURA, A. Self-efficacy mechanism in human agency. *American Psychologist* 37(2):122–147, February 1982.

BAREFOOT, J.C., GIRODO, M. The misattribution of smoking cessation symptoms. *Canadian Journal of Behavioral Science* 4(4):358–363, 1972.

BARRIOS, F.X., NIEHAUS, J.C. The influence of smoker status, smoking history, sex, and situational variables on smokers' self-efficacy. *Addictive Behaviors* 10:425–429, 1985.

BELLOC, N.B., BRESLOW, L. Relationship of physical health status and health practices. *Preventive Medicine* 1:409–421, 1972.

BENOWITZ, N.L. Pharmacologic aspects of cigarette smoking and nicotine addiction. *New England Journal of Medicine* 319(20):1318–1330, November 17, 1988.

BENOWITZ, N.L., HALL, S.M., MODIN, G. Persistent increase in caffeine concentrations in people who stop smoking. *British Medical Journal* 298:1075–1076, April 22, 1989.

BILLINGS, A.G., MOOS, R.H. The role of coping responses and social resources in attenuating the stress of life events. *Journal of Behavioral Medicine* 4:139–146, 1981.

BLAIR, A., BLAIR, S.N., HOWE, H.G., PATE, R.R., ROSENBERG, M., PARKER, G.M., PICKLE, L.W. Physical, psychological, and sociodemographic differences among smokers, ex-smokers, and nonsmokers in a working population. *Preventive Medicine* 9:747–759, 1980.

BLITTNER, M., GOLDBERG, J., MERBAUM, M. Cognitive self-control factors in the reduction of smoking behavior. *Behavior Therapy* 9:553–561, 1978.

BOBO, J.K. Nicotine dependence and alcoholism epidemiology and treatment. *Journal of Psychoactive Drugs* 21(3):323–329, July–September 1989.

BOSSÉ, R., GARVEY, A.J., COSTA, P.T. Predictors of weight change following smoking cessation. *International Journal of the Addictions* 15:969–991, 1980.

BROWN, C.R., JACOB, P. III, WILSON, M., BENOWITZ, N.L. Changes in rate and pattern of caffeine metabolism after cigarette abstinence. *Clinical Pharmacology and Therapeutics* 43(5):488–491, May 1988.

CALNAN, M., RUTTER, D.R. Preventive health practices and their relationship with sociodemographic characteristics. *Health Education Research* 1(4):247–253, 1986.

CARMODY, T.P., BRISCHETTO, C.S., PIERCE, D.K., MATARAZZO, J.D., CONNOR, W.E. A prospective five-year follow-up of smokers who quit on their own. *Health Education Research* 1(2):101–109, 1986.

CARROLL, M.E., MEISCH, R.A. Increased drug-reinforced behavior due to food deprivation. In: Thompson, T., Dews, P.B., Barrett, J.E. (eds.) *Advances in Behavioral Pharmacology*, Volume 4. New York: Academic Press, 1984, pp. 47–88.

CASTRO, F.G., NEWCOMB, M.D., MCCREARY, C., BAEZCONDE-GARBANATI, L. Cigarette smokers do more than just smoke cigarettes. *Health Psychology* 8(1):107–129, 1989.

CHAO, A., PAGANINI-HILL, A., ROSS, R.K., HENDERSON, B.E. Use of preventive care by the elderly. *Preventive Medicine* 16:710–722, 1987.

CHAPMAN, R.F., SMITH, J.W., LAYDEN, T.A. Elimination of cigarette smoking by punishment and self-management training. *Behavioral Research and Therapy* 9:255–264, 1971.

CLARKE, P.B.S. Nicotine and smoking: A perspective from animal studies. *Psychopharmacology* 92:135-143, 1987.

COELHO, R.J. Self-efficacy and cessation of smoking. *Psychological Reports* 54:309–310, 1984.

COHEN, S., KAMARCK, T., MERMELSTEIN, R. A global measure of perceived stress. *Journal of Health and Social Behavior* 24:385–396, December 1983.

COHEN, S., LICHTENSTEIN, E. Perceived stress, quitting smoking, and smoking relapse. *Health Psychology*, in press.

CONDIOTTE, M.M., LICHTENSTEIN, E. Self-efficacy and relapse in smoking cessation programs. *Journal of Consulting and Clinical Psychology* 49(5):648–658, October 1981.

CONWAY, T.L., CRONAN, T.A. Smoking, exercise, and physical fitness. Paper presented at the 1988 Annual Convention of the American Psychological Association, Atlanta, Georgia, August 1988a.

CONWAY, T.L., CRONAN, T.A. Smoking and physical fitness among navy shipboard men. *Military Medicine* 153(11):589–594, November 1988b.

COVEY, L.S., GLASSMAN, A.H., STETNER, F. Depression and depressive symptoms in smoking cessation. *Comprehensive Psychiatry*, in press.

CUMMINGS, K.M., GIOVINO, G., JAÈN, C.R., EMRICH, L.J. Reports of smoking withdrawal symptoms over a 21 day period of abstinence. *Addictive Behaviors* 10(4):373–381, 1985.

DUFFY, J., HALL, S.M. *Weight control and maintaining nonsmoking: Two incompatible goals?* Paper presented at the annual convention of the American Psychological Association, Boston, 1990.

DUNNE, M.P., MACDONALD, D., HARTLEY, L.R. The effects of nicotine upon memory and problem solving performance. *Physiology and Behavior* 37(6):849–854, 1986.

DUTTON, D. Financial, organizational and professional factors affecting health care utilization. *Social Science and Medicine* 23(7):721–735, 1986.

EISINGER, R.A. Psychosocial predictors of smoking recidivism. *Journal of Health and Social Behavior* 12:355–362, December 1971.

EMLEY, G.S., HUTCHINSON, R.R. Behavioral effects of nicotine. In: Thompson, T., Dews, P.B., Barrett, J.E. (eds.) *Advances in Behavioral Pharmacology*, Volume 4. New York: Academic Press, 1984, pp. 105–129.

EMMONS, K.M., WEIDNER, G., FOSTER, W.M., COLLINS, R.L. The effect of smoking cessation on cardiovascular reactivity to stress. Paper presented at the 20th Annual Meeting of the Association for Advancement of Behavior Therapy, Chicago, Illinois, 1986.

EMONT, S.L., CUMMINGS, K.M. Weight gain following smoking cessation: A possible role for nicotine replacement in weight management. *Addictive Behaviors* 12:151–155, 1987.

EYSENK, J.H., EYSENK, S.B.G. *Manual of the Eysenk Personality Questionnaire*. London: Hodder and Stoughton, 1975.

FAGERSTRÖM, K.-O. Measuring degree of physical dependence to tobacco smoking with reference to individualization of treatment. *Addictive Behaviors* 3:235–241, 1978.

FAGERSTRÖM, K.-O. Physical dependence on nicotine as a determinant of success in smoking cessation. *World Smoking and Health* 5:22–23, 1980.

FINNEGAN, D.L., SULER, J.R. Psychological factors associated with maintenance of improved health behaviors in postcoronary patients. *Journal of Psychology* 119(1):87–94, January 1985.

FIORE, M.C., NOVOTNY, T.E., PIERCE, J.P., GIOVINO, G.A., HATZIANDREU, E.J., NEWCOMB, P.A., SURAWICZ, T.S., DAVIS, R.M. Methods used to quit smoking in the United States. Do cessation programs help? *Journal of the American Medical Association* 263(20):2760–2765, May 23/30, 1990.

FLEISHER, L., KEINTZ, M., RIMER, B., UTT, M., WORKMAN, S., ENGSTROM, P.F. Process evaluation of a minimal-contact smoking cessation program in an urban nutritional assistance (WIC) program. In: Engstrom, P.F., Rimer, B., Mortenson, L.E. (eds.) *Advances in Cancer Control*. New York: Alan R. Liss, Inc., in press.

FOLKMAN, S., LAZARUS, R.S. Coping as a mediator of emotion. *Journal of Personality and Social Psychology* 54(3):466–475, 1988.

FRANCIS, D.A., NELSON, A.A. JR. Effect of patient recognition of tranquilizers on their use in alcohol detoxification. *American Journal of Hospital Pharmacy* 41:488–492, March 1984.

FRERICHS, R.R., ANESHENSEL, C.S., CLARK, V.A., YOKOPENIC, P. Smoking and depression: A community survey. *American Journal of Public Health* 71(6):637–640, June 1981.

FRIEDMAN, G.D., SIEGELAUB, A.B., DALES, L.G., SELTZER, C.C. Characteristics predictive of coronary heart disease in ex-smokers before they stopped smoking: Comparison with persistent smokers and nonsmokers. *Journal of Chronic Diseases* 32:175–190, 1979.

GERACE, T.A., HOLLIS, J., OCKENE, J.K., SVENDSEN, K. Cigarette smoking intervention in the Multiple Risk Factor Intervention Trial: Results and relationships to other outcomes. 5. Relationship of smoking cessation to diastolic blood pressure, body weight, and plasma lipids. *Preventive Medicine*, in press.

GIANNETTI, V.J., REYNOLDS, J., RIHN, T. Factors which differentiate smokers from ex-smokers among cardiovascular patients: A discriminant analysis. *Social Science and Medicine* 20(3):241–245, 1985.

GOLDBOURT, U., MEDALIE, J.H. Characteristics of smokers, nonsmokers and ex-smokers among 10,000 adult males in Israel. I. Distribution of selected sociodemographic and behavioral variables and the prevalence of disease. *Israel Journal of Medical Science* 11(11):1079–1101, November 1975.

GOLDSTEIN, M.G., WARD, K., NIAURA, R. Nicotine gum, tobacco dependence and withdrawal. Paper presented at the annual meeting of the American Psychiatric Association, Montreal, Canada, May 1988.

GORDON, N.P., CLEARY, P.D. Smoking cessation in a national probability sample cohort 1979–1980: Health attitudes, practices, and smoking behavior associated with quit attempts and behavior change at one year. *Smoking and Behavior Policy*. Cambridge, Massachusetts: Harvard University, October 1986.

GORDON, N.P., POLEN, M.R. Predicting success for men and women smokers in stop smoking programs. Paper presented at the 115th Annual Meeting of the American Public Health Association, New Orleans, Louisiana, October 20, 1987.

GOTTLEIB, A.M., KILLEN, J.D., MARLATT, G.A., TAYLOR, C.B. Psychological and pharmacological influences in cigarette smoking withdrawal: Effects of nicotine gum and expectancy on smoking withdrawal symptoms and relapse. *Journal of Consulting and Clinical Psychology* 55(4):606–608, 1987.

GRAHAM, S., GIBSON, R.W. Cessation of patterned behavior: Withdrawal from smoking. *Social Science and Medicine* 5:319–337, 1971.

GRITZ, E.R. Smoking behavior and tobacco abuse. In: Mello, N.K. (ed.) *Advances in Substance Abuse*, Volume 1. Greenwich, Connecticut: JAI Press, Inc., 1980, pp. 91–158.

GRITZ, E.R., CARR, C.R., MARCUS, A.C. The tobacco withdrawal syndrome in unaided quitters. Unpublished manuscript, 1990.

GROSS, J., STITZER, M.L. Nicotine replacement: Ten-week effects on tobacco withdrawal symptoms. *Psychopharmacology* 98:334–341, 1989.

GRUNBERG, N.E., BAUM, A. Biological commonalities of stress and substance abuse. In: Shiffman, S., Wills, T.A. (eds.) *Coping and Substance Use*. New York: Academic Press, 1985, pp. 25–61.

GRUNBERG, N.E., BOWEN, D.J. Coping with the sequelae of smoking cessation. *Journal of Cardiopulmonary Rehabilitation* 5(6):285–289, June 1985.

GUILFORD J.S. *Factors Related to Successful Abstinence From Smoking*. Pittsburgh, Pennsylvania: American Institute for Research, July 1966.

HAJEK, P., JARVIS, M.J., BELCHER, M., SUTHERLAND, G., FEYERABEND, C. Effect of smoke-free cigarettes on 24 h cigarette withdrawal: A double-blind placebo-controlled study. *Psychopharmacology* 97:99–102, 1989.

HALL, S.M. The abstinence phobias: Links between substance abuse and anxiety. *International Journal of the Addictions* 19(6):613–631, 1984.

HALL, S.M., BACHMAN, J., HENDERSON, J.B., BARSTOW, R., JONES, R.T. Smoking cessation in patients with cardiopulmonary disease: An initial study. *Addictive Behaviors* 8:33–42, 1983.

HALL, S.M., GINSBERG, D., JONES, R.T. Smoking cessation and weight gain. *Journal of Consulting and Clinical Psychology* 54:342–346, 1986.

HATSUKAMI, D.K., HUGHES, J.R., PICKENS, R.W. Characterization of tobacco withdrawal: Physiological and subjective effects. In: Grabowski, J., Hall, S. (eds.) *Pharmacological Adjuncts in Smoking Cessation*, NIDA Research Monograph 53. DHHS Publication No. (ADM) 85-1333, 1985, pp. 56–67.

HEIMSTRA, N.W., FALLESEN, J.J., KINSLEY, S.A., WARNER, N.W. The effects of deprivation of cigarette smoking on psychomotor performance. *Ergonomics* 23(11):1047–1055, 1980.

HEINOLD, J.W., GARVEY, A.J., GOLDIE, C., BOSSÉ, R. Retrospective analysis in smoking cessation research. *Addictive Behaviors* 7:347–353, 1982.

HENNINGFIELD, J.E. Behavioral pharmacology of cigarette smoking. In: Thompson, T., Dews, P.B., Barrett, J.E. (eds.) *Advances in Behavioral Pharmacology*, Volume 4. New York: Academic Press, 1984, pp. 131–210.

HINDMARCH, I., KERR, J.S., SHERWOOD, N. Effects of nicotine gum on psychomotor performance in smokers and non-smokers. *Psychopharmacology* 100:535–541, 1990.

HORWITZ, M.B., HINDI-ALEXANDER, M., WAGNER, T.J. Psychosocial mediators of abstinence, relapse, and continued smoking: A one-year follow-up of a minimal intervention. *Addictive Behaviors* 10:29–39, 1985.

HUGHES, J.R. Identification of the dependent smoker: Validity and clinical utility. *Behavioral Medicine Abstracts* 5(4):202–204, Fall 1984.

HUGHES, J.R. Craving as a psychological construct. *British Journal of Addiction* 82:38–39, 1986a.

HUGHES, J.R. Problems of nicotine gum. In: Ockene, J.K. (ed.) *Pharmacologic Treatment of Tobacco Dependence: Proceedings of the World Congress, November 4–5, 1985*. Cambridge, Massachusetts: Institute for the Study of Smoking Behavior and Policy, 1986b, pp. 141–147.

HUGHES, J.R. Clonidine, depression, and smoking cessation. *Journal of the American Medical Association* 259(19):2901–2902, May 20, 1988.

HUGHES, J.R. Tobacco withdrawal in self-quitters. *American Review of Respiratory Disease*, 1990.

HUGHES, J.R., GULLIVER, S.B., AMORI, G., MIREAULT, G., FENWICK, J. Effect of instructions and nicotine on smoking cessation, withdrawal symptoms and self-administration of nicotine gum. *Psychopharmacology* 99:486–491, 1989.

HUGHES, J.R., GUST, S.W., PECHACEK, T.F. Prevalence of tobacco dependence and withdrawal. *American Journal of Psychiatry* 144(2):205–208, February 1987.

HUGHES, J.R., GUST, S.W., SKOOG, K., KEENAN, R., FENWICK, J.W. Symptoms of tobacco withdrawal: A replication and extension. *Archives of General Psychiatry*, 1990.

HUGHES, J.R., HATSUKAMI, D. Signs and symptoms of tobacco withdrawal. *Archives of General Psychiatry* 43(3):289–294, March 1986.

HUGHES, J.R., HIGGINS, S.T., HATSUKAMI, D. Effects of abstinence from tobacco: A critical review. In: Kozlowski, L.T., Annis, H., Cappell, H.D., Glaser, F., Goodstadt, M., Israel, Y., Kalant, H., Sellers, E.M., Vingilis, E. (eds.) *Research Advances in Alcohol and Drug Problems*, Volume 10. New York: Plenum Press, 1990, pp. 317–398.

HUGHES, J.R., KEENAN, R.M., YELLIN, A. Effect of tobacco withdrawal on sustained attention. *Addictive Behaviors* 14:577–580, 1989.

HUGHES, J.R., KRAHN, D. Blindness and the validity of the double-blind procedure. *Journal of Clinical Psychopharmacology* 5(3):138–142, 1985.

IKARD, F.F., GREEN, D.E., HORN, D. A scale to differentiate between types of smoking as related to the management of affect. *International Journal of the Addictions* 4(4):649–659, December 1969.

ISTVAN, J., MATARAZZO, J.D. Tobacco, alcohol, and caffeine use: A review of their interrelationships. *Psychological Bulletin* 95(2):301–326, 1984.

JANZ, N.K., BECKER, M.H. The health belief model: A decade later. *Health Education Quarterly* 11(1):1–47, Spring 1984.

JARVIS, M. Gender and smoking: Do women really find it harder to give up? *British Journal of Addiction* 79(4):383–387, December 1984.

KAPLAN, R.M. Health-related quality of life in cardiovascular disease. *Journal of Consulting and Clinical Psychology* 56(3):382–392, 1988.

KATZ, R.C., SINGH, N.N. Reflections on the ex-smoker: Some findings on successful quitters. *Journal of Behavioral Medicine* 9(2):191–202, 1986.

KEENAN, R.M., HATSUKAMI, D.K., ANTON, D.J. The effects of short-term smokeless tobacco deprivation on performance. *Psychopharmacology* 98:126-130, 1989.

KILLEN, J., TAYLOR, C., MACCOBY, N., YOUNG, J. Investigating predictors of smoking relapse: An analysis of biochemical and self-report measures of tobacco dependence. Unpublished manuscript, 1990.

KILLEN, J.D., MACCOBY, N., TAYLOR, C.B. Nicotine gum and self-regulation training in smoking relapse prevention. *Behavior Therapy* 15:234–248, 1984.

KNUDSEN, N., SCHULMAN, S., FOWLER, R., VAN DEN HOEK, J. Why bother with stop-smoking education for lung cancer patients? *Oncology Nursing Forum* 11(3):30–33, May–June 1984.

KOVAR, M.G., POE, G.S. The National Health Interview Survey design, 1973–84, and procedures, 1975–83. National Center for Health Statistics, Series 1, No. 18. DHHS Publication No. (PHS) 85-1320, 1985.

KOZLOWSKI, L.T. Effects of caffeine consumption on nicotine consumption. *Psychopharmacology* 47(2):165–168, 1976.

KOZLOWSKI, L.T., FERRENCE, R.G. Statistical control in research on alcohol and tobacco: An example from research on alcohol and mortality. *British Journal of Addiction* 85(2):271–278, February 1990.

KOZLOWSKI, L.T., FERRENCE, R.G., CORBIT, T. Tobacco use: A perspective for alcohol and drug researchers. *British Journal of Addiction* 85:245, 1990.

KOZLOWSKI, L.T., MANN, R.E., WILKINSON, D.A., POULOS, C.X. "Cravings" are ambiguous: Ask about urges or desires. *Addictive Behaviors* 14:443–445, 1989.

KOZLOWSKI, L.T., WILKINSON, D.A. Use and misuse of the concept of "craving" by alcohol, tobacco, and drug researchers. *British Journal of Addiction* 82(1):31–36, January 1987a.

KOZLOWSKI, L.T., WILKINSON, D.A. Comments on Kozlowski and Wilkinson's use and misuse of the concept of craving by alcohol, tobacco and drug researchers: A reply from the authors. *British Journal of Addiction* 82:489–492, 1987b.

KOZLOWSKI, L.T., WILKINSON, D.A., SKINNER, W., KENT, C., FRANKLIN, T., POPE, M.A. Comparing tobacco cigarette dependence with other drug dependencies: Greater or equal "difficulty quitting" and "urges to use," but less pleasure from cigarettes. *Journal of the American Medical Association* 261(6):898–901, February 10, 1989.

KRONENFELD, J.J., GOODYEAR, N., PATE, R., BLAIR, A., HOWE, H., PARKER, G., BLAIR, S.N. The interrelationship among preventive health habits. *Health Education Research* 3(3):317–323, 1988.

LADER, M.H., HIGGITT, A.C. Management of benzodiazepine dependence—Update 1986. *British Journal of Addiction* 81(1):7–10, February 1986.

LARSON, P.S., FINNEGAN, J.K., HAAG, H.B. Observations on the effect of cigarette smoking on the fusion frequency of flicker. *Journal of Clinical Investigation* 29:483–486, 1950.

LAWRENCE, P.S., AMOEDI, N., MURRAY, A. Withdrawal symptoms associated with smoking cessation. Paper presented at the Annual Convention of the Association for the Advancement of Behavior Therapy, Los Angeles, November 1982.

LICHTENSTEIN, E., GLASGOW, R.E., ABRAMS, D.B. Social support in smoking cessation: In search of effective interventions. *Behavior Therapy* 17:607–619, 1986.

LUDWIG, A.M., WIKLER, A. "Craving" and relapse to drink. *Journal of Studies on Alcohol* 35:108–130, 1974.

LYON, R.J., TONG, J.E., LEIGH, G., CLARE, G. The influence of alcohol and tobacco on the components of choice reaction time. *Journal of Studies on Alcohol* 36:587–596, 1975.

MACANDREW, C. On the possibility of the psychometric detection of persons who are prone to the abuse of alcohol and other substances. *Addictive Behaviors* 4(1):11–20, 1979.

MACERA, C.A., PATE, R.R., DAVIS, D.R. Runners' health habits, 1985—"The Alameda 7" revisited. *Public Health Reports* 104(4):341–349, July–August 1989.

MACRAE, F.A., HILL, D.J., ST. JOHN, D.J.B., AMBIKAPATHY, A., GARNER, J.F., BALLARAT GENERAL PRACTITIONER RESEARCH GROUP. Predicting colon cancer screening behavior from health beliefs. *Preventive Medicine* 13:115–126, 1984.

MARLATT, G.A. Relapse prevention: Theoretical rationale and overview of the model. In: Marlatt, G.A., Gordon, J.R. (eds.) *Relapse Prevention: Maintenance Strategies in the Treatment of Addictive Behaviors*. New York: Guilford Press, 1985a, pp. 3–67.

MARLATT, G.A. Cognitive factors in the relapse process. In: Marlatt, G.A., Gordon, J.R. (eds.) *Relapse Prevention: Maintenance Strategies in the Treatment of Addictive Behaviors*. New York: Guilford Press, 1985b, pp. 128–193.

MARLATT, G.A. Lifestyle modification. In: Marlatt, G.A., Gordon, J.R. (eds.) *Relapse Prevention: Maintenance Strategies in the Treatment of Addictive Behaviors*. New York: Guilford Press, 1985c, pp. 280–344.

MARLATT, G.A. Craving notes. *British Journal of Addiction* 82:42–43, 1987.

MARLATT, G.A., GORDON, J.R. Determinants of relapse: Implications for the maintenance of behavior change. In: Davidson, P.O., Davidson, S.M. (eds.) *Behavioral Medicine: Changing Health Lifestyles*. New York: Brunner/Mazel, Inc., 1980, pp. 410–452.

MARLATT, G.A., GORDON, J.R. (eds.) *Relapse Prevention: Maintenance Strategies in the Treatment of Addictive Behaviors*. New York: Guilford Press, 1985.

MARON, D.J., TELCH, M.J., KILLEN, J.D., VRANIZAN, K.M., SAYLOR, K.E., ROBINSON, T.N. Correlates of seat-belt use by adolescents: Implications for health promotion. *Preventive Medicine* 15:614–623, 1986.

MARSDEN, M.E., BRAY, R.M., HERBOLD, J.R. Substance use and health among U.S. military personnel: Findings from the 1985 worldwide survey. *Preventive Medicine* 17:366–376, 1988.

MARTIN, J.E., DUBBERT, P.M. Exercise applications and promotion in behavioral medicine: Current status and future directions. *Journal of Consulting and Clinical Psychology* 50(6):1004–1017, 1982.

MARTIN, W.R., JASINSKI, D.R. Physiological parameters of morphine dependence in man—Tolerance, early abstinence, protracted abstinence. *Journal of Psychiatric Research* 7:9–17, 1969.

MCINTYRE, K.O., LICHTENSTEIN, E., MERMELSTEIN, R.J. Self-efficacy and relapse in smoking cessation: A replication and extension. *Journal of Consulting and Clinical Psychology* 51(4):632–633, 1983.

MERMELSTEIN, R., COHEN, S., LICHTENSTEIN, E., BAER, J.S., KAMARCK, T. Social support and smoking cessation and maintenance. *Journal of Consulting and Clinical Psychology* 54(4):447–453, 1986.

MILLER, W.R., HEDRIK, K.E., TAYLOR, C.A. Addictive behaviors and life problems before and after behavioral treatment of problem drinkers. *Addictive Behaviors* 8(4):403–412, 1983.

MLOTT, S.R, MLOTT, Y.D. Dogmatism and locus of control in individuals who smoke, stopped smoking and never smoked. *Journal of Community Psychology* 3:53–57, 1974.

MOTHERSILL, K.J., MCDOWELL, I., ROSSER, W. Subject characteristics and long term post-program smoking cessation. *Addictive Behaviors* 13(1):29–36, 1988.

MURRAY, A.L., LAWRENCE, P.S. Sequelae to smoking cessation: A review. *Clinical Psychology Review* 4:143–157, 1984.

NATIONAL CENTER FOR HEALTH STATISTICS. Massey, J.T., Moore, T.F., Parsons, V.L., Tadros, W. *Design and Estimation for the National Health Interview Survey, 1985–94*. Series 2, No. 110, August 1989.

NIAURA, R., GOLDSTEIN, M.G., WARD, K.D., ABRAMS, D.B. Reasons for smoking and severity of residual nicotine withdrawal symptoms when using nicotine chewing gum. *British Journal of Addiction* 84:681–687, 1989.

NICKI, R.M., REMINGTON, R.E., MACDONALD, G.A. Self-efficacy, nicotine-fading/self-monitoring and cigarette-smoking behaviour. *Behavioral Research and Therapy* 22(5):477–485, 1984.

OCKENE, J.K., BENFARI, R.C., NUTTALL, R.L., HURWITZ, I., OCKENE, I.S. Relationship of psychosocial factors to smoking behavior change in an intervention program. *Preventive Medicine* 11:13–28, 1982.

OCKENE, J.K., NUTALL, R., BENFARI, R.C., HURWITZ, I., OCKENE, I.S. A psychosocial model of smoking cessation and maintenance of cessation. *Preventive Medicine* 10:623–638, 1981.

OCKENE, J.K., SORENSEN, G., KABAT-ZINN, J., OCKENE, I.S., DONNELLY, G. Benefits and costs of lifestyle change to reduce risk of chronic disease. *Preventive Medicine* 17:224–234, 1988.

OLBRISCH, M., OADES-SOUTHER, D. *Smoking Cessation and Changes in Food, Alcohol, and Caffeine Intake*. Paper presented at the annual convention of the American Psychological Association, Washington, D.C., 1986.

ORLEANS, C.T. Understanding and promoting smoking cessation: Overview and guidelines for physician intervention. *Annual Review of Medicine* 36:51–61, 1985.

ORLEANS, C.T., SHIPLEY, R.H. Assessment in smoking cessation research: Some practical guidelines. In: Keefe, F.J., Blumenthal, J.A. (eds.) *Assessment Strategies in Behavioral Medicine*. New York: Grune and Stratton, 1982.

ORLEANS, C.T., SHIPLEY, R.H., WILBUR, C., PISERCHIA, P., WHITEHURST, D. Wide-ranging improvements in employee health lifestyle and wellbeing accompanying smoking cessation in the Live For Life program. Paper presented at the Annual Meeting of the Society of Behavioral Medicine, Baltimore, Maryland, 1983.

PARROT, A.C., WINDER, G. Nicotine chewing gum (2 mg, 4 mg) and cigarette smoking: Comparative effects upon vigilance and heart rate. *Psychopharmacology* 97:257–261, 1989.

PEDERSON, L.L., LEFCOE, N.M. A psychological and behavioural comparison of ex-smokers and smokers. *Journal of Chronic Diseases* 29:431–434, 1976.

PERKINS, K.A., EPSTEIN, L.H., PASTOR, S. Changes in energy balance following smoking cessation and resumption of smoking in women. *Journal of Consulting and Clinical Psychology* 58:121–125, 1990.

PERTSCHUK, M.J., POMERLEAU, O.F., ADKINS, D., HIRSH, C. Smoking cessation: The psychological costs. *Addictive Behaviors* 4:345–348, 1979.

POMERLEAU, C.S., POMERLEAU, O.F. Performance anxiety, smoking and cardiovascular reactivity. *Psychosomatic Medicine* 48(3/4):300, March/April 1986.

POMERLEAU, O., ADKINS, D., PERTSCHUK, M. Predictors of outcome and recidivism in smoking cessation treatment. *Addictive Behaviors* 3:65–70, 1978.

POMERLEAU, O., POMERLEAU, C., FAGERSTRÖM, K.-O., HENNINGFIELD, J.E., HUGHES, J.R. *Nicotine Replacement. A Critical Evaluation*. New York: Alan R. Liss, Inc., 1988.

PRENTICE-DUNN, S., ROGERS, R.W. Protection Motivation Theory and preventive health: Beyond the Health Belief Model. *Health Education Research* 1(3):153–161, 1986.

PROCHASKA, J.O., CRIMI, P., LAPSANSKI, D., MARTEL, L., REID, P. Self-change processes, self-efficacy and self-concept in relapse and maintenance of cessation of smoking. *Psychological Reports* 51:983–990, 1982.

PROCHASKA, J.O., DICLEMENTE, C.C., VELICER, W.F., GINPIL, S., NORCROSS, J.C. Predicting change in smoking status for self-changers. *Addictive Behaviors* 10:395–406, 1985.

PROCHASKA, J.O., DICLEMENTE, C.C., VELICER, W.F., ROSSI, J.S., GUADAGNOLI, E. Patterns of change in smoking cessation: Between variable comparisons. *Multivariate Behavioral Research*, in press.

PUDDEY, I.B., VANDONGEN, R., BEILIN, L.J., ENGLISH, D.R., UKICH, A.W. The effect of stopping smoking on blood pressure—A controlled trial. *Journal of Chronic Diseases* 38(6):483–493, 1985.

RANKIN, H. Craving competition. *British Journal of Addiction* 76:1–2, 1987.

REMINGTON, P.L., SMITH, M.Y., WILLIAMSON, D.F., ANDA, R.F., GENTRY, E.M., HOGELIN, G.C. Design, characteristics, and usefulness of state-based behavioral risk factor surveillance: 1981–87. *Public Health Reports* 103(4):366–375, 1988.

RIMER, B.K., DAVIS, S.W., ENGSTROM, P.F., MYERS, R.E., ROSAN, J.R. Some reasons for compliance and noncompliance in a health maintenance organization breast cancer screening program. *Journal of Compliance in Health Care* 3(2):103–114, 1988.

RIMER, B.K., KEINTZ, M.K., KESSLER, H.B., ENGSTROM, P.F., ROSAN, J.R. Why women resist screening mammography: Patient-related barriers. *Radiology* 172:243–246, 1989.

RIMER, B.K., ORLEANS, C.T., KEINTZ, M.K., CRISTINZIO, S., FLEISHER, L. The older smoker: Status, challenges and opportunities for intervention. *Chest* 97(3):547–553, March 1990.

RODIN, J. Weight change following smoking cessation: The role of food intake and exercise. *Addictive Behaviors* 12:303–317, 1987.

ROSE, J.E. The role of upper airway stimulation in smoking. In: Pomerleau, O.F., Pomerleau, C., Fagerström, K.-O., Henningfield, J.E., Hughes, J.R. (eds.) *Nicotine Replacement in the Treatment of Smoking*. New York: Alan R. Liss, Inc., 1988, pp. 95–106.

ROSENBAUM, M., ARGON, S. Locus of control and success in self-initiated attempts to stop smoking. *Journal of Clinical Psychology* 35(4):870–872, October 1979.

ROTTER, J.B. Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs* 80(1), 1966.

RUSSELL, M.A.H. Effect of electric aversion on cigarette smoking. *British Medical Journal* 1:82–86, 1970.

RUSSELL, M.A.H., PETO, J., PATEL, U.A. The classification of smoking by factoral structure of motives. *Journal of the Royal Statistical Society* 137(Part 3):313–333, 1974.

SACHS, D.P.L., BENOWITZ, N.L. The nicotine withdrawal syndrome: Nicotine absence or caffeine excess? In: Harris, L.S. (ed.) *Problems of Drug Dependence*, NIDA Research Monograph Series, 1990.

SAMET, J.M., WIGGINS, C.L. Unpublished analyses of the 1987 Behavioral Risk Factor Surveillance System.

SCHACHTER, S. Regulation, withdrawal, and nicotine addiction. In: Krasnegor, N.A. (ed.) *Cigarette Smoking as a Dependence Process*. NIDA Research Monograph 23. U.S. Department of Health, Education, and Welfare, Public Health Service, Alcohol, Drug Abuse, and Mental Health Administration, National Institute on Drug Abuse. January 1979, pp. 123–133.

SCHACHTER, S. Recidivism and self-care of smoking and obesity. *American Psychologist* 37(4):436–444, April 1982.

SCHNEIDER, N.G., JARVIK, M.E., FORSYTHE, A.B. Nicotine vs. placebo gum in the alleviation of withdrawal during smoking cessation. *Addictive Behaviors* 9(2):149–156, 1984.

SCHOENBORN, C.A., BENSON, V. Relationships between smoking and other unhealthy habits: United States, 1985. *Vital and Health Statistics*. No. 154, U.S. Department of Health and Human Services, Public Health Service, DHHS Publication No. (PHS) 88-1250, May 27, 1988.

SCHOENBORN, C.A., BOYD, G.M. Smoking and other tobacco use: United States, 1987. *Vital and Health Statistics*. No. 169 (Series 10), U.S. Department of Health and Human Services, Public Health Service, DHHS Publication No. (PHS) 89-1597, September 1989, pp. 1–78.

SCHOENENBERGER, J.C. Smoking change in relation to changes in blood pressure, weight, and cholesterol. *Preventive Medicine* 11:441–453, 1982.

SCHWARTZ, J.L., DUBITZKY, M. Changes in anxiety, mood, and self-esteem resulting from an attempt to stop smoking. *American Journal of Psychiatry* 124(11):138–142, May 1968.

SELTZER, C.C., BOSSÉ, R., GARVEY, A.J. Mail survey response by smoking status. *American Journal of Epidemiology* 100(6):453–457, 1974.

SETTERGREN, S.K., WILBUR, C.S., HARTWELL, T.D., RASSWEILER, J.H. Comparison of respondents and nonrespondents to a worksite health screen. *Journal of Occupational Medicine* 25(6):475–480, June 1983.

SHIFFMAN, S. Relapse following smoking cessation: A situational analysis. *Journal of Consulting and Clinical Psychology* 50(1):71–86, 1982.

SHIFFMAN, S. Craving: Don't let us throw the baby out with the bathwater. *British Journal of Addiction* 82:37–38, 1987.

SHIFFMAN, S., WILLS, T.A. (eds.) *Coping and Substance Use*. Orlando, Florida: Academic Press, 1985.