because of tobacco withdrawal and that the improvement in performance occurred because smoking relieves tobacco withdrawal (Schachter 1979; Silverstein 1982). This latter interpretation assumes that overnight deprivation induces withdrawal; although this assumption has not been tested directly, withdrawal effects can occur after only 12 hours of deprivation (Hughes, Higgins, Hatsukami 1990).

Ideally, studying smokers before initiation would allow comparison of this baseline with before and after a smoking episode. As this is impractical, one solution has been to add a control group of nonsmokers (Hughes, Higgins, Hatsukami 1990). For example, smokers performed better after smoking and the same as nonsmokers in several studies of errors on a vigilance task (Taylor and Blezard 1979; Hughes, Keenan, Yellin 1989; Lyon et al. 1975; Heimstra et al. 1980; Tong et al. 1977; Tarriere and Hartmann 1983; Keenan, Hatsukami, Anton 1989) and a tracking task (Lyon et al. 1975) (Figure 1, upper panel). The effect was attributed to relief of withdrawal.

One study provided evidence for enhancement of performance from smoking independent of reversing withdrawal. Wesnes and Warburton (1978) reported a pattern consistent with enhancement when errors on vigilance tasks were studied (Figure 1, lower panel).

Other indirect evidence can be used to test the withdrawal relief versus enhancement models. Two studies reported enhancement of tracking or motor skills when smokers were not deprived (Parrott and Winder 1989; Hindmarch, Kerr, Sherwood 1990; Larson, Finnegan, Haag 1950; Pomerleau and Pomerleau 1986). Several studies have examined the effect of cigarette smoking or nicotine administration on the performance of nonsmokers (Dunne, MacDonald, Hartley 1986; Hindmarch, Kerr, Sherwood 1990; Wesnes, Warburton, Matz 1983; Wesnes and Revell 1984; West and Jarvis 1986; Wesnes and Warburton 1984). In two studies, the improvement in nonsmokers was similar to that of deprived smokers (Wesnes, Warburton, Matz 1983; Wesnes and Revell 1984). One study reported performance to be similar between deprived smokers and nonsmokers (Warburton 1990). Finally, nicotine appears to improve the performance of animals not previously exposed to nicotine (Clarke 1987; Emley and Hutchinson 1984).

In summary, the results of studies to assess if smoking increases performance through withdrawal relief or by direct enhancement appear contradictory. One possible explanation of this discrepancy is that smoking may increase performance through both withdrawal relief and direct enhancement. The specific mechanism that is operative may vary not only among smokers but also within smokers across situations.

Variability in Withdrawal

Whereas the necessary and sufficient condition to establish dependence is repeated exposure to the drug, other factors may exacerbate nicotine withdrawal symptoms. Although several investigators have commented on the variability of postcessation symptoms, it is unclear that this variability is greater than with other drug withdrawal syndromes (Hughes, Higgins, Hatsukami 1990; US DHHS 1988). The results of retrospective and postcessation studies on self-reported withdrawal symptoms (e.g., hunger, restlessness, or inability to concentrate) among smokers who have a greater

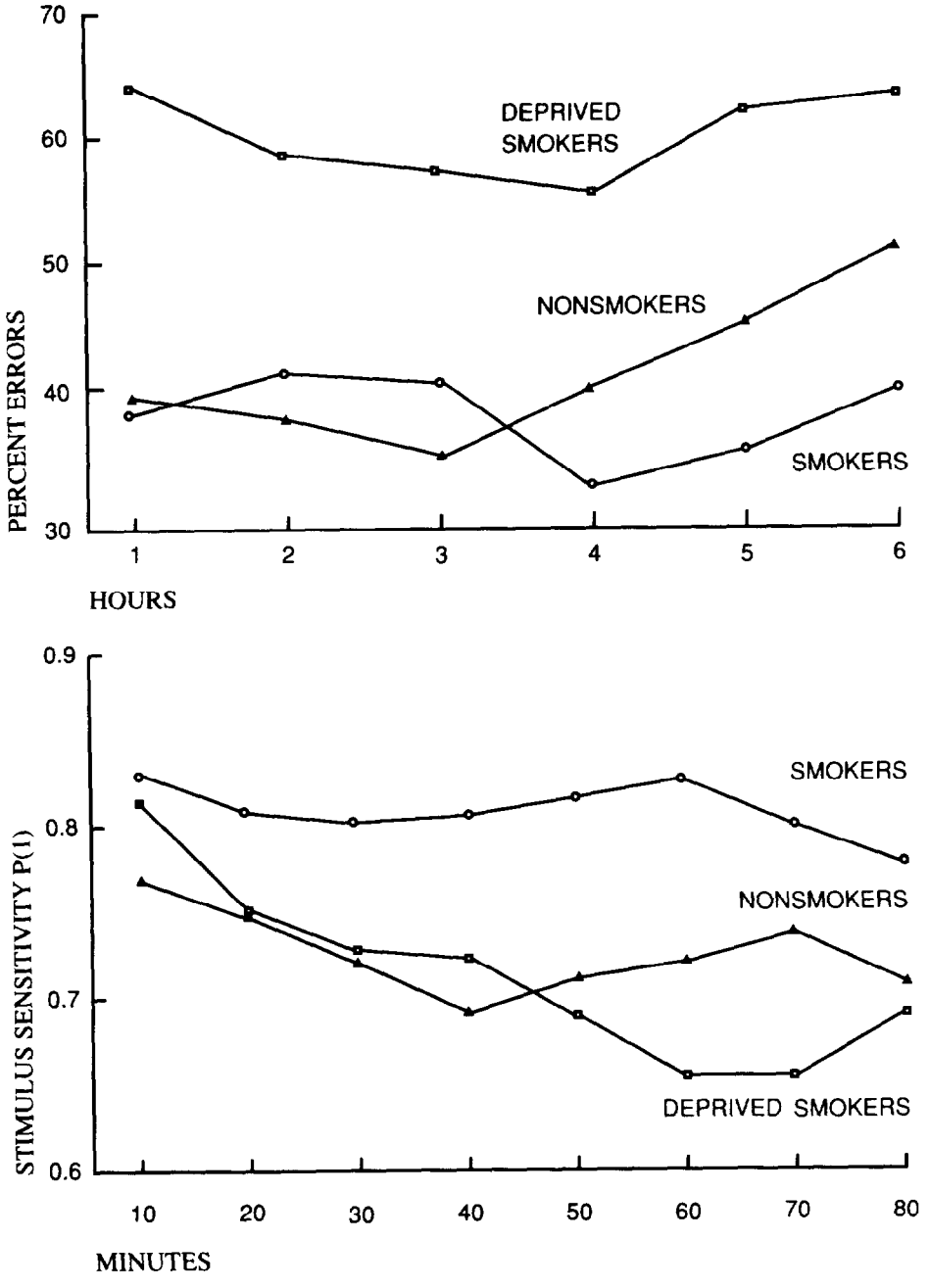

FIGURE 1.—*Upper panel:* **Performance on a meter (i.e., visual) vigilance task**

SOURCE: Heimstra et al. 1980.

Lower panel: **Performance on the continuous clock task, a visual vigilance task**

NOTE: Increased stimulus sensitivity refers to fewer errors.

SOURCE: Wesnes and Warburton (1978).

nicotine intake are inconclusive (Goldstein, Ward, Niaura 1988; Hughes, Higgins, Hatsukami 1990; Shiffman 1979; US DHHS 1988; Williams 1979). Withdrawal effects, including weight gain, have not been found to differ consistently by gender or age (Hughes, Higgins, Hatsukami 1990).

Several studies have suggested that expectancy influences the effects of abstinence; that is, some individuals may amplify, deny, or misattribute their withdrawal symptoms (Barefoot and Girodo 1972; Gottlieb et al. 1987; Hughes and Krahn 1985; Hughes et al. 1989). According to the misattribution model, at times the individual can "mistake" withdrawal symptoms for other possible events. For example, in one study a labeling mistake was made when individuals were told that a placebo they were taking was alleged to have side effects similar to the effects of cigarette withdrawal (Barefoot and Girodo 1972).

Three direct tests of expectancy have been published (Gottlieb et al. 1987; Hughes and Krahn 1985; Hughes et al. 1989). In one study, subjects in a double-blind trial of nicotine polacrilex gum were asked if they thought they had received nicotine or placebo gum. Those who believed they had received placebo gum had more abstinence discomfort than those who could not differentiate what they had received; this latter group had more discomfort than those who thought they had received the nicotine polacrilex gum (Hughes and Krahn 1985). Because this study used post hoc ratings, it is unclear that the belief in which gum had been received modified the level of abstinence effects, or that the level of abstinence effects modified the belief of which gum had been received.

Two experimental trials have manipulated instructions and thereby directly tested if expectancy influences abstinence effects. The first study randomly assigned smokers to a 2x2 design of contrasting instructions; subjects were told that they received either nicotine polacrilex gum or placebo gum, and actually received either nicotine polacrilex gum or placebo gum (Gottlieb et al. 1987). Most of the measures of abstinence effects were unchanged by instructions or by actual drugs. The physical symptoms and stimulation scores on the Shiffman-Jarvik Withdrawal Scale were less only on some days in the group told they were receiving nicotine than in the group told they were receiving placebo. A second study used a similar design and found that abstinence symptoms were fewer among those who received nicotine polacrilex gum than among those who received placebo gum, but found no effect of instructions (Hughes et al. 1989). In summary, the seemingly valid proposition that abstinence effects are influenced by expectancy has not been completely supported by empirical tests.

Abstinence effects have been hypothesized to be greater in more dependent smokers. However, the scales for dependence used to test this hypothesis vary according to whether they are quantifying physical dependence (withdrawal), behavioral dependence (desire for tobacco or tendency to relapse), or dependence on tobacco or on the nicotine in tobacco (Hughes 1984). The Fagerström Tolerance Scale (TQ) is the most widely used dependence scale (Fagerström 1978). TQ consists mostly of items that refer to behavioral dependence on tobacco. The total TQ score predicted total abstinence discomfort in one study (Fagerström 1980) and weight gain in another study (Tønnesen et al. 1988). However, two detailed studies failed to indicate that TQ

predicted weight gain (Emont and Cummings 1987) or self-reported withdrawal symptoms.

The Reasons for Smoking Scale has two scales relevant to the dependence construct—the addiction scale and the negative affect scale (Ikard, Green, Horn 1969). Neither of these has been shown to predict weight gain (Bossé, Garvey, Costa 1980), self-reported withdrawal (Hughes and Hatsukami 1986), or relief by nicotine polacrilex gum (Hughes and Hatsukami 1986).

Russell's Smoking Motivation Questionnaire has a subscale for dependence (Russell, Peto, Patel 1974). In one study, the scale predicted total abstinence discomfort and irritability but did not predict restlessness, depression, hunger, or inability to concentrate (West and Russell 1985).

Another measure somewhat related to dependence includes the severity of abstinence discomfort in the past, which appears to predict self-reported abstinence (Hughes and Hatsukami 1986). Other generic scales, such as the MacAndrews Scale for Addiction (MacAndrew 1979) and Eysenk Personality Questionnaire (Eysenk and Eysenk 1975), do not predict abstinence discomfort and weight gain (Bossé, Garvey, Costa 1980). Although one study found that self-reported smoking for stimulation predicted abstinence effects (Niaura et al. 1989), an earlier study had found no such relationship (West and Russell 1985).

In summary, the evidence that any dependence scale predicts abstinence effects is quite limited. Further tests that use scales that more specifically determine physical versus behavioral dependence and dependence on nicotine versus tobacco may provide more informative data.

Timecourse of Withdrawal

Several recent studies produced concordant results on the timecourse of nicotine withdrawal. Most signs and symptoms of nicotine withdrawal are readily detected within 24 hours (Hughes, Higgins, Hatsukami 1990). Previous studies have suggested that abstinence effects can occur even sooner, for example, within 2 hours (US DHHS 1988). These studies have measured effects during smoking and 2 to 6 hours postsmoking; it was noted that 2 to 6 hours after smoking, self-ratings of performance were worse than during smoking. Several investigators have interpreted the scores during smoking as representing baseline and the postsmoking scores as representing withdrawal. However, as discussed earlier, an alternate interpretation is possible: the scores 2 to 6 hours postsmoking represent baseline scores and the scores during smoking represent the acute effects of smoking (Hughes et al. 1990).

The results of several prospective studies indicate that the signs and symptoms of nicotine withdrawal peak in the first 1 to 2 days following cessation (Cummings et al. 1985; Hughes and Hatsukami 1986; West et al. 1984; Shiffman and Jarvik 1976; Schneider, Jarvik, Forsythe 1984) and last about 1 month (Gritz, Carr, Marcus 1990; Cummings et al. 1985; Gross and Stitzer 1989; Hughes 1990; Hughes et al. 1990; Lawrence, Amoedi, Murray 1982; West, Hajek, Belcher 1987). For each of 10 weeks, Gross and Stitzer (1989) recorded symptoms of quitters and found a peak during the first week and a return to baseline 3 to 4 weeks postcessation. Snyder, Davis, and

Henningfield (1989) tracked performance on several tasks over 10 days. Impairment in performance peaked at 1 to 2 days, and performance on most tasks returned to baseline during the 10 days; however, performance on some tasks was still impaired after 10 days. A study by Cummings and colleagues (1985) included 33 subjects who kept a daily record of 8 withdrawal symptoms. At 21 days, few subjects were reporting withdrawal symptoms, with the exception of an occasional desire for a cigarette. A fourth study (Hughes 1990) provided a less-detailed timecourse but included groups of never smokers, ex-smokers, and continuing smokers. The withdrawal scores of abstinent smokers at 1 month were equivalent to their baseline scores and to those of never smokers and continuing smokers (Hughes 1990). Although the average withdrawal symptom score returned to baseline at 1 month, 45 percent of subjects reported symptoms still above precessation levels at 1-month followup (Hughes 1990). Further followup of these subjects indicated that their withdrawal scores had returned to baseline or below baseline by 6 months postcessation. Craving, hunger, and weight gain are exceptions to the 1-month duration; they may continue at least through the first 6-months after cessation (Gritz, Carr, Marcus 1990; Hughes 1990; Hughes et al. 1990; West, Hajek, Belcher 1987).

With cessation of other drugs, a prolonged withdrawal syndrome has been postulated (Martin and Jasinski 1969). There is no evidence of a prolonged nicotine withdrawal syndrome. In fact, scores on withdrawal scales appear to decrease below precessation levels at followup (Figure 2); that is, positive mood changes occur after long-term abstinence from smoking (Chapter 11, see section on long-term psychological and behavioral consequences and correlates of smoking cessation) (Gritz, Carr, Marcus 1990; Gross and Stitzer 1989; Hughes 1990; Hughes et al. 1990).

Withdrawal as a Cause of Relapse

Seven recent studies have examined nicotine withdrawal as a predictor of relapse, that is, whether smokers with severe withdrawal are more likely to relapse. Five studies found that some withdrawal symptoms predicted relapse at some points in time (Gritz, Carr, Marcus 1990; West, Hajek, Belcher 1990; Hughes 1990; Killen et al. 1990; Swan et al. 1988). The two studies that did not indicate such a relationship examined the ability of withdrawal to predict abstinence at very early followup (Hughes and Hatsukami 1986) or very late followup (Hughes et al. 1990). In the five positive studies, mood changes, such as depression and anxiety, were the more common predictors. However, both across and within the studies, there was no consistent or clear grouping of symptoms predicting withdrawal at specific points in time. One common finding was that the number of symptoms appeared to be a predictor (Gritz, Carr, Marcus 1990; Hughes 1990). For subgroups of smokers, such as more dependent smokers, withdrawal may be an especially important factor in relapse, but this relationship has not been demonstrated.

Postcessation weight gain has often been hypothesized to be a major cause of relapse, especially among women (Hall, Ginsberg, Jones 1986). Contrary to several *a priori* hypotheses, three prospective studies have found that more weight gain predicted less relapse (Duffy and Hall 1990; Hall, Ginsberg, Jones 1986; Hughes et al. 1990). There

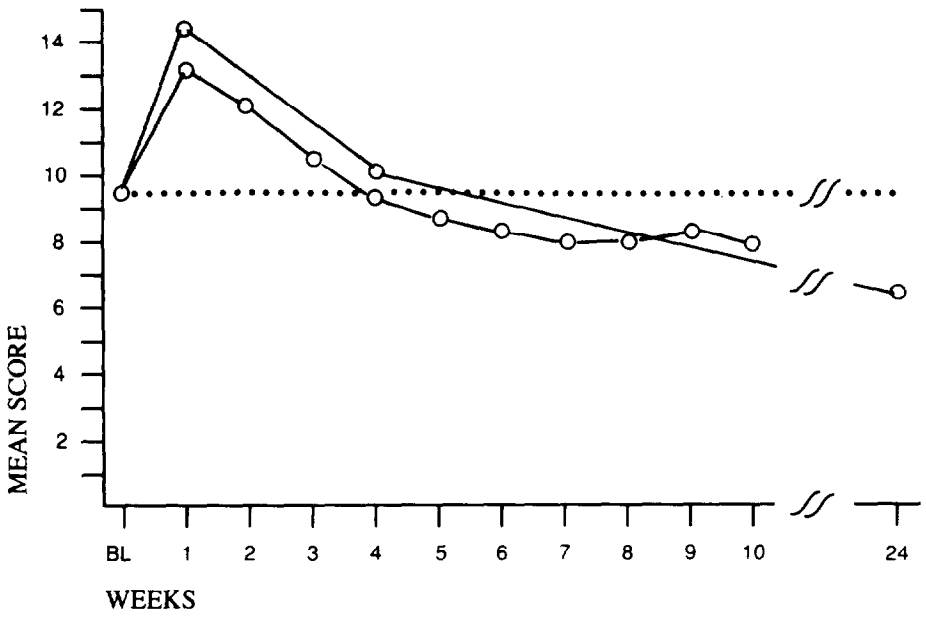

FIGURE 2.—Self-reported withdrawal discomfort among abstinent smokers

SOURCE: Gross and Stitzer 1989; Hughes (1990).

was no gender difference in this prediction in any of the three studies. This finding is further supported by a study in which women who reported eating more in the first 4 days of cessation were more likely to be abstinent at 6-month followup (Guilford 1966). One explanation for the weight gain–relapse finding is that food deprivation increases the reinforcing effects of drugs (Carroll and Meisch 1984). Cessation of smoking may decrease metabolic rate (Perkins, Epstein, Pastor 1990); if this is true, to avoid weight gain, smokers may deprive themselves of food and thereby increase the reinforcing effects of cigarettes smoked during periods of relapse.

In summary, this recent evidence shows that smokers with more severe withdrawal symptoms are more likely to relapse. However, these results should not be misinterpreted. First, prediction is not equivalent to causality; withdrawal symptoms may predict relapse, not because they cause relapse, but because they are associated with some other variable, such as degree of dependence. Second, those symptoms that predict the occurrence of relapse and the timing of relapse—very early (<2 days), early (2–10 days), or later (10–30 days)—vary across studies. Third, although studies have shown that withdrawal is an early predictor of relapse, these studies have not shown that withdrawal predicts eventual outcome (i.e., long-term abstinence).

Summary

Strong evidence indicates that smokers who stop smoking experience a nicotine withdrawal syndrome that includes the short-term consequences of anxiety, irritability,

frustration, anger, difficulty concentrating, and restlessness. These symptoms generally occur within 24 hours and subside after about 1 month. Smokers also report strong cravings or urges to smoke when they are not smoking; this symptom will persist among some former smokers. Hunger and weight gain may also persist longer than 1 month. Abstinence does not appear to affect short-term caffeine intake. However, it does increase caffeine metabolism, which may mimic or potentiate symptoms of nicotine withdrawal. There are conflicting data on the short-term effects of smoking abstinence on alcohol intake. However, the data suggest that smokers attempting permanent smoking abstinence experience decreased alcohol intake.

Research on the effects of smoking abstinence on performance indicates that abstinence impairs performance on attention tasks. This impairment may persist for at least 7 to 10 days and is relieved by nicotine replacement. Other more complex types of tasks as well as memory and learning have not been clearly shown to be impaired by abstinence. The relation of improvement in attention tasks with nicotine may be due either to withdrawal relief or to performance enhancement; findings are consistent with both models. However, evidence more strongly suggests withdrawal relief from receiving nicotine.

Variability in tobacco withdrawal symptoms resembles that observed for other drug withdrawal syndromes. Several studies have suggested that expectancy influences withdrawal effects. However, this has not been completely supported by empirical tests. Although abstinence effects have been hypothesized to be greater in more dependent smokers, the evidence is conflicting. Recent data indicate that smokers with more severe withdrawal symptoms are more likely to relapse. However, no symptoms or groups of symptoms consistently predict relapse at any given point in time.

LONG-TERM PSYCHOLOGICAL AND BEHAVIORAL CONSEQUENCES AND CORRELATES OF SMOKING CESSATION

Introduction

Most long-term studies of self-quitters or smokers taking part in treatment programs only include data on smoking behavior or smoking status (Adesso 1979; Gordon and Cleary 1986; Orleans and Shipley 1982; Shipley, Rosen, Williams 1982); followup measures of psychological and behavioral consequences are rarely included. Thus, although former smokers represent a large and growing segment of the U.S. population (Volume Appendix), the long-term psychological and behavioral consequences of smoking cessation have not been well studied.

Very few studies of former smokers have employed prospective or longitudinal designs; rather, most have used retrospective or cross-sectional designs. In the typical retrospective study, subjects are asked whether after quitting or during their experience of trying to quit, they were more or less nervous, irritable, depressed, sedentary, or health conscious than before quitting. While relevant to the experience of a person abstaining from tobacco, retrospective studies potentially suffer from several limitations, including the absence of information about baseline group similarities or differ-

ences and the problem of recall bias. (See Chapter 2 for a discussion of methodologic problems.) Successful former smokers may minimize or fail to recall their difficulties or exaggerate their prowess (Heinold et al. 1982); recidivists may exaggerate withdrawal problems to justify their relapse (Graham and Gibson 1971). Cross-sectional studies do not permit the establishment of comparability at baseline. Conclusions from the data are therefore limited, often identifying the correlates of cessation rather than the consequences. Both consequences and correlates of cessation will be discussed in this Section.

Most prospective studies of smoking cessation sequelae have been conducted with smokers participating in formal treatment programs rather than with smokers quitting on their own (Hughes, Higgins, Hatsukami 1990). Treatment participants may differ in several ways from self-quitters. In a recent review of findings concerning short-term withdrawal effects, Hughes, Higgins, and Hatsukami (1990) noted that self-quitters had fewer and less severe withdrawal symptoms than treated quitters; they noted, as did Schachter (1982), that clinic populations may include a higher proportion of hardcore, highly dependent smokers. On the other hand, treated quitters may learn new coping skills such as relaxation, self-reward, or exercise and gain additional support for their initial quitting efforts. Therefore, their short-term postquitting experiences may not be representative of the 90 percent of former smokers who quit on their own (US DHHS 1988; Fiore et al. 1990). Thus, in drawing conclusions from studies of participants in treatment programs, it is important to be aware of the possible differences between these two populations of abstainers.

Mood, Anxiety, Perceived Stress, and Psychological Well-Being

Tobacco use has often been described as a maladaptive response to, or a way to cope with, life stress and a way to regulate negative affect (Tomkins 1966; Billings and Moos 1981; Ockene et al. 1981; Orleans 1985; Abrams et al. 1987). Smokers often believe that smoking helps them cope with stress and anxiety (Ikard, Green, Horn 1969). Thus, in addition to the stress of separation from cigarettes (Tamerin 1972), abstaining from cigarettes potentially could make the smoker feel less able to cope with stress (Abrams et al. 1987; Marlatt and Gordon 1985) and thereby constitute a biologically based source of stress (Grunberg and Baum 1985). If the quitter feels unable to cope with stress without cigarettes, perceived stress may increase, and self-efficacy may decrease, resulting in heightened anxiety and an overall negative shift in well-being. Alternatively, Cohen and Lichtenstein (in press) have hypothesized that for smokers who want to quit smoking, continued smoking may prove more stressful than cessation, and quitting smoking may result in a more positive self-appraisal and heightened feelings of self-esteem and personal competence. Similarly, other researchers have proposed that smoking may cause negative self-evaluations and feelings of guilt and helplessness among smokers who want to quit, so that quitting would result in an overall long-term improvement in mood, self-image, and self-esteem (Frerichs et al. 1981; Knudsen et al. 1984; Schwartz and Dubitzky 1968).

Possible long-term changes in anxiety levels after quitting might also reflect quitting-related changes in physiologic stress reactivity (Abrams et al. 1987). To the extent that

smoking contributes to excess physiologic stress reactivity and more ready arousal to anxiety (Emmons et al. 1986; Williams, Hudson, Redd 1982; US DHHS 1988), cessation might lead to stable reductions in general anxiety.

Several models have been proposed to understand the possible long-term consequences of smoking cessation for depression or dysphoria (Frerichs et al. 1981; Hughes 1988; Hughes, Higgins, Hatsukami 1990; Tamerin 1972). Studies of withdrawal effects have found depressed mood or dysphoria to be a common, transient withdrawal effect, partly reflecting multiple pharmacologic effects of nicotine abstinence (Backon 1983; Hughes, Higgins, Hatsukami 1990; US DHHS 1988). Covey, Glassman, and Stetner (in press) found that smokers with a history of major depression had more severe symptoms of depression 2 weeks after a behavioral treatment for smoking than those without such a history. However, some theorists have proposed that for smokers who want to quit, quitting could result in improved mood, well-being, and self-esteem (Frerichs et al. 1981).

Research Results

Five cross-sectional studies have compared former smokers with continuing smokers or relapsers on measures of mood, affect, anxiety, and psychological well-being (Abrams et al. 1987; Giannetti, Reynolds, Rihn 1985; Orleans et al. 1983; Pederson and Lefcoe 1976; Pomerleau, Adkins, Pertschuk 1978). Of these five studies, three found no differences between these groups, and two found differences demonstrating more healthy outcomes for former smokers. Pederson and Lefcoe (1976) compared 46 former smokers, mostly self-quitters who had not smoked cigarettes for 1 year or longer, with 46 current smokers volunteering for treatment. These researchers found no differences on Jackson Personality Inventory scales that included measures of anxiety and self-esteem. Likewise, Pomerleau, Adkins, and Pertschuk (1978) used the Symptom Checklist (SCL-56) as a 2-year followup measure of dysphoria among 60 smoking cessation treatment participants and found no differences between quitters and continued smokers. Mean duration of smoking abstinence was not reported. Giannetti, Reynolds, and Rihn (1985) compared 47 former smokers who had been abstinent for at least 6 months with 35 current smokers hospitalized for cardiovascular disease and found no differences in "habits of nervous tension."

In the only study to employ multiple self-report, physiologic, and observer measures, Abrams and colleagues (1987) found no significant differences between 22 former smokers (mean abstinence approximately 2 years) and 22 relapsers on the State-Trait Anxiety Inventory, but did find that former smokers reported significantly less anxiety and had significantly lower heart rates in response to simulated smoking-related stressors. In a study of worksite health screen participants, Orleans and colleagues (1983) compared 525 long-term former smokers who had been abstinent for more than 12 months (mean abstinence = approximately 9 years) with 856 current smokers and found that the long-term former smokers had significantly better age- and sex-adjusted scores on the Health and Nutrition Examination Survey (HANES) General Well-Being Index, including its anxiety and depression subscales, and on the Framingham measures of anger symptoms and anger internalization. However, there were no differences on

these measures between current smokers and recent ex-smokers, those who had been abstinent for less than 12 months.

Prospective longitudinal studies of smokers who become former smokers or remain continuing smokers are needed to establish whether any differences between former and current smokers existed prior to quitting, especially since baseline or "prequitting" measures of psychological well-being and self-esteem have been found to predict success in quitting smoking (Hall et al. 1983; Ockene et al. 1982; Schwartz and Dubitzky 1968; Straits 1970; West et al. 1977). The few prospective studies (Table 2) that have been conducted have either documented no significant change in psychological factors from baseline among former smokers, or no difference in the magnitude of change for former and continuing smokers, or have indicated improvements for former smokers. None of these studies demonstrated long-term negative psychological changes for former smokers.

Two of the prospective studies found no significant changes in a variety of mood and psychological measures from a prequitting baseline to long-term followup among former smokers and no significant differences between quitters and continuing smokers in the magnitude of such change. Pertschuk and coworkers (1979) asked 24 participants in a nonaversive cognitive-behavioral treatment to complete pretreatment and 2-month followup ratings of psychological functioning. These researchers found no significant changes in stress, affect, symptoms of psychological distress, or utilization of psychiatric treatment as indicated by need for psychotropic medication or mental health services. Changes from baseline to followup were not evaluated separately for quitters and nonquitters, but these groups did not differ on 4-month followup ratings. Emmons and associates (1986) studied the effects of smoking cessation on cardiovascular reactivity to stress among quit-smoking clinic participants and found no significant changes from baseline to a 6-month followup among 16 abstainers or 8 relapsers. However, this study noted that an average weight gain of 5 pounds among abstainers may have masked improvements in reactivity scores. Because weight was related to baseline and followup cardiovascular measures, it is possible that in each of these studies, treatment assisted quitters in avoiding persistent unwanted side effects.

Two studies of nicotine withdrawal effects that extended measurement beyond 4 weeks of abstinence have yielded no evidence for a withdrawal syndrome beyond 4 to 5 weeks (Hughes, Gust, Pechacek 1987; Gross and Stitzer 1989). These studies, reviewed in detail by Hughes, Higgins, and Hatsukami (1990), found that adverse postquitting changes in levels of anxiety, restlessness, impatience, irritability, and dysphoria peaked during the first 2 weeks after quitting, returned to baseline or below-baseline levels by 4 weeks, and remained at those levels at 10- to 26-week followups.

Gross and Stitzer (1989) studied 40 smokers who quit after a 3-session cessation class and maintained biochemically validated smoking abstinence for 10 weeks while using nicotine polacrilex gum or a placebo. Subjects completed weekly ratings of withdrawal symptoms, including symptoms of psychological distress such as irritability, anxiety, and impatience. Weekly followup ratings were adjusted for baseline ratings and baseline smoking rate. For the 20 placebo subjects, mean ratings for irritability, anxiety, and impatience increased from baseline to the first postquit week, returned to baseline

TABLE 2.—Prospective studies of quitting-related changes in mood, anxiety, stress reactivity, perceived stress, self-image, and psychological well-being

Reference	Sample size	Type of study	Findings	Strengths or limitations
Pertschuk et al. (1979)	24 smoking cessation clinic participants	Stress, affect, psychological distress, and utilization of psychiatric treatment were assessed at the start of treatment and 2 mo posttreatment	No significant pre- to posttreatment change in self-reported anxiety, depression, anger, irritability, appetite loss, insomnia, hopelessness, difficulty concentrating, apathy, use of psychotropic medication	Although posttreatment scores did not differentiate abstainers (N=16) and recidivists (N=8), these groups were not compared on pre- to posttreatment changes
Emmons et al. (1986)	24 smoking cessation clinic participants	Cardiovascular reactivity (SBP, DBP, HR) in response to cognitive and physical stressors were assessed 1 wk prior to treatment and 6 mo after treatment	No significant pre- to posttreatment change for abstainers (N=16) in mean SBP, DBP, or HR, and no difference in amount of change between abstainers and recidivists (N=8)	Only abstainers had a significant weight increase during the following period; this may account for lack of reduction in cardiovascular reactivity
Gross and Stitzer (1989)	40 abstainers using nicotine polacrilex gum or a placebo following a 3-session treatment	A 15-item withdrawal symptom measure was completed weekly for 10 postquit weeks	For placebo subjects, rated symptoms of psychological distress (irritability, anxiety, impatience) increased from baseline to first postquit week, returned to baseline by week 4, then declined below baseline initially, stabilizing after 5 wk; scores for active gum users declined below baseline initially, stabilizing after 3 wk at below-baseline levels	Self-reported abstinence biologically confirmed and baseline scores and baseline smoking rate used as covariates, but no control for repeated measurement

TABLE 2.—Continued

Reference	Sample size	Type of study	Findings	Strengths or limitations
Hughes, Gust, Pechacek (1987)	315 smokers followed for 6 mo after a contact treatment with physician advice and active nicotine polacrilex or placebo gum	At 1–2 wk, 1 mo, and 6 mo, subjects rated 5 withdrawal symptoms relevant to mood and psychological functioning (anger, anxiety, difficulty concentrating, impatience, restlessness)	Among abstinent subjects, these ratings peaked at 1–2 wk postquitting, returned to baseline by 1 mo, and declined further to below-baseline at 6 mo	Below-baseline 6-mo ratings among nonquitters suggest a drift in measures due to a repeated testing effect
Hall et al. (1983)	35 participants in a cessation clinic for smokers with chronic cardiopulmonary disease	POMS was administered before and 6 mo after treatment	A measure of total mood disturbance (anger/irritability + tension + anxiety + fatigue + confusion + depression/dejection – vigor) at 6 mo was significantly negatively correlated with smoking reduction; parallel significant relations were noted for the scales anger/irritability and tension/anxiety	Analyses controlled for pretreatment measures
Orleans et al. (1983)	72 ex-smokers (N=7 mo abstinent) who had quit during the year following a worksite health screen (49 at companies with health promotion programs, 23 at control companies)	HANES well-being, anxiety, and depression scales and the Framingham anger symptom scales were administered at a baseline health screen and 1-yr followup	Significant baseline to 1-yr improvements in the HANES well-being and depression scales were observed for new ex-smokers at treatment sites only; no changes in Framingham anger measures were observed	Analyses controlled for age, sex, baseline values, and duration of abstinence; comparisons with never smokers, long-term former smokers, or recidivists at treatment sites were not conducted

TABLE 2.—Continued

Reference	Sample size	Type of study	Findings	Strengths or limitations
Prochaska et al. (in press)	63 smokers quitting on their own rated their self-change processes semiannually for 2.5 yr	Self-reevaluation scale items assessed changes in self-image related to smoking	T-scores declined progressively for smokers going from action to maintenance stages	Analyses assessed stage-based patterns of change; comparisons with smokers who did not progress were not reported
Cohen and Lichtenstein (in press)	150 smokers planning to quit on their own	Smoking status and perceived stress were assessed at baseline, 1, 3, and 6 mo	Smokers who never quit (N=57) and those who quit and relapsed (N=81) maintained baseline stress levels over the 6-mo followup; smokers who quit and remained abstinent (N=12) showed a significant decrease in perceived stress from baseline to followup	Causality is unclear stress may have contributed to the failure to quit smoking and failure to quit may have raised perceived stress

NOTE: SBP= systolic blood pressure; DBP= diastolic blood pressure; HR= heart rate; POMS=Profile of Mood States; HANES=Health and Nutrition Examination Survey.

levels by week four, then continued to decline, stabilizing at below-baseline levels by week six. There were significant interactions between use of the gum and the weeks during which it was used for each of these symptoms, with nicotine polacrilex gum significantly suppressing postcessation ratings only during the first 4 to 5 weeks after quitting. The authors concluded that several of the most disturbing aspects of the tobacco withdrawal syndrome appear to resolve within 4 to 5 weeks after quitting (Gross and Stitzer 1989). Although findings suggest positive changes over baseline for these recent quitters, below-baseline 6- to 10-week scores may reflect the effects of the initial treatment or a repeated-testing effect.

In a similar study of the effects of nicotine polacrilex gum on tobacco withdrawal, Hughes, Gust, and Pechacek (1987) studied 315 smokers for 6 months after a minimal contact treatment involving brief physician counseling, instruction in nicotine polacrilex gum use, and prescription of nicotine polacrilex gum or a placebo. At a pretreatment baseline, and again at 1- to 2-week, 1-month, and 6-month followups, subjects rated six withdrawal symptoms related to mood and psychological functioning including anger, anxiety, difficulty concentrating, impatience, and restlessness in addition to four others—craving, hunger, insomnia, and physical symptoms. For 75 subjects abstinent at 6 months, of whom 57 used nicotine polacrilex gum and 18 used a placebo, ratings for anger, anxiety, difficulty concentrating, restlessness, and impatience peaked at the 1- to 2-week followup, returned to baseline at 1 month, then dipped to below-baseline levels at 6 months. Subjects receiving nicotine polacrilex gum compared with those using placebo reported smaller increases from baseline to 1- to 2-week and 1-month ratings for most withdrawal symptoms, but nicotine polacrilex gum effects were not explored at the 6-month followup because too few subjects continued using the gum. However, 6-month ratings were lower on many symptoms even among 240 nonquitters, suggesting a drift in ratings due to a testing effect. In fact, the only symptom change from baseline, which differentiated quitters and nonquitters at 6 months, was that quitters had a greater increase in hunger than did nonquitters ($p<0.001$).

Hughes, Gust, and Pechacek (1987) concluded that, with the possible exception of hunger and craving or an urge to smoke, there was no evidence for prolonged withdrawal reactions lasting 6 months or more. (See Chapter 11 for discussion of hunger and weight effects.) However, these researchers also noted that results based on a select group of smokers who enrolled in a study and the absence of control groups of long-term former smokers and continuing smokers not trying to quit limit the generalizations that can be made about the symptoms of long-term abstainers.

Two other prospective studies comparing quitters and nonquitters have documented 6-month improvements in mood and well-being among former smokers who had participated in cessation treatments. Hall and associates (1983) administered the Profile of Mood States to 35 smokers with cardiopulmonary disease both before and 6 months after, 1 of 2 different 6-session quitting treatments. Controlling for baseline scores, they found that total mood disturbance, including anger/irritability, tension/anxiety, fatigue, confusion, and depression/dejection, was negatively correlated with smoking reduction ($p<0.02$). That is, smokers achieving the greatest smoking reduction showed the greatest improvements in overall mood. The same held true for the separate factors

of anger/irritability ($p<0.05$) and tension/anxiety ($p<0.05$). Treatment differences were not explored.

Orleans and colleagues (1983) studied a group of 72 smokers who had quit in the previous year (mean abstinence, 7 months), and compared the changes in mood and well-being occurring among 49 quitters at 4 worksites where a range of employee health promotion programs had been offered including smoking cessation, exercise, weight control, and stress management, with those occurring among 23 quitters at 4 no-treatment control worksites. The investigators controlled for age, sex, baseline values, and months since quitting. Significant improvements in HANES well-being, anxiety, and depression scores were observed only among former smokers at treatment companies, but not among those at control companies ($p<0.01$). These results suggest that treatment may have potentiated positive changes among new quitters. However, never smokers, long-term former smokers, continuing smokers, or recidivists at treatment companies were not compared.

Two studies have documented long-term, quitting-related improvements in psychosocial outcomes among self-quitters. Prochaska and associates (in press) assessed the processes that smokers undergo during different stages of smoking behavior change in a 2.5-year longitudinal study of self-change among 63 self-quitters. These researchers found significant decreases from baseline in smoking-related negative self-evaluations (e.g., "My dependency on cigarettes makes me feel disappointment in myself") from a prequitting baseline for 9 subjects who progressed from the contemplation stage to the action stage and then to maintenance, and for 54 subjects who progressed from action to maintenance. Formal comparisons with subjects who did not progress in their stage of change were not reported. (See Chapter 2 for a discussion of stages of change.)

Cohen and Lichtenstein (in press) found significant long-term reductions in perceived stress in a prospective study of 150 unaided quitters. They administered the Perceived Stress Scale (Cohen, Kamarck, Mermelstein 1983) prior to quitting and again at 1, 3, and 6 months after the quit date. This scale measures the degree to which individuals perceive the stresses in their lives to exceed their abilities to cope (range=0–16). For the 12 subjects who quit and remained continuously abstinent, perceived stress decreased significantly from a prequitting mean of 5.7 to a 6-month followup mean of 2.9. Among 57 continuing smokers, perceived stress levels increased slightly from 6.1 prior to quitting to 6.3 at 6 months. Likewise, for the 81 smokers who quit but relapsed, perceived stress levels increased slightly from a prequitting mean of 5.8 to a 6-month mean of 6.1. There were no significant differences between quitters, continuing smokers, and relapsers in prequitting perceived stress levels. The investigators suggest that among smokers who want to stop smoking, quitting may have a beneficial influence on perceived stress, self-esteem, and general self-efficacy (a belief that one has the ability to perform a specific behavior such as smoking cessation) (Bandura 1982), and failing to quit may have opposite effects. However, these researchers also noted that a causal explanation cannot be clearly invoked: It is possible both that perceived stress contributed to the failure to quit smoking (Marlatt 1985a; Shiffman 1982) and that failure to quit contributed to stress.

More prospective studies are needed to clarify the long-term postwithdrawal psychological consequences of smoking abstinence suggested by the research reviewed

for this Report. Studies designed specifically to assess long-term abstinence effects will require longer followup, larger samples of unselected quitters, and control groups of smokers who are not trying to quit. When possible and appropriate, self-report and physiologic and observer ratings of emotional and psychological changes should be included (Abrams et al. 1987; Hughes, Higgins, Hatsukami 1990) with measures of health-related quality of life (Kaplan 1988).

Self-Efficacy and Locus of Control

Self-Efficacy

Self-efficacy has been shown to be a strong mediator of smoking behavior change and to predict short- and long-term quitting outcomes (Condiotte and Lichtenstein 1981; Coelho 1984; McIntyre, Lichtenstein, Mermelstein 1983). As defined by Bandura (1982), self-efficacy refers to one's perceived ability to perform a specific behavior, such as resist temptations to smoke under specific circumstances; that is, self-efficacy is a response to a stressful event rather than a global sense of personal competence. As such, self-efficacy related to smoking cessation is likely to influence both the decision to engage in a quit attempt and perseverance in coping after quitting (Coelho 1984; Marlatt 1985b).

The self-efficacy measures employed in smoking cessation research have concerned only expectations for smoking behavior control. However, several researchers have proposed that successful smoking cessation might itself result in feelings of increased general self-mastery and self-confidence. That is, generalized self-efficacy may be a consequence of smoking cessation (Cohen and Lichtenstein, in press; Marlatt 1985b,c; Prochaska et al., in press). No studies have yet examined prequitting to postquitting changes in generalized self-efficacy.

However, the relationship between cessation and self-efficacy around smoking control has been studied. Cross-sectional studies among smokers wanting to quit have found that successful quitters score significantly higher on measures of self-efficacy than either those who tried to quit and failed (Abrams et al. 1987; Barrios and Niehaus 1985; Prochaska et al. 1982) or continuing smokers (Katz and Singh 1986). These differences may reflect that successful quitters generally have higher efficacy scores to begin with (Fleisher et al., in press; Mothersill, McDowell, Rosser 1988; Ockene et al. 1982; Prochaska et al. 1985) or that one's expectations that smoking can be resisted would rise significantly as a function of actual success in doing so.

Prospective longitudinal studies, with followup periods ranging from several weeks to 2.5 years postquitting, lend support to the hypothesis that increases in self-efficacy concerning smoking control are related to smoking cessation both for untreated self-quitters (Prochaska et al., in press) and for smokers enrolled in treatment programs (Coelho 1984; Killen, Maccoby, Taylor 1984; Nicki, Remington, MacDonald 1984; Schwartz and Dubitzky 1968). Coelho (1984) reported that smoking control self-efficacy scores increased significantly from a mean of 77.1 at the time of enrolling in treatment to a mean of 127.4 at 3 months posttreatment for 18 subjects who had quit smoking. (Abstinence was defined as continuous nonsmoking since a quit date, but

mean duration of abstinence was not reported.) Conversely, pretreatment and posttreatment means for 48 nonquitters were unchanged from 78.1 to 75.1, respectively.

Two studies examined the effects of different types of smoking intervention treatments on self-efficacy ratings. Killen, Maccoby, and Taylor (1984) found no differences in the amount of positive change in self-efficacy among abstainers of 4 weeks or longer who took part in different treatments that included nicotine polacrilex gum, nonsmoking skill training, or combined nicotine polacrilex gum and skill training. Nicki, Remington, and MacDonald (1984) followed 53 subjects for 1 year after treatment and found significantly greater increases in smoking control self-efficacy among quitters and nonquitters randomized to a behavioral smoking intervention treatment designed explicitly to enhance smoking control self-efficacy than among those randomized to a standard control treatment ($p<0.05$). The mean duration of abstinence for quitters was not reported.

Locus of Control

Measures of locus of control reflect the extent to which an individual believes that he or she has control over personal happenings and circumstances. Measures of a generalized locus of control reflect either expectations that one has internal (i.e., personal) control over the reinforcements for one's behavior, indicating an internal locus of control, rather than believing that these reinforcements are determined by fate, luck, or other forces beyond control (Rotter 1966), which reflects a more external locus of control. Measures of health locus of control reflect beliefs that important health outcomes can be controlled through behavior rather than by being at the mercy of luck, fate, or powerful others (Wallston, Wallston, DeVellis 1978). It is possible that former smokers would shift toward a more positive or more internal control orientation in reaction to their successful quitting. Anecdotal evidence suggests that when smokers quit smoking they feel both more competent and more in control of their lives and that they experience pride in their perceived "strength of will" (Knudsen et al. 1984).

Cross-sectional studies have demonstrated that former smokers, both self-quitters and treated quitters, exhibit significantly more internal control orientations than either those who tried to quit and failed (Rosenbaum and Argon 1979) or continued to smoke and did not attempt cessation (Mlott and Mlott 1974; Orleans et al. 1983; Rosenbaum and Argon 1979). However, prequitting measures of generalized (Ockene et al. 1982) and health-specific (Horwitz, Hindi-Alexander, Wagner 1985) locus of control also differentiate these groups.

Locus of control may be related to the duration of abstinence. Orleans and associates (1983) found no significant differences between 1,343 current smokers and 856 short-term ex-smokers (abstinent for <3 months) in a baseline measure of perceived personal control over preventable illness. However, 89 medium-term former smokers (abstinent 3–12 months) and 525 long-term former smokers (abstinent for >12 months) scored significantly higher on personal control than current smokers ($p<0.01$). A followup conducted 1 year later showed a significant ($p<0.01$) increase toward internal control among 72 smokers who had quit since baseline (mean abstinence, 7 months).

Conversely, Orleans and colleagues (1983) found a significant shift toward more external health locus of control of similar magnitude among 30 individuals who had been former smokers at baseline, but who had relapsed by the 1-year followup. A similar pattern was reported by Horwitz, Hindi-Alexander, and Wagner (1985) who followed 219 participants in a single-session hypnosis treatment over a 1-year period. These researchers found a significant shift ($p<0.001$) toward a more external orientation among 79 smokers who had tried to quit but failed, with the mean falling from 27.6 pretreatment to 24.2 at the 1-year followup. The investigators suggested that generalized expectancies for control over one's health might be diminished by failure and by the "abstinence violation effect" (i.e., when individuals take a cigarette or relapse, they may feel guilty or depressed or believe that they are lacking in will power and may decide they are not maintaining control over smoking) (Marlatt 1985b). However, Horwitz, Hindi-Alexander, and Wagner (1985) found no significant pretreatment to followup shift toward an internal health locus of control among 56 continuously abstinent quitters who had quit with hypnosis. This lack of change toward an internal health locus of control may in part reflect that treatment using hypnosis does not engender strong personal, internal attributions for success.

Two studies suggest that treatment factors can influence shifts in locus of control. Orleans and associates (1983) divided 72 recent former smokers into 2 groups: 49 at 4 worksite companies where a comprehensive employee health promotion program had been introduced and 23 at 4 no-treatment control companies. The significant overall shift toward an internal health locus of control was accounted for wholly by the former smokers at treatment companies. It is possible that the intervening health promotion program emphasizing personal control over health, well-being, and preventable illness potentiated or hastened this shift. Blittner, Goldberg, and Merbaum (1978) randomly assigned 54 smokers seeking treatment to 1 of 3 conditions: a stimulus control treatment coupled with bogus feedback of superior self-control abilities, a stimulus control treatment alone, or a wait list control. A statistically significant pretreatment to posttreatment increase in internal orientation was observed only for the subjects who received feedback to enhance their expectations of inner control ability. This group also achieved the greatest 14-month smoking reductions ($p<0.001$).

Thus, most of the available data suggest that smoking cessation is related to an increase in a more internal locus of control orientation; no data indicate a shift toward an external locus of control for abstainers. There is some support to suggest that treatment method may have a differential effect on an increase in internal locus of control orientation.

Coping and Self-Management Skills

The relation of abstinence from cigarettes to a generalized improvement in the extent and use of coping and self-management skills has not been studied. To the extent that stopping smoking results in an individual's acquiring or strengthening generally applicable stress-coping and temptation-coping skills, long-term benefits of abstinence might be expected to include the generalized use of such skills. However, no studies have assessed whether increases in generalized stress-coping skills occur as a conse-

quence of cessation. Longitudinal studies have not included prequitting and postquitting measures of generic coping strategies. A brief review of the relation of coping to smoking cessation and maintenance of abstinence may help to provide direction for this line of needed research.

Shiffman and Wills (1985) have developed a conceptual framework of coping that distinguishes stress-coping skills, that is, skills used to cope with general life stressors, and temptation-coping skills, or skills relevant for coping with a situation in which there is a specific temptation for substance use or an urge to smoke. Folkman and Lazarus (1988) defined stress-coping as constantly changing cognitive and behavioral efforts to manage specific external and internal demands that are appraised as taxing or exceeding the resources of the person to maintain an appropriate balance between environmental demands and resources available to the individual to meet those demands. Temptation coping can be separated into what smokers do when faced with the immediate temptation to smoke and anticipatory coping or the strategies smokers use to maintain commitment to abstinence and prevent temptation (Shiffman and Wills 1985).

To the extent that smoking constitutes a maladaptive response for coping with stress and negative affects such as anxiety, depression, anger, frustration, loneliness, or boredom (Abrams et al. 1987; Marlatt 1985b,c; Ockene et al. 1981), the former smoker must find alternative strategies for coping. The use of healthy all-purpose coping strategies such as self-reinforcement, assertive behavior, social support, relaxation, and exercise has proven important to success in maintaining abstinence in some studies (Ashenberg, Morgan, Fisher 1984; Grunberg and Bowen 1985; Marlatt 1985c; Shiffman 1982).

However, two large worksite studies demonstrated no differences between current and former smokers in the self-reported use of healthy and unhealthy techniques for coping with stress (Blair et al. 1980; Orleans et al. 1983). In support of the importance of coping skills, Katz and Singh (1986) found that 77 former smokers who had abstained for 6 months or more (mean 6.7 years) had significantly higher scores on the Rosenbaum Self-Control Schedule (a self-report measure of individual differences in applying self-control or coping methods) than 52 smokers recruited for a quit-smoking treatment. "Self-cured" and treated former smokers did not differ on this measure. The investigators concluded that former smokers may have succeeded because they possessed better self-coping skills initially. The same interpretation could be applied to the study by Abrams and associates (1987) in which 22 former smokers (mean abstinence 22 months) exhibited better observer-rated skills to resist the temptation to smoke than did 22 recidivists in simulations involving interpersonal smoking triggers. Shiffman (1982) found that former smokers who reported using cognitive and behavioral strategies to cope with smoking temptations were less likely to relapse. These few studies support the conclusion that use of skills to cope with stress and with temptations or urges to smoke seem to be more prevalent among former smokers compared with current smokers.

Social Support and Interpersonal Interactions

Research has not addressed how smoking cessation influences the level of general or quitting-relevant social support available to the quitter or how cessation affects the quality of the individual's interpersonal interactions. Research on social support processes has focused on examining baseline or posttreatment measures of social support as predictors of quitting success (Graham and Gibson 1971; Lichtenstein, Glasgow, Abrams 1986; Mermelstein et al. 1986; Ockene et al. 1982; US DHHS 1989). Several studies have demonstrated that successful quitters had significantly fewer smokers in their social networks at baseline than did continuing smokers (Eisinger 1971; Graham and Gibson 1971; Ockene et al. 1982). Others have demonstrated that the quitter's success stimulated quitting by others, especially spouses (Suedfeld and Best 1977).

A few studies are relevant to the investigation of cessation effects on social support. A large-scale, cross-sectional and longitudinal worksite study (Orleans et al. 1983) found no differences among current smokers, former smokers, and never smokers at baseline in satisfaction with personal relationships and interpersonal communication or in satisfaction with coworker relationships. However, at 1-year followup, 72 baseline smokers who had quit (mean abstinence, 7 months) showed a significant decline from baseline in satisfaction with coworker relationships ($p<0.01$) and scored significantly lower in satisfaction with personal relationships ($p<0.05$) than a group of 30 baseline former smokers who had relapsed since baseline. Whether new former smokers were in no-treatment control companies or in treatment companies where they benefitted from multiple health promotion programming, designed in part to boost coworker support, did not affect changes in satisfaction with interpersonal relationships. These negative changes in interpersonal relationships are difficult to interpret because former smokers in this study also demonstrated decreases in anxiety and depression and improvements in coping strategies compared with baseline. One possibility is that new former smokers may be less tolerant of smokers in their environment. Further study is needed to replicate and explain this isolated finding.

In contrast, Prochaska and colleagues (in press) monitored a group of 63 self-quitters who progressed through the stages of smoking behavior change to maintain abstinence over 2.5 years (mean duration of abstinence was not reported) (Chapter 2). They found that their use of helping relationships continued to increase with time. Similarly, Horwitz, Hindi-Alexander, and Wagner (1985) found that 56 successful quitters reported significantly greater social support from spouses and friends 1 year after a single-session hypnosis treatment than they did at baseline. No changes in reported level of support were noted for 84 continuing smokers, but even 79 recidivists reported significant increases in spouse support over baseline. Notwithstanding hypnotic suggestions that "other peoples' smoke will not bother you," successful quitters reported significantly ($p<0.05$) more often expressing objections to others smoking around them (mean=2.38) than either recidivists (mean=0.75) or continuing smokers (mean=0.50) at the 1-year followup. Likewise, more former smokers requested nonsmoking areas in restaurants (53 percent) and public transport (32 percent) than did recidivists (12 percent and 12 percent, respectively) or continuing smokers (8 percent and 6 percent,

respectively). This practice may have helped to minimize social pressures to smoke commonly precipitating relapse (Marlatt and Gordon 1985), and helped to assure support for maintenance. It is also possible that these practices simply resulted from, rather than contributed to, smoking abstinence.

The results of these studies, although somewhat conflicting, suggest that former smokers played an active role in structuring the improved support they reported as a way of maintaining abstinence. However, given the limited information, no conclusions regarding the effect of smoking cessation on social interactions can be made at present.

Summary

Research findings provide no evidence for any long-term negative psychological effects beyond hunger and craving. However, the available findings suggest that there are some postwithdrawal psychological benefits that may increase with duration of abstinence.

HEALTH PRACTICES OF FORMER SMOKERS

Introduction

Several studies have found that both good health practices and poor health practices cluster (Belloc and Breslow 1972; Tapp and Goldenthal 1982; Verbrugge 1982; Marsden, Bray, Herbold 1988). Self-defined former smokers appear more likely than current smokers to engage in regular exercise and to practice other recommended health behaviors. In general, smokers who quit and who subsequently or concurrently change other health behaviors may represent a more distinct health-conscious group. Castro and coworkers (1989) have suggested that cigarette smokers exhibit less healthy lifestyles along cognitive, behavioral, and motivational dimensions. As the authors noted, addictive behaviors seldom occur in isolation but are instead embedded within complex behavioral chains or lifestyles. Conversely, the data presented in this Section suggest that when individuals stop smoking, other beneficial health practices also may emerge. Given the nature of the available data, it is not possible to determine whether these other beneficial health behaviors reflect the characteristics of a distinct health-conscious subgroup of smokers, emerge as part of the smokers' efforts to maintain abstinence (e.g., increased exercise), represent a response to adverse withdrawal symptoms (e.g., changes in dietary practices), or are direct effects of quitting.

This Section reviews data on former smokers' physical activity and dietary practices and use of other substances such as alcohol and other forms of tobacco, and former smokers' profiles with regard to multiple health-enhancing behaviors. Changes in former smokers' physical activity and dietary practices, as they relate to postcessation weight changes, are also reviewed in Chapter 10.

The studies reviewed in Chapter 10 are longitudinal investigations in which former and continuing smokers are compared. This Section focuses on cross-sectional data

from two nationwide surveys, the National Health Interview Survey (NHIS) conducted by the National Center for Health Statistics (Kovar and Poe 1985; Schoenborn and Benson 1988) and the Behavioral Risk Factor Surveillance System (BRFSS) coordinated by the Centers for Disease Control and conducted by State health departments (Remington et al. 1988). Both surveys provide large data sets on health behaviors in the noninstitutionalized adult population. The limitations of drawing conclusions from cross-sectional data apply here (Chapter 2).

For its yearly interviews, NHIS uses a multistage probability scheme sampling technique developed in collaboration with the Bureau of the Census and employs personnel trained for the decennial census. BRFSS uses a multistage cluster technique of random digit dialing to select households for its yearly telephone survey. Both randomly select a respondent from a list of residents identified when a household is chosen.

A core set of questions each year is used in NHIS, then additional questions are added in supplements to the core survey in keeping with each year's chosen focus. In 1985, the NHIS special topic was health promotion, with variables such as physical activity, dietary practices, sleep, weight, alcohol use, and smoking that were similar to those used in the pioneering Alameda County study. The health promotion portion of the interview was completed by an estimated 90 percent of eligible respondents (Schoenborn and Benson 1988). In 1987, the special topic was cancer, with questions on diet, smoking, smokeless tobacco use, alcohol use, vitamin and mineral consumption, knowledge about cancer risks, cancer screening and preventive care, and family history of cancer. The cancer-related portion of the interview was completed by approximately 86 percent of eligible respondents (Schoenborn and Boyd 1989). In both NHIS surveys, a former smoker self-reported as having smoked at least 100 cigarettes and not smoking at the time of the survey. Mean duration of abstinence was not reported (Schoenborn and Benson 1988; Schoenborn and Boyd 1989).

In 1987, BRFSS covered blood pressure, physical activity, weight and dieting, diet, alcohol use, preventive practices, seatbelt use, stress, pregnancy status, use of oral contraceptives, and use of smokeless tobacco and cigarettes. The median cooperation rate (the ratio of completed interviews to the sum of completed interviews and refusals) among the participating States was 84 percent (Remington et al. 1988). Similar to NHIS, BRFSS defined a former smoker as an individual who had smoked at least 100 cigarettes in his or her lifetime and was not smoking at the time of the survey. (Mean abstinence of former smokers cannot be calculated. However, 64 and 54 percent of men and women, respectively, were abstinent from cigarettes for more than 5 years.)

Although these three surveys are similar, the published data available from them differ in several respects. Data from the 1985 NHIS, presented in Table 3, are age-adjusted (Schoenborn and Benson 1988). Data from the 1987 NHIS, presented in Table 4, are simple proportions with no variables controlled (Schoenborn and Boyd 1989). Data from the 1987 BRFSS were analyzed to assess the relationships between cigarette smoking and lifestyle and preventive practices (Table 5) and to examine the same relationships with respect to the duration of cigarette abstinence (Table 6). The odds ratios, presented in Tables 5 and 6, are controlled for age, ethnicity, and level of education.

TABLE 3.—Summary of data from 1985 NHIS, behaviors of never, former, and current smokers aged 20 and older

Behavior	Never smokers %	Former smokers %	Current smokers %
MEN			
Alcohol consumption			
Heavier drinker[a]	7.9	12.7	18.9
≥5 drinks[b]	13.8	21.2	28.7
Weight/diet/exercise			
Never eats breakfast	18.9	22.3	33.3
Snacks daily	39.3	40.4	38.5
Less physically active[c]	13.2	14.6	18.8
Sedentary[d]	46.6	47.7	57.2
Overweight[e]	28.1	30.0	21.2
Other			
Sleeps ≤6 hr	21.5	22.5	24.9
WOMEN			
Alcohol consumption			
Heavier drinker[a]	1.1	3.7	6.1
≥5 drinks[b]	2.2	5.0	8.5
Weight/diet/exercise			
Never eats breakfast	17.7	19.8	37.6
Snacks daily	37.6	41.5	35.3
Less physically active[c]	19.9	23.3	24.9
Sedentary[d]	61.1	58.5	64.3
Overweight[e]	24.9	23.0	17.9
Other			
Sleeps ≤6 hr	20.4	19.9	24.4

NOTE: All percentages are age adjusted; NHIS=National Health Interview Survey.

[a]Measure developed by the National Institute on Alcohol Abuse and Alcoholism. Categories based on ounces of ethanol consumed during the past 2 wk; heavier drinker is defined as having an average of 1.0 oz (2 drinks) or more/day.

[b]Five drinks or more on 10 days or more in the past year.

[c]Based on perceived level of physical activity relative to others.

[d]Energy expenditure on leisure activity of 0 to 1.4 kcal kg/day.

[e]Twenty percent or more above desirable weight based on 1983 Metropolitan Life Insurance Company standards, according to self-report of weight.

SOURCE: Schoenborn and Benson (1988).

TABLE 4.—Summary of data from 1987 NHIS behaviors of never, former, and current smokers aged 18 and older

Behavior	Never smokers %	Former smokers %	Current smokers %
MEN			
Alcohol consumption			
Drinks beer ≥5/wk	6.4	12.6[a b]	17.1[c]
Drinks ≥3 beers/episode	36.3	30.5[a b]	52.1[c]
Drinks wine ≥5/wk	1.2	3.1[a b]	1.7[c]
Drinks ≥3 glasses wine/episode	12.9	11.6[a b]	20.2[c]
Drinks liquor ≥5/wk	1.7	4.8[a b]	4.1[c]
≥3 drinks/episode	30.4	25.8[a b]	45.1[c]
Dietary practices			
3 meals/day on weekdays	48.6	50.9[a b]	32.8[c]
3 meals/day on weekends	44.3	44.0[b]	35.0[c]
Avoids snacks weekdays	24.5	30.5[a b]	26.5[c]
Avoids snacks weekends	21.0	25.9[a b]	23.6[c]
Has changed diet for health	35.0	44.8[a b]	26.4[c]
≥20% above desirable weight	24.9	34.2[a b]	23.8[c]
Preventive care			
Digital rectal exam (ever)	59.5	66.8[a b]	59.4
Blood stool test (ever)	38.6	44.9[a b]	33.9[c]
Proctoscopic exam (ever)	24.0	27.7[a b]	21.0[c]
WOMEN			
Alcohol consumption			
Drinks beer ≥5/wk	0.9	2.3[a b]	4.0[c]
Drinks ≥3 beers/episode	17.1	17.2[b]	32.7[c]
Drinks wine ≥5/wk	1.3	4.3[a b]	1.9[c]
Drinks ≥3 glasses wine/episode	7.0	10.9[a b]	17.8[c]
Drinks liquor ≥5/wk	0.7	2.7[a]	2.7[c]
≥3 drinks/episode	13.7	14.1[b]	32.0[c]
Dietary practices			
3 meals/day on weekdays	50.1	49.5[b]	29.5[c]
3 meals/day on weekends	44.2	41.8[a b]	29.4[c]
Avoids snacks weekdays	26.6	26.9	26.8
Avoids snacks weekends	23.6	24.4[a d]	23.6
Has changed diet for health	38.7	49.0[a b]	34.5[c]
≥20% above desirable weight	24.3	24.8[b]	20.3[c]
Preventive care			
Digital rectal exam (ever)	56.8	67.4[a b]	60.6[c]
Blood stool test (ever)	37.9	46.2[a b]	35.7[c]
Proctoscopic exam (ever)	20.8	27.2[a b]	21.1
Pap smear (within year)	39.2	43.5[a b]	40.7[c]
Breast self-exam (within yr)	34.8	40.3[a b]	34.0
Breast exam (monthly)	51.5	52.2	52.1
Mammogram (ever)	38.5	46.7[a b]	35.1[c]

NOTE: NHIS=National Health Interview Survey.
[a]Former smokers differ from never ($p \leq 0.5$).
[b]Former smokers differ from current ($p \leq 0.5$).
[c]Current differ from never ($p \leq 0.5$).
[d]This is (a) but not (b) because of sample size despite same point estimate.
SOURCE: Schoenborn and Boyd (1989).

TABLE 5.—Summary of data from 1987 BRFSS, behaviors of former smokers and current smokers aged 18 and older

Behavior	Adjusted odds ratios		
	Former smokers relative to never smokers	Current smokers relative to never smokers	Former smokers relative to current smokers
MEN			
Alcohol consumption			
Any alcohol/mo	1.75[a]	2.11[a]	0.82[a]
≥5 drinks/episode	1.67[a]	2.64[a]	0.63[a]
≥60 drinks/mo	1.75[a]	3.03[a]	0.58[a]
Drinking and driving	1.44[a]	1.99[a]	0.71[a]
Weight/diet/exercise			
Obese (BMI)[c]	1.05	0.62[a]	1.68[a]
Obese (Met. Life)[d]	1.06	0.64[a]	1.63[a]
Trying to lose pounds	1.22[a]	0.63[a]	1.92[a]
More exercise	0.98	0.82[a]	1.17[b]
Eating fewer kcal	0.85[b]	0.82[b]	1.04
Physical activity	1.10[b]	0.69[a]	1.57[a]
Sedentary	0.91[b]	1.44[a]	0.64[a]
Preventive care			
Cholesterol test	1.27[a]	0.94	1.34[a]
Flu shot past month	1.09	0.87[b]	1.26[a]
Other			
Use ST	1.74[a]	0.84[b]	2.09[a]
Use seatbelt	0.92[b]	0.58[a]	1.60[a]
WOMEN			
Alcohol consumption			
Any alcohol/mo	2.07[a]	2.34[a]	0.87[a]
≥5 drinks/episode	1.86[a]	3.35[a]	0.55[a]
≥60 drinks/mo	2.88[a]	5.45[a]	0.52[a]
Drinking and driving	1.87[a]	2.92[a]	0.65[a]
Weight/diet/exercise			
Obese (BMI)[c]	0.98	0.63[a]	1.59[a]
Obese (Met. Life)[d]	0.96	0.65[a]	1.52[a]
Trying to lose pounds	1.19[a]	0.75[a]	1.60[a]
More exercise	1.07	0.72[a]	1.48[a]
Eating fewer kcal	0.97	0.96	0.99
Physical activity	1.17[a]	0.81[a]	1.45[a]
Sedentary	0.86[a]	1.24[a]	0.69[a]
Preventive care			
Cholesterol test	1.15[a]	1.11[a]	1.05
Flu shot past month	0.95	0.91[b]	1.05