

- SHIFFMAN, S.M. The tobacco withdrawal syndrome. In: Krasnegor, N.A. (ed.) *Cigarette Smoking as a Dependence Process*. NIDA Research Monograph 23. DHEW Publication No. (ADM) 79-800. January 1979, pp. 158-184.
- SHIFFMAN, S.M., JARVIK, M.E. Smoking withdrawal symptoms in two weeks of abstinence. *Psychopharmacology* 50(1):35-39, 1976.
- SHIPLEY, R.H., ORLEANS, C.T., WILBUR, C.S., PISERCHIA, P.V., MCFADDEN, D.W. Effect of the Johnson & Johnson Live for Life Program on employee smoking. *Preventive Medicine* 17:25-34, 1988.
- SHIPLEY, R.H., ROSEN, T.J., WILLIAMS, C. Measurement of smoking: Surveys and some recommendations. *Addictive Behaviors* 7:299-302, 1982.
- SILVERSTEIN, B. Cigarette smoking, nicotine addiction, and relaxation. *Journal of Personality and Social Psychology* 42(5):946-950, May 1982.
- SNYDER, F.R., DAVIS, F.C., HENNINGFIELD, J.E. The tobacco withdrawal syndrome: Assessment on a computerized test battery. *Drug and Alcohol Dependence* 23:259-266, 1989.
- SNYDER, F.R., HENNINGFIELD, J.E. Effects of nicotine administration following 12 h of tobacco deprivation: Assessment on computerized performance tasks. *Psychopharmacology* 97:17-22, 1989.
- SOBELL, L.C., SOBELL, M.B., KOZLOWSKI, L.T., TONEATTO, T. Alcohol or tobacco research versus alcohol and tobacco research. *British Journal of Addiction* 85(2):263-269, February 1990.
- STOCKWELL, T. Is there a better word than "craving?" *British Journal of Addiction* 82:44-45, 1987.
- STRAITS, B.C. Social and psycho-physiological correlates of smoking withdrawal. *Social Science Quarterly* 51(1):80-96, 1970.
- SUEDFELD, P., BEST, J.A. Satiation and sensory deprivation combined in smoking therapy: Some case studies and unexpected side-effects. *International Journal of the Addictions* 12(2/3):337-359, 1977.
- SWAN, F., DENK, C., PARKER, S., CARMELLI, D., FURZE, C., ROSENMAN, R. Risk factors for late relapse in male and female ex-smokers. *Addictive Behaviors* 13:253-256, 1988.
- TAMERIN, J.S. The psychodynamics of quitting smoking in a group. *American Journal of Psychiatry* 129(5):101-107, November 1972.
- TAPP, J.T., GOLDENTHAL, P. A factor analytic study of health habits. *Preventive Medicine* 11:724-728, 1982.
- TARRIERE, H.C., HARTMANN, F. Investigation into the effects of tobacco smoke on a visual vigilance task. *Pharmacology and Therapeutics* 21:208, 1983.
- TAYLOR, D.H., BLEZARD, P.N. The effects of smoking and urinary pH on a detection task. *Quarterly Journal of Experimental Psychology* 31:635-640, 1979.
- TIPTON, R.M., RIEBSAME, W.E. Beliefs about smoking and health: Their measurement and relationship to smoking behavior. *Addictive Behaviors* 12:217-223, 1987.
- TOMKINS, S.S. Psychological model for smoking behavior. *American Journal of Public Health* 56(12):17-20, December 1966.
- TONG, J.E., LEIGH, G., CAMPBELL, J., SMITH, D. Tobacco smoking, personality and sex factors in auditory vigilance performance. *British Journal of Psychology* 68:365-370, 1977.
- TØNNESEN, P., FRYD, V., HANSEN, M., HELSTED, J., GUNNERSEN, A.B., FORCHAMMER, H., STOCKNER, M. Effect of nicotine chewing gum in combination with group counseling on the cessation of smoking. *New England Journal of Medicine* 318(1):15-18, 1988.

- TUOMILEHTO, J., NISSINEN, A., PUSKA, P., SALONEN, J., JALKANEN, L. Long-term effects of cessation of smoking on body weight, blood pressure and serum cholesterol in the middle-aged population with high blood pressure. *Addictive Behaviors* 11:1-9, 1986.
- U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES. *The Health Consequences of Smoking: Nicotine Addiction. A Report of the Surgeon General, 1988.* U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, Center for Health Promotion and Education, Office on Smoking and Health. DHHS Publication No. (CDC) 88-8406, 1988.
- U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES. *Reducing the Health Consequences of Smoking: 25 Years of Progress. A Report of the Surgeon General.* U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. DHHS Publication No. (CDC) 89-8411, 1989.
- VERBRUGGE, L.M. Work satisfaction and physical health. *Journal of Community Health* 7(4):262-283, Summer 1982.
- WALLSTON, K.A., WALLSTON, B.S., DEVELLIS, R. Development of the multidimensional health locus of control (MHLC) scales. *Health Education Monographs* 6(2):160-170, Spring 1978.
- WARBURTON, D.M. Psychopharmacological aspects of nicotine. In: Wonnacott, S., Russell, M.A.H., Stolerman, I.P. (eds.) *Nicotine Psychopharmacology.* New York: Oxford University Press, 1990, pp. 76-111.
- WESNES, K., REVELL, A. The separate and combined effects of scopolamine and nicotine on human information processing. *Psychopharmacology* 84:5-11, 1984.
- WESNES, K., WARBURTON, D.M. The effects of cigarette smoking and nicotine tablets upon human attention. In: Thornton, R.E. (ed.) *Smoking Behaviour: Physiological and Psychological Influences.* London: Churchill Livingstone, 1978, pp. 131-147.
- WESNES, K., WARBURTON, D.M. Smoking, nicotine and human performance. *Pharmacology and Therapeutics* 21:189-208, 1983.
- WESNES, K., WARBURTON, D.M. Effects of scopolamine and nicotine on human rapid information processing performance. *Psychopharmacology* 82:147-150, 1984.
- WESNES, K., WARBURTON, D.M., MATZ, B. Effects of nicotine on stimulus sensitivity and response bias in a visual vigilance task. *Neuropsychobiology* 9:41-44, 1983.
- WEST, D.W., GRAHAM, S., SWANSON, M., WILKINSON, G. Five year follow-up of a smoking withdrawal clinic population. *American Journal of Public Health* 67(6):536-544, June 1977.
- WEST, R. Use and misuse of craving. *British Journal of Addiction* 82:39-40, 1987.
- WEST, R., SCHNEIDER, N. Craving for cigarettes. *British Journal of Addiction* 82(4):407-415, April 1987.
- WEST, R.J. Psychology and pharmacology in cigarette withdrawal. *Journal of Psychosomatic Research* 28(5):379-386, 1984.
- WEST, R.J., HAJEK, P., BELCHER, M. Time course of cigarette withdrawal symptoms during four weeks of treatment with nicotine gum. *Addictive Behaviors* 12:1-5, 1987.
- WEST, R.J., HAJEK, P., BELCHER, M. Severity of withdrawal symptoms as a predictor of outcome of an attempt to quit smoking. *Psychological Medicine* 19(4):981-985, November 1989.
- WEST, R.J., JARVIS, M.J. Effects of nicotine on finger tapping rate in non-smokers. *Pharmacology, Biochemistry and Behavior* 25:727-731, 1986.
- WEST, R.J., JARVIS, M.J., RUSSELL, M.A.H., CARRUTHERS, M.E., FEYERABEND, C. Effect of nicotine replacement on the cigarette withdrawal syndrome. *British Journal of Addiction* 79:215-219, 1984.

- WEST, R.J., KRANZLER, H.R. Craving for cigarettes and psychoactive drugs. In: Warburton, D. (ed.) *Comparative Drug Use*. Harwood Academic Publishers, 1990.
- WEST, R.J., RUSSELL, M.A.H. Pre-abstinence smoke intake and smoking motivation as predictors of severity of cigarette withdrawal symptoms. *Psychopharmacology* 87:334–336, 1985.
- WILLIAMS, D.G. Different cigarette-smoker classification factors and subjective state in acute abstinence. *Psychopharmacology* 64(2):231–235, August 8, 1979.
- WILLIAMS, S.G., HUDSON, A., REDD, C. Cigarette smoking, manifest anxiety and somatic symptoms. *Addictive Behaviors* 7(4):427–428, 1982.
- WORLD HEALTH ORGANIZATION. The craving for alcohol. Report of the WHO Expert Committee on Mental Health and on Alcohol. *Quarterly Journal of Studies on Alcohol* 16:33–66, 1955.

**VOLUME APPENDIX
NATIONAL TRENDS IN SMOKING
CESSATION**

CONTENTS

Introduction	583
Sources of Data	583
National Center for Health Statistics Surveys	583
Office on Smoking and Health Surveys	584
Measures of Quitting Behavior	584
Percentage of Former Smokers in the Entire Population	585
Percentage of Ever Smokers Who Are Former Smokers ("Quit Ratio")	585
The Smoking Continuum	585
Other Measures	588
Trends in the Proportion of Ever Smokers Who Are Former Smokers ("Quit Ratio")	588
Trends by Gender	588
Trends by Race	593
Trends by Age	593
Trends by Level of Educational Attainment	595
Long-Term Abstinence and Relapse	595
National Health and Nutrition Examination Survey Epidemiologic Followup Study	596
The Smoking Continuum	599
Percentage of Ever Smokers Who Have Never Tried to Quit	599
Percentage of Those Smoking at 12 Months Prior to a Survey Interview Who Quit for at Least 1 Day During Those 12 Months	606
Percentage of Ever Smokers Who Had Been Abstinent for Less Than 1 Year ..	606
Percentage of Ever Smokers Who Had Been Abstinent for 1 to 4 Years	606
Percentage of Ever Smokers Who Had Been Abstinent for at Least 5 Years ...	607
Interpretation of Continuum Findings	607
Other Measures Related to Smoking Cessation	608
Intention to Smoke in 5 Years	608
Receipt of Advice to Quit From a Doctor	609
Conclusions	610
References	613

INTRODUCTION

This volume appendix discusses national trends in smoking cessation over the last 25 years, specifically updating and expanding descriptions of the national trends in quitting activity presented in previous Surgeon General's reports (US DHHS 1980, 1983, 1988, 1989a). This Section does not provide a detailed discussion of psychosocial, pharmacologic, and behavioral factors known to be related to cessation, because this information is available from other sources (US DHEW 1979; US DHHS 1980, 1988, 1989a).

Data are utilized from 5 national cross-sectional surveys on adult tobacco use that were performed by the Office on Smoking and Health (OSH) (formerly the National Clearinghouse for Smoking and Health) and the 12 National Health Interview Survey (NHIS) supplements and the National Health and Nutrition Examination Survey (NHANES) Epidemiologic Followup Study (NHEFS), both performed by the National Center for Health Statistics (NCHS). The surveys were conducted between 1965 and 1987. The national surveys and the measures of quitting activity are described below, followed by a discussion of the data. Information on smoking cessation during pregnancy is also included in Chapter 8.

Information on smoking behavior was obtained from these surveys by means of self-report (i.e., without biochemical validation). As discussed in Chapter 2, self-report is considered a valid measure of smoking status in cross-sectional surveys, although some underreporting of daily cigarette consumption likely occurs.

SOURCES OF DATA

National Center for Health Statistics Surveys

Survey data collected by NCHS and available for inclusion in this Report were derived from the 1965, 1966, 1970, 1974, 1976, 1977, 1978, 1979, 1980, 1983, 1985, and 1987 supplements to NHIS and the 1982 to 1984 NHEFS. Cigarette smoking status (current, former, and never) is assessed in the same manner in all surveys. The constructs assessed on the NHIS supplements vary from survey year to survey year. Variables assessed include attempts to quit smoking among current smokers, duration of abstinence among former smokers, and receipt of advice to quit from a doctor.

NHIS, a cross-sectional household interview survey, samples the civilian, noninstitutionalized population of the United States (NCHS 1958, 1985, 1989). Weighting procedures are used to provide national estimates. Sample sizes for the smoking supplements (ages 20+) vary from approximately 9,700 in 1980 to over 80,000 in 1966.

NHEFS was a followup study of persons enrolled in NHANES-I, which assessed lifetime patterns of cigarette smoking behavior among current and former smokers. Whereas NHANES-I participants were drawn from a national probability sample of the civilian, noninstitutionalized population, NHEFS participants included only those who underwent the medical examination in NHANES-I. Personal interviews with each participant or a proxy (for deceased NHANES-I participants) were completed for 12,200 of the 14,407 original examinees. Proxy interviews were conducted with 1,697

representatives of deceased NHANES-I examinees. The interval between NHANES-I and NHEFS was about 10 years (Madans et al. 1986; NCHS 1987).

Office on Smoking and Health Surveys

OSH has commissioned five national surveys of tobacco use among adults in this country, referred to as the Adult Use of Tobacco Surveys (AUTSs). The surveys ask detailed questions designed to assess the knowledge, attitudes, and practices of adults regarding all forms of tobacco use. These cross-sectional surveys were conducted in 1964, 1966, 1970, 1975, and 1986 (US DHEW 1969, 1973, 1976; US DHHS 1989b).

The similar or identical wording of several standard questions for all five surveys facilitates comparisons. Constructs assessed included tobacco use behavior, intentions regarding future smoking behavior among ever smokers, and receipt of a doctor's advice to quit smoking.

Some differences in the conduct and design of the studies occurred. The mode of interviewing changed with time. The 1964 survey obtained data solely from personal household interviews. Whereas personal household interviews were the major mode of data collection in the 1966 survey, telephone interviews and mailed questionnaires were also used to collect data from eligible household members not available when the interviewer was present in the house. The 1970 and 1975 surveys conducted telephone interviews when possible and personal household interviews in nontelephone households. The 1986 survey was conducted entirely by telephone. The 1964 and 1966 surveys drew samples only from the contiguous United States. Other AUTSs collected data from residents of all 50 States.

The actual number of respondents for each survey was 4,635 in 1964, 4,061 in 1966, 5,191 in 1970, 12,029 in 1975, and 13,031 in 1986 (US DHEW 1969, 1973, 1976; US DHHS 1989b). In each survey, weighting procedures were used to adjust for an oversampling of ever smokers in the original study population. Comparisons between the 1986 AUTS and the others will not be exact, because the 1986 AUTS weights to an estimate of the adult U.S. population, whereas the other surveys weight to their respective sample sizes.

MEASURES OF QUITTING BEHAVIOR

As documented in several previous Surgeon General's reports (US DHEW 1979; US DHHS 1988, 1989a) and discussed in Chapter 2 of this Report, smoking cessation is a multifactorial process for overcoming an addictive behavior. One model characterizes this process as having several stages—precontemplation, contemplation, action, and maintenance (Prochaska and DiClemente 1983; Chapter 2). People frequently cycle and recycle through the various stages (marked by frequent relapse episodes) on their way to becoming long-term ex-smokers (Prochaska and DiClemente 1983; Cohen et al. 1989). This analysis of national trends in smoking cessation will use several measures to describe the quitting process. The 1989 Surgeon General's Report (US DHHS 1989a) discusses three measures of quitting behavior. These interrelated parameters are discussed below.

Percentage of Former Smokers in the Entire Population

This measure of quitting behavior has been used to calculate the number of former smokers in the population. Based on data from the 1987 NHIS, for example, 23.6 percent of the 162.6 million civilian, noninstitutionalized adults 20 years of age and older were former cigarette smokers. There were, therefore, approximately 38.5 million former smokers 20 years old or older in the United States in 1987. The percentage of former smokers in the entire population is limited as a measure of quitting activity primarily because it does not take into account the percentage of the population that has ever smoked (and thus is "at risk" of quitting). It also does not differentiate between people who have been abstinent for a short period and people who have maintained abstinence for several years (US DHHS 1989a).

Percentage of Ever Smokers Who Are Former Smokers ("Quit Ratio")

By dividing the number of ever smokers into the number of former smokers, perspective is given to the magnitude of quitting in a population. The term "quit ratio" has been used to describe this measure (CDC 1986; Pierce, Aldrich et al. 1987; US DHHS 1988, 1989a; Fiore et al. 1989) and is the term used below; this measure has also been termed the "quit rate" (Kabat and Wynder 1987) or the "cessation rate" (Jarvis 1984). The term "ratio" is mostly used in sciences when the numerator and the denominator are two separate and distinct quantities (Elandt-Johnson 1975). "Quit ratio" is used here, even though the numerator is included in the denominator, because of its repeated use in the literature as well as in previous Surgeon General's reports. The percentage of ever smokers who have discontinued smoking indicates the prevalence of abstinence (Ossip-Klein et al. 1986).

In 1987, 23.6 percent of the population were former cigarette smokers and 29.1 percent of the population were current smokers. The quit ratio among ever smokers was 44.8 percent; that is, nearly one-half of all living adults who ever smoked cigarettes had quit. Quit ratios by gender and age were recently published for 36 States and the District of Columbia based on 1988 data from the Behavioral Risk Factor Surveillance System (Anda et al. 1990) (Table 1).

The measure is limited because it treats all former smokers equally, regardless of duration of abstinence. It also classifies current smokers who had never tried to stop smoking in the same manner as it does current smokers who had been abstinent for a long period of time and relapsed shortly before the time of the survey (US DHHS 1989a).

The Smoking Continuum

The 1989 Surgeon General's Report defined a 10-category smoking continuum based on data from the 1986 AUSTS. This continuum expanded on the smoking status variable (current, former, and never) to incorporate the timing and duration of quit attempts (US DHHS 1989a). Respondents were asked whether they had ever made a serious attempt to quit, and if the response was affirmative, they were then asked about the timing of

TABLE 1.—Quit ratio^a in selected States, by age group and gender—BRFSS, 1988

State	18-34		35-49		50-64		≥65		Men		Women		Total	
	%	(±95% CI) ^b	%	(±95% CI)	%	(±95% CI)	%	(±95% CI)	%	(±95% CI)	%	(±95% CI)	%	(±95% CI)
Alabama	24.5	(7.0)	41.3	(7.3)	54.3	(8.3)	65.8	(10.1)	47.4	(5.6)	37.3	(5.9)	43.2	(4.1)
Arizona	45.5	(7.9)	54.2	(8.0)	61.2	(9.9)	67.9	(8.8)	60.1	(6.2)	49.8	(6.0)	55.4	(4.3)
California	40.1	(5.7)	54.3	(5.6)	64.3	(6.9)	65.6	(7.8)	56.9	(4.4)	49.3	(4.5)	53.7	(3.2)
Connecticut	38.6	(7.4)	49.0	(7.3)	60.7	(9.3)	74.9	(8.0)	55.1	(6.4)	50.4	(5.8)	52.8	(4.3)
District of Columbia	37.2	(8.8)	45.4	(9.9)	56.5	(11.6)	59.4	(12.5)	52.0	(8.0)	43.4	(7.3)	47.6	(5.5)
Florida	43.7	(7.4)	45.3	(7.2)	52.3	(7.7)	77.6	(5.7)	58.5	(4.8)	50.4	(5.2)	54.8	(3.5)
Georgia	39.5	(5.6)	40.3	(8.7)	53.1	(12.7)	70.2	(17.2)	44.2	(7.2)	46.6	(6.8)	45.3	(5.2)
Hawaii	33.7	(7.1)	45.0	(7.6)	61.5	(9.1)	70.9	(9.9)	49.6	(5.8)	44.3	(6.3)	47.3	(4.3)
Idaho	42.6	(7.1)	49.2	(6.9)	58.3	(8.3)	77.1	(6.2)	61.3	(5.5)	44.2	(5.5)	54.0	(3.9)
Illinois	35.1	(6.7)	42.6	(6.6)	53.6	(8.0)	64.1	(8.3)	48.9	(5.3)	42.4	(5.2)	45.8	(3.6)
Indiana	33.1	(5.5)	42.2	(5.8)	51.9	(6.7)	79.1	(5.9)	51.6	(4.4)	41.2	(4.6)	47.0	(3.2)
Iowa	30.0	(9.2)	59.5	(10.5)	55.4	(12.3)	71.1	(10.9)	60.3	(8.1)	39.1	(7.2)	50.7	(5.8)
Kentucky	22.6	(5.6)	33.6	(6.9)	48.2	(7.0)	63.6	(7.0)	42.6	(4.9)	31.1	(4.5)	37.8	(3.4)
Maine	38.3	(7.2)	50.4	(7.4)	65.3	(8.4)	72.7	(8.7)	60.5	(5.9)	44.5	(5.5)	53.2	(4.1)
Maryland	41.1	(9.0)	45.6	(8.3)	57.9	(9.9)	70.9	(9.3)	53.0	(7.3)	48.0	(6.5)	50.6	(5.0)
Massachusetts	35.2	(6.6)	50.8	(7.0)	59.8	(9.5)	75.5	(7.1)	56.2	(6.3)	47.6	(5.2)	51.9	(4.2)
Michigan	37.4	(7.0)	50.5	(7.3)	55.0	(10.3)	65.9	(13.4)	52.0	(6.4)	45.5	(5.8)	48.9	(4.5)
Minnesota	41.2	(4.4)	55.2	(4.3)	64.6	(5.4)	76.0	(5.0)	60.4	(3.4)	49.2	(3.8)	55.4	(2.5)
Missouri	35.8	(7.1)	42.9	(7.5)	57.5	(8.4)	79.2	(7.0)	54.7	(6.1)	43.5	(5.4)	49.6	(4.1)
Montana	45.7	(9.6)	58.8	(7.7)	58.8	(8.2)	79.0	(7.1)	62.0	(6.4)	54.1	(6.2)	58.6	(4.5)

TABLE 1.—Continued

State	18–34		35–49		50–64		≥65		Men		Women		Total	
	%	(±95% CI)	%	(±95% CI)	%	(±95% CI)	%	(±95% CI)	%	(±95% CI)	%	(±95% CI)	%	(±95% CI)
Nebraska	39.6	(7.4)	57.6	(8.3)	57.6	(9.0)	74.5	(7.8)	59.0	(5.9)	47.2	(6.1)	54.0	(4.3)
New Hampshire	35.2	(7.0)	53.0	(7.4)	60.3	(9.9)	74.2	(9.2)	53.8	(6.1)	48.6	(6.0)	51.5	(4.6)
New Mexico	38.4	(8.7)	47.0	(9.2)	53.4	(9.8)	64.7	(11.7)	49.4	(7.3)	46.3	(7.0)	48.0	(5.2)
New York	29.8	(7.4)	42.7	(8.1)	66.3	(8.9)	80.3	(8.2)	54.2	(6.8)	46.8	(6.5)	50.5	(4.7)
North Carolina	37.0	(6.8)	47.5	(6.7)	47.9	(8.5)	72.3	(7.9)	50.4	(5.7)	43.4	(5.2)	47.3	(3.9)
North Dakota	38.7	(7.1)	50.9	(6.8)	62.2	(7.9)	73.3	(7.4)	58.3	(5.1)	45.5	(5.6)	53.1	(3.8)
Ohio	30.6	(6.5)	42.3	(7.6)	57.4	(9.0)	67.3	(8.4)	52.0	(6.2)	37.4	(5.7)	44.9	(4.2)
Oklahoma	37.1	(9.1)	43.6	(8.6)	55.9	(10.2)	62.9	(13.4)	53.4	(7.0)	39.6	(6.7)	47.5	(5.1)
Rhode Island	34.7	(6.4)	44.8	(6.8)	55.6	(8.5)	69.8	(7.2)	51.1	(5.6)	44.6	(5.1)	47.8	(3.8)
South Carolina	28.9	(5.8)	41.5	(6.6)	58.7	(7.6)	72.2	(8.8)	46.0	(5.1)	42.1	(5.4)	44.4	(3.8)
South Dakota	37.4	(9.2)	52.3	(8.6)	60.8	(9.2)	71.1	(8.7)	55.6	(5.8)	50.5	(6.7)	53.4	(4.3)
Tennessee	29.0	(4.8)	40.9	(5.7)	49.5	(6.8)	67.2	(7.9)	43.4	(4.5)	39.4	(4.1)	41.8	(3.2)
Texas	38.8	(8.6)	45.7	(8.4)	53.7	(10.5)	69.3	(12.5)	52.5	(6.7)	41.4	(6.8)	47.9	(4.8)
Utah	33.5	(7.5)	50.9	(8.1)	68.3	(11.3)	80.1	(9.2)	65.2	(5.8)	40.5	(8.6)	56.6	(5.0)
Washington	37.7	(7.3)	54.8	(7.5)	53.7	(8.7)	82.5	(7.9)	58.2	(5.8)	46.1	(5.8)	53.0	(4.2)
West Virginia	38.5	(7.1)	43.4	(6.5)	49.1	(7.2)	69.4	(7.2)	54.5	(5.2)	38.4	(5.0)	47.6	(3.7)
Wisconsin	35.0	(6.9)	52.0	(7.3)	62.2	(8.5)	76.0	(9.1)	63.8	(5.6)	46.3	(6.7)	56.5	(4.4)
Median prevalence	37.2		47.0		57.5		71.1		54.2		44.6		50.5	

NOTE: BRFSS=Behavioral Risk Factor Surveillance System.

^aDefined as the percentage of ever smokers who were former smokers at the time of the survey.

^bConfidence interval.

SOURCE: BRFSS 1988 (Anda et al. 1990)

their most recent quit attempt. This measure provides information on the recent quitting history of the population (Pierce, Giovino et al. 1989; US DHHS 1989a). The trend analyses presented below will use an eight-category continuum (Table 2) among ever smokers to incorporate data from the 1978, 1979, 1980, and 1987 NHISs. As opposed to the 1986 AUTS, the questions asked in these NHISs do not permit a dichotomous classification of current smokers who had never tried to quit according to interest in quitting.

In addition to a description of the overall smoking continuum, several segments of the continuum, or measures derived from the continuum, will be described separately. These measures include the following:

- The percentage of ever smokers who have never tried to quit;
- The percentage of people smoking at 12 months prior to a survey interview who had been abstinent for at least 1 day during those 12 months;
- The percentage of ever smokers who had stopped smoking for less than 1 year;
- The percentage of ever smokers who had stopped smoking for 1 to 4 years; and
- The percentage of ever smokers who had stopped smoking for at least 5 years.

Other Measures

Respondents to AUTSs were asked to estimate the possibility that they would be smoking 5 years after the survey. This question gives a measure of intention to smoke. Finally, respondents to several NHISs and to all OSH tobacco use surveys were asked if a physician had ever advised them to stop smoking.

TRENDS IN THE PROPORTION OF EVER SMOKERS WHO ARE FORMER SMOKERS (“QUIT RATIO”)

Using data from NHISs for 1965 to 1987, trends in the proportion of ever cigarette smokers in the U.S. adult population who have stopped smoking cigarettes (quit ratio) are presented by gender and by race in Figures 1 and 2, respectively. Trends for the total adult population, as well as trends by age and by education, are shown in Table 3. These data, with the exception of the age-specific estimates, are age-adjusted to the 1985 population. In these analyses, the quit ratio was regressed on the calendar year of data collection. The R^2 statistic, supplied for each trend analysis, is a measure of the strength of the linear relationship. R^2 values may range from 0 (no linear trend) to 1.0 (a perfect positive or negative linear relationship).

Trends by Gender

As shown in Figure 1, the quit ratio for both genders has been increasing in an approximately linear fashion ($R^2=0.94$ for males and 0.97 for females) since 1965, and

TABLE 2.—Cigarette smoking continuum by year, percentage of ever cigarette smokers, NHISs, United States, 1978–87, adults aged 20 and older

Cigarette smoking continuum	1978	1979	1980	1987
1. Current smokers who had never tried to quit	25.9	26.1	25.4	18.9
2. Current smokers who had quit previously but not in past year	22.7	21.4	23.1	20.0
3. Current smokers who had quit for <7 days in past year	6.6	6.0	5.9	7.0
4. Current smokers who had quit for ≥7 days in past year	8.5	8.6	7.8	8.4
5. Former smokers who had quit within past 3 mo	1.3	1.6	1.4	1.8
6. Former smokers who had been abstinent for 3–12 mo	2.7	2.6	2.7	2.8
7. Former smokers who had been abstinent for 1–5 yr	9.0	10.0	9.5	10.4
8. Former smokers who had quit ≥5 yr earlier	23.3	23.6	24.1	30.7
Percentage of those smoking during the year prior to the survey who tried to quit during that year (Categories 3+4+5+6 divided by 1+2+3+4+5+6)	28.2	28.4	26.8	34.0
Percentage of those smoking during the year prior to the survey who quit during that year and were still abstinent at the time of the survey (Categories 5+6 divided by 1+2+3+4+5+6)	6.1	6.3	6.2	7.8

NOTE: NHIS=National Health Interview Survey.
SOURCE: NHISs 1978, 1979, 1980, 1987.

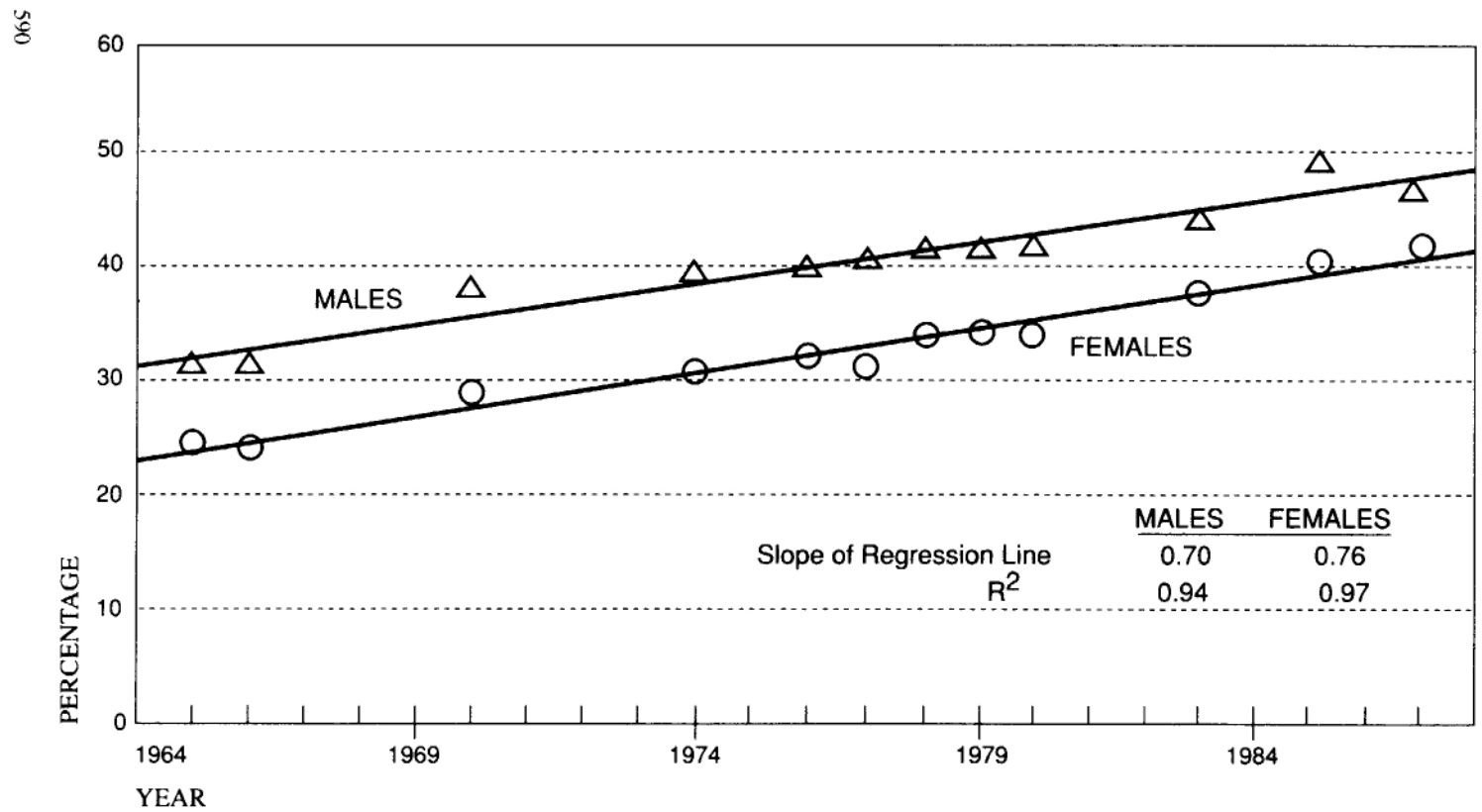


FIGURE 1.—Trends in the quit ratio, United States, 1965–87, by gender

NOTE: Quit ratio is the proportion of ever smokers who are former smokers. NHIS=National Health Interview Survey; OSH=Office on Smoking and Health.

SOURCE: NHISs 1965, 1966, 1970, 1974, 1976, 1977, 1978, 1979, 1980, 1983, 1985, 1987; OSH,

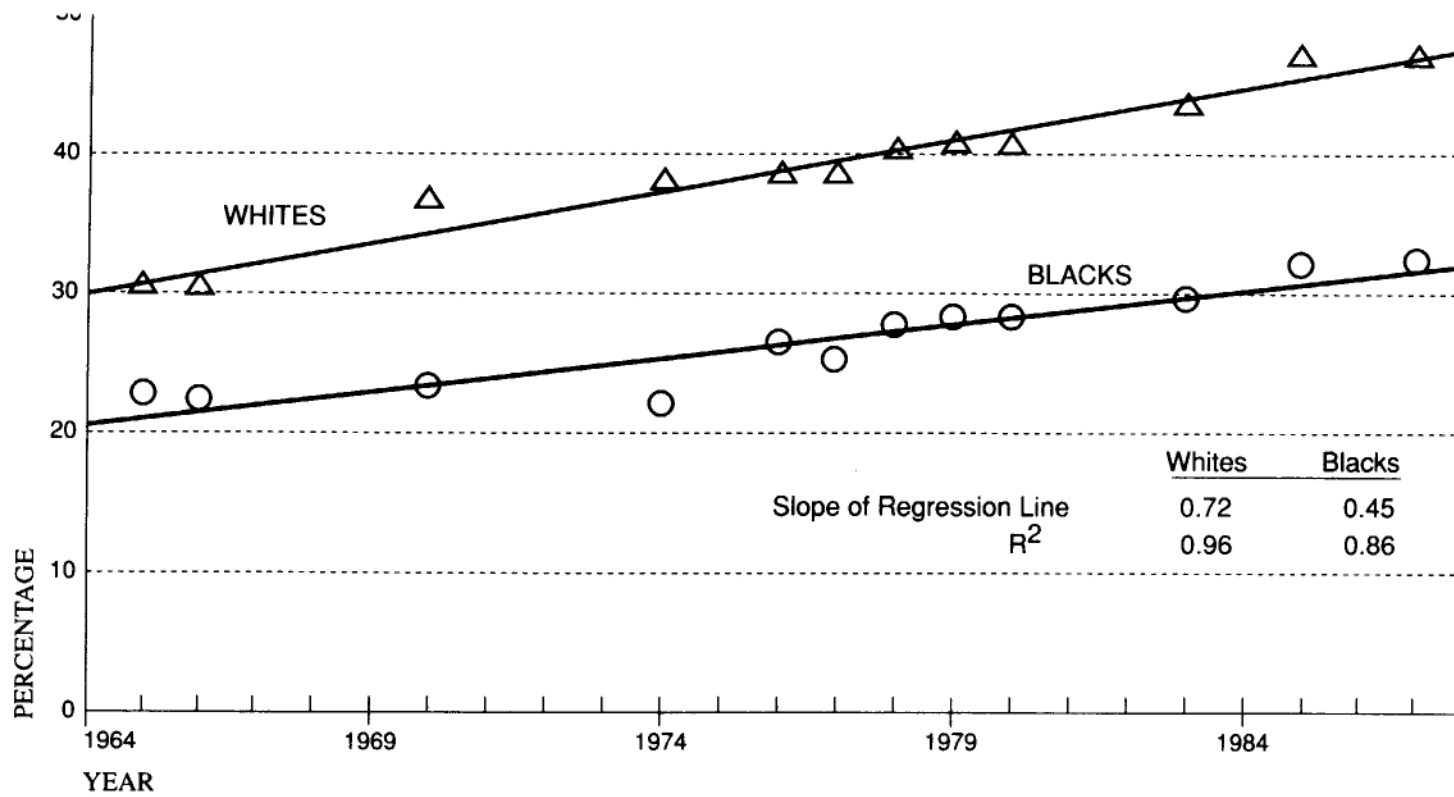


FIGURE 2.—Trends in the quit ratio, United States, 1965–87, by race

NOTE: NHIS=National Health Interview Survey; OSH=Office on Smoking and Health.

SOURCE: NHISs 1965, 1966, 1970, 1974, 1976, 1977, 1978, 1979, 1980, 1983, 1985, 1987; OSH, unpublished data.

TABLE 3.—Trends in quit ratio (%) (percentage of ever cigarette smokers who are former cigarette smokers), by age and by education, NHISs, United States, 1965–87, adults aged 20 and older

Year	Overall population	Age (yr)				Educational level			
		20–24	25–44	45–64	≥65	Less than high school graduate	High school graduate	Some college	College graduate
1965 ^d	29.6	17.8	23.6	30.9	48.7	—	—	—	—
1966	29.5	17.0	23.4	30.9	50.5	33.3	28.0	28.7	39.7
1970	35.3	20.8	29.8	36.1	56.9	38.1	33.6	34.9	48.2
1974	36.3	20.9	29.3	39.7	57.8	38.0	35.2	36.6	47.9
1976	37.1	22.0	29.4	40.4	59.6	39.5	35.0	37.2	46.1
1977	36.8	22.9	29.6	39.5	58.7	38.3	34.0	36.8	48.6
1978	38.5	22.8	31.9	40.1	62.4	38.7	36.3	41.0	49.7
1979	39.0	22.6	31.8	42.4	61.7	40.8	36.7	37.5	50.6
1980	39.0	22.2	33.0	40.9	61.0	39.4	36.5	40.6	48.7
1983	41.8	21.4	34.3	46.4	64.7	42.1	38.7	41.2	54.9
1985	45.0	26.0	38.2	49.7	68.0	41.3	40.5	46.0	61.1
1987	44.8	23.8	37.2	49.2	69.2	44.3	41.1	45.5	59.1
Trend information (1965–87)									
Change ^b /yr	0.68	0.26	0.61	0.84	0.86	0.44	0.55	0.74	0.88
Standard error (±)	0.04	0.06	0.05	0.06	0.06	0.05	0.05	0.08	0.13
R ²	0.96	0.64	0.93	0.95	0.96	0.88	0.92	0.90	0.83

NOTE: The data stratified by education are age adjusted to the 1985 population. NHIS=National Health Interview Survey.

^dFor 1965, data stratified by education were unavailable.

^bIn percentage points.

SOURCE: NHISs 1965, 1966, 1970, 1974, 1976, 1977, 1978, 1979, 1980, 1983, 1985, 1987.

the rates of increase for both are also similar (0.70 percentage points/year for males and 0.76 percentage points/year for females). The quit ratio has been consistently higher for males than for females. Using data from the 1970 and 1975 AUTSs, Jarvis (1984) reclassified as current smokers males who gave up smoking cigarettes but who continued to smoke cigars and/or pipes. When the use of other forms of smoking tobacco was considered, the difference between males and females in the quit ratio (termed as the "cessation rate" by Jarvis) was reduced by more than two-thirds.

Data from the 1987 NHIS Cancer Epidemiology and Control supplement (Schoenborn and Boyd 1989) were analyzed to update the work of Jarvis (Table 4). The weighted percentage of ever cigarette smokers who were former cigarette smokers among males was 48.7 percent. The corresponding number among females was 40.1 percent. When former cigarette smokers who smoked cigars and/or pipes were reclassified as current smokers (without changing the denominator), the prevalence of cessation among ever smokers became 45 percent for males and 40 percent for females. Furthermore, when former cigarette smokers who used any other form of tobacco (cigars, pipes, snuff, and/or chewing tobacco) at the time of the survey were classified as current tobacco users, the figures became 42.1 percent for males and 39.9 percent for females (OSH, unpublished data). Thus, reclassification of former cigarette smokers who were smoking cigars and/or pipes as current smokers reduced the difference in the quit ratio between males and females from 8.6 to 5.0 percentage points. Former cigarette smokers who were using any other form of tobacco were reclassified as current tobacco users, and this reclassification further reduced the difference to 2.2 percentage points.

Trends by Race

Trends by race are presented in Figure 2. The quit ratio among both whites and blacks has been increasing steadily since 1965 ($R^2=0.96$ for whites and 0.86 for blacks). While the change per year since 1965 is higher for whites (0.72 percentage points/year) than it is for blacks (0.45 percentage points/year), the lines have been essentially parallel since 1974 (Fiore et al. 1989). Use of the 1987 NHIS data to reclassify as current smokers all former cigarette smokers who were smoking cigars or pipes reduced the quit ratio from 46.4 to 44.2 percent among whites and from 31.5 to 30.2 percent among blacks. Further reclassification, as current tobacco users, of former cigarette smokers who were using any other form of tobacco reduced the numbers to 42.5 percent for whites and 29.1 percent for blacks (OSH, unpublished data).

Trends by Age

Table 3 provides information on the quit ratio stratified by age. For all age categories, the quit ratio increased from 1965 to 1987. The rate of change was highest in the age categories of 45–64 years and 65 years and older. Reclassification of the 1987 data to account for cigar and pipe smoking and for any other tobacco use lowered the numbers from 23.8 percent to 23.4 and 22.2 percent, respectively, among the 20–24-year-olds; from 37.2 percent to 35.6 and 34.3 percent, respectively, among 25–44-year-olds; from

49.2 percent to 46.4 and 45.0 percent, respectively, among 45–64-year-olds; and from 69.2 percent to 66.2 percent and 62.8 percent, respectively, among those 65-years-old and older (Table 4) (OSH, unpublished data). A detailed analysis of trends in the quit ratio by age for the period 1974 through 1987 has been completed (Novotny et al., in press).

Differences in quit ratios between age groups may reflect actual differences in quitting activity by age—that is, older persons may be more prone to quit and maintain abstinence than younger smokers, perhaps because of the occurrence of smoking-related symptoms or illness. However, continuing smokers are less likely than former smokers to survive to old age (Chapter 3); this selective mortality will artifactually increase the quit ratio among older age groups.

TABLE 4.—Effect of adjusting for use of other tobacco products on quit ratio (percentage of ever cigarette smokers who are former cigarette smokers), 1987, NHIS, United States

	Quit ratio (%)		
	Unadjusted ^d	Adjusting for cigars/pipes ^b	Adjusting for cigars/pipes/snuff/chewing tobacco ^c
Gender			
Males	48.7	45.0	42.1
Females	40.1	40.0	39.9
Race			
Whites	46.4	44.2	42.5
Blacks	31.5	30.2	29.1
Age (yr)			
20–24	23.8	23.4	22.2
25–44	37.2	35.6	34.3
45–64	49.2	46.4	45.0
≥65	69.2	66.2	62.8
Education (yr)			
<12	39.7	38.1	35.2
12	40.9	39.2	37.8
13–15	46.9	44.9	43.5
≥16	61.4	57.3	56.6
Overall	44.8	42.8	41.1

NOTE: NHIS=National Health Interview Survey.

^aThe percentage of ever cigarette smokers who were former cigarette smokers at the time of the survey.

^bAs in footnote (a), but former cigarette smokers who were using cigars and/or pipes at the time of the survey reclassified as current smokers.

^cAs in footnote (a), but former cigarette smokers who were using either cigars, pipes, snuff, or chewing tobacco at the time of the survey reclassified as current tobacco users.

SOURCE: NHIS (1987).

Trends by Level of Educational Attainment

Table 3 shows the quit ratio among college graduates is consistently higher than the ratios among persons with less than high school graduation, high school graduation, or some college education. Also, the rate of increase per year rises as the educational level increases (0.44, 0.55, 0.74, and 0.88 percentage points/ year in persons with <12, 12, 13–15, and 16 or more years of education, respectively). From 1966 to 1977 the quit ratio among high school dropouts was higher than the ratios among the two middle education categories; the reason for this is unclear.

Reclassification of the 1987 NHIS former cigarette smokers based on the use of other tobacco products did not affect the magnitude of the relationships between education categories (Table 4). After reclassification, the quit ratio dropped from 39.7 percent to 38.1 and 35.2 percent in the less-than-high-school-graduation category, from 40.9 percent to 39.2 and 37.8 percent in the high-school-graduation category, from 46.9 percent to 44.9 and 43.5 percent in the some-college category, and from 61.4 percent to 57.3 and 56.6 percent in the college graduation category (OSH, unpublished data).

LONG-TERM ABSTINENCE AND RELAPSE

The prototypical pattern of relapse after cessation among group clinic participants was first published by Hunt, Barnett, and Branch (1971) and is cited in the 1988 Surgeon General's Report (US DHHS 1988). The relapse curve for smokers indicates that approximately 65 percent of all quitters relapsed within 3 months of quitting; another 10 percent relapsed from 3 to 6 months postcessation. About 3 percent more of the original sample of quitters relapsed from 6 to 12 months postcessation.

Because smokers who attend quit-smoking classes are likely to be different from smokers who attempt to quit on their own (Fiore et al. 1990), the probability of quitting success in one group may not apply to the other. Indeed, the results of a meta-analysis of 10 prospective studies of people attempting to quit without any assistance or using only self-help materials suggested that about 24 percent of those study participants who were continuously abstinent at the 6-month followup relapsed before the 1-year followup (Cohen et al. 1989); the corresponding percentage in the study of clinic attendees (Hunt, Barnett, Branch 1971) was 12 percent, as calculated using the percentages in the previous paragraph.

Few prospective studies of cessation have observed participants for longer than 1 year (Schwartz 1987; Glasgow and Lichtenstein 1987). Relapse data after 1 year of continuous abstinence are not presented in some of the intervention studies that include followup periods of more than 1 year (e.g., Lando and McGovern 1982; Lichtenstein and Rodrigues 1977; Ockene et al. 1982; West et al. 1977). In the Multiple Risk Factor Intervention Trial, 15 percent of the special-intervention group and 16 percent of the usual-care group who were abstinent from cigarettes at both the first- and second-year followup assessments reported recidivism during the third or fourth year of followup (Ockene et al. 1982).

Hammond and Garfinkel (1964) provided data from the Cancer Prevention Study I (CPS-I) on a cohort of 65,709 male former smokers (aged 30–89) who were re-

interviewed after 2 years. Of those who had been abstinent for less than 1 year at baseline, 37.3 percent were smoking cigarettes again at followup. Of those who had been abstinent for at least 1 year but less than 2 years or for 2 years or more at baseline, 19.1 and 4.6 percent, respectively, were smoking cigarettes again at the 2-year followup interview.

In another report also based on CPS-I, Hammond and Garfinkel (1963) further subdivided the duration of abstinence at baseline for males aged 50 to 69. For those abstinent for 2 to 4 years, 5 to 9 years, and 10 years or more at baseline, 8.7, 4.1, and 2.2 percent, respectively, were smoking cigarettes at the 2-year followup interview.

Kirscht, Brock, and Hawthorne (1987) surveyed a probability sample of 3,073 Michigan adults in 1980. In 1982, completed followup questionnaires were obtained from 2,110 members (68.7 percent) of the original sample. In 1980, 23.0 percent of the entire sample were ex-smokers. Of those ex-smokers who had been abstinent for less than 6 months in 1980, 38.7 percent were smoking again when they completed the 1982 questionnaire. Among those ex-smokers who had been abstinent between 6 and 23 months in 1980, 29.5 percent were smoking in 1982. Among those abstinent between 24 and 119 months or for 120 months or more in 1980, 9.5 and 2.3 percent, respectively, reported that they were smoking again when the 1982 survey was conducted.

National Health and Nutrition Examination Survey Epidemiologic Followup Study

Data from NHEFS (NCHS 1987; Madans et al. 1986) were used to assess lifetime patterns of quitting in a sample of the adult population (OSH, unpublished data). Reconstructed cigarette smoking prevalence from NHEFS shows good agreement with self-reported smoking status recorded during the original NHANES-I interview (Machlin, Kleinman, Madans 1989).

The description of quitting and relapse discussed below is limited because only quit attempts of 12 months or more were assessed and the reclassification of former cigarette smokers who smoked cigars or pipes as current smokers is not always possible. Quit attempts that occurred before the age of 21 were not considered.

As shown by NHEFS data in Figure 3, of the 6,460 ever cigarette smokers, 55.2 percent had stopped smoking cigarettes for at least 1 year at some point before the NHEFS interview. Of these, 37.6 percent relapsed after at least 1 year of maintaining abstinence. Of those who relapsed, 43.0 percent quit again for at least 1 year. Among those who quit again for at least 1 year, 35.2 percent relapsed a second time. These data indicate that at least one-third of all ever smokers who quit for at least 1 year will eventually relapse.

The product-limit method (Lee 1980) was used to estimate the relapse rate after the first 1-year period of abstinence. As shown in Figure 4, most of the relapse after the first 1-year abstinence period occurred within a few years. About 28 percent of ever smokers who attained abstinence for at least 1 year relapsed within 5 years of quitting. Another 7 percent of the original sample of ever smokers who had quit for 1 year or more relapsed within the next 5 years. Thus, about one-third (35 percent) of former smokers who have maintained abstinence for at least 1 year may eventually relapse.

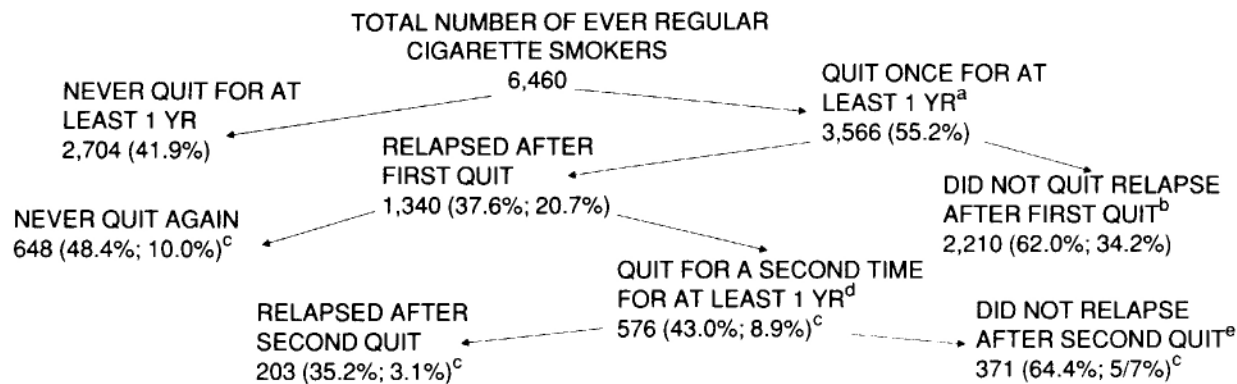


FIGURE 3.—Flow chart of quitting history, attempts lasting longer than 1 year, NHEFS

NOTE: NHEFS=National Health and Nutrition Examination Survey (NHANES-I) Epidemiologic Followup Study.

^aOf the 6,640 ever regular cigarette smokers, 155 quit within the year preceding the NHEFS interview. Data on the first quit attempt were missing for 35 people (4 were current smokers, 6 were former smokers, and 25 were deceased at the time of the interview).

^bOf the 3,566 people who quit for at least 1 year, data were not available on 16 (15 were former smokers and 1 was deceased at the time of the interview).

^cThe first number represents the percentage of the reference number one row above (e.g., 1,340 is 37.6% of 3,566); the second number represents the percentage of the total number of ever regular cigarette smokers in this sample (e.g., 1,340 is 20.7% of 6,460).

^dOf the 1,340 people who relapsed after their first ≥ 1 -yr period of abstinence, 74 quit within the year preceding the interview and 26 never returned to regular smoking. Data were not available on 16 others (11 were current smokers, 3 were former smokers, and 2 were deceased at the time of the interview).

^eOf the 576 people who quit twice for at least 1 yr, data were not available for 2 (both were former smokers at interview).

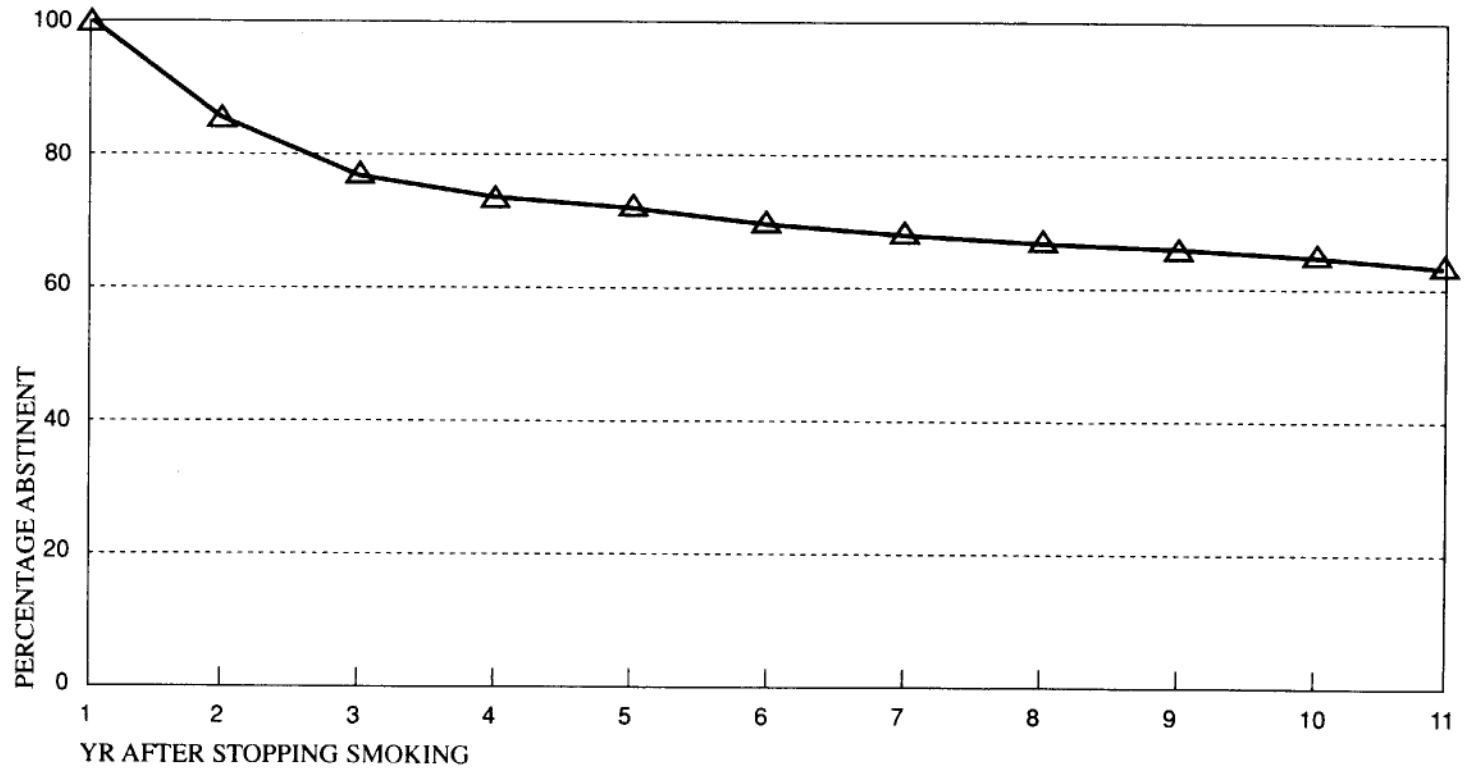


FIGURE 4.—Estimated duration of abstinence on first 1-year or longer quit attempt, product-limit method, N=3,363

SOURCE: NHANES-I Epidemiologic Followup Study 1982-84; OSH, unpublished data.

THE SMOKING CONTINUUM

A number of surveys have sought detailed information on respondents' quitting histories. An eight-point smoking continuum among ever smokers can be developed from the 1978, 1979, and 1980 NHIS tobacco supplements, the 1986 AUSTS, and the 1987 NHIS. Smoking continuums for the four NHISs are presented in Table 2, and are similar over time.

The data in Table 2 can be used in various ways. For example, by focusing on those who were smoking during the year before the survey (categories 1 through 6), the proportion that tried to quit during that year (categories 3+4+5+6 divided by categories 1+2+3+4+5+6) and the proportion that quit during that year and were still abstinent at the time of the survey (categories 5+6 divided by categories 1+2+3+4+5+6) can be estimated. The proportion who tried to quit during the year before the survey was higher in 1987 (34 percent) than in 1978, 1979, and 1980 (27 to 29 percent). The proportion who quit during the year before the survey and were still abstinent at the time of the survey remained stable at 6 to 8 percent from 1978 to 1987.

Data are presented below on various components of the smoking continuum. Data from NHIS years not included in Table 2 are often presented in the following sections because, whereas these surveys did not provide all the questions necessary to construct a complete continuum, enough information to define one or more components of the continuum was collected. These data are broken down by education (Table 5 and Figures 5–9) because educational attainment is a strong sociodemographic predictor of smoking and quitting behavior (US DHHS 1989a; Pierce, Fiore et al. 1989). Data from other stratified analyses (i.e., gender, race, and age) are also presented in Table 5. The data on the continuum have been age-adjusted to the overall 1985 population.

Percentage of Ever Smokers Who Have Never Tried to Quit

There is no overall clear and significant trend from 1974 to 1987 in the percentage of ever smokers who have never tried to quit. Education has a consistent effect on quitting—lower levels of educational attainment are associated with a higher probability of never having tried to quit (Figure 5).

The difference between genders in the proportion of ever smokers who have never tried to quit has been decreasing with time (Table 5). While the proportion of females in this category has been decreasing over the years, it has remained fairly constant for males. The data also show that, on average, over time, females are more likely than males to have never tried to quit smoking.

Trend data broken down by race show that blacks have been consistently more likely than whites to have never tried to quit smoking; however, the difference between the races has been narrowing with time. The data also show that the likelihood of having ever tried to quit smoking increases with age. For all age categories, the percentage of ever smokers who have never tried to quit has been decreasing with time (especially for the oldest age group).

TABLE 5. —Selected measures of quitting activity (%), NHISs, United States, adults aged 20 and older^a

	Overall	Gender		Race		Age (yr)				Education (yr)			
		Male	Female	Whites	Blacks	20-24	25-44	45-64	≥65	<12	12	13-15	≥16
Never tried to quit ^b													
1974	22.5	20.1	25.8	21.1	34.4	28.5	22.8	22.4	16.5	26.3	23.9	19.0	15.3
1987	18.7	18.5	19.5	17.7	26.5	26.6	20.3	16.9	11.0	25.5	18.5	16.7	13.9
Mean	23.4	22.0	25.6	22.6	30.1	31.7	24.7	22.2	15.3	28.0	24.2	20.0	16.9
Quit for at least 1 day ^c													
1978	27.8	25.8	30.2	26.9	36.5	41.6	27.8	22.5	26.4	26.7	27.4	30.2	29.2
1987	31.6	31.1	32.1	30.6	37.7	40.6	32.6	26.5	29.8	29.0	30.5	33.8	34.8
Mean	28.0	26.7	29.6	27.1	35.0	38.8	29.1	22.3	26.5	27.4	27.6	28.7	30.8
Off less than 1 yr ^d													
1965 ^e	4.6	4.8	4.2	4.8	2.9	5.1	4.7	3.9	4.8	3.0	3.6	4.0	4.7
1987	4.6	4.5	4.7	4.5	4.9	6.2	5.5	3.6	2.5	4.1	4.5	4.8	4.8
Mean	4.3	4.3	4.4	4.3	3.7	6.9	5.0	2.9	2.6	3.0	4.5	4.8	5.3
Off 1-4 yr ^f													
1965 ^e	8.0	8.7	6.7	8.2	6.1	6.5	7.8	7.6	10.0	7.4	9.1	9.0	14.1
1987	10.5	10.2	10.8	11.0	7.3	11.6	10.9	10.4	8.4	7.7	10.6	12.3	12.1
Mean	9.2	9.4	9.0	9.4	7.1	10.0	9.8	7.6	8.7	7.0	9.0	10.4	12.3
Off ≥5 yr ^g													
1965 ^e	12.4	14.0	8.7	12.7	8.3	1.2	7.3	15.4	30.2	12.2	12.2	14.6	18.3
1987	29.8	32.8	25.5	30.9	20.7	4.7	22.1	36.7	58.3	22.4	27.4	32.6	42.0
Mean	21.7	24.3	17.5	20.8	14.3	2.9	15.2	27.0	46.4	18.1	21.9	25.2	33.1

NOTE: NHIS=National Health Interview Survey.

^aData were age-adjusted to the overall U.S. population in 1985.^bNever tried to quit = percentage of ever smokers who have never tried to quit.^cQuit for at least 1 day = percentage of those smoking at 12 mo prior to interview who quit for at least 1 day during those 12 mo.^dOff <1 yr = percentage of ever smokers who have been abstinent for <1 yr.^e1966 (not 1965) is the first year for which data are available for the four education strata.^fOff 1-4 yr = percentage of ever smokers who have been abstinent for 1-4 yr.^gOff ≥5 yr = percentage of ever smokers who have been abstinent for at least 5 yr.