

CHAPTER 5

CHANGES IN SMOKING BEHAVIOR AND KNOWLEDGE ABOUT DETERMINANTS

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INTRODUCTION

This Chapter reviews two major aspects of smoking behavior since release of the first Surgeon General's Report on smoking and health in 1964: (1) changes in smoking behavior in the United States (Part I) and (2) changes in our knowledge about the determinants of smoking during this period (Part II).

During the past 25 years, the prevalence of cigarette smoking has declined in virtually every major sociodemographic group, including men and women, adults and adolescents, blacks and whites, and persons with and without college education. This decline has been particularly evident among men, in whom the prevalence of smoking declined from 50 percent in 1965 to 32 percent in 1987. The first part of this Chapter analyzes trends in smoking prevalence, cessation, and initiation, and examines smoking patterns among different sociodemographic groups and other special populations. These analyses are based, for the most part, on cross-sectional population-based data collected periodically since 1964.

At the same time, our knowledge about determinants of smoking has increased substantially. Physiological, behavioral, and social factors that may influence the initiation and maintenance of smoking have been extensively researched. Many important predictors of initiation, quitting, and relapse have been identified. The development of this body of knowledge is reviewed in the second part of this Chapter. Information reviewed in that part of the Chapter is primarily derived from research studies and intervention trials that employ smaller sample sizes than the population-based surveys used in Part I. These studies, however, usually collect more detailed information and often obtain longitudinal followup data.

PART I. CHANGES IN SMOKING BEHAVIOR

Trends in Cigarette Smoking

Introduction

Accurate information on trends in smoking prevalence in the major sociodemographic groups in the United States is of interest to public health officials, policymakers, researchers, clinicians, and news media. These data are important for estimating the magnitude of the problem of smoking and for targeting public health interventions to those at highest risk of smoking.

Accurate data on trends in smoking (including initiation and quitting) are necessary to be able to project future smoking patterns. Accurate projections must be available, in turn, to set appropriate but realistic goals for key future years (e.g., 1990, 2000). This Section analyzes trends in smoking prevalence, quitting, and initiation during the past quarter century. Data on smoking prevalence in the 1940s and 1950s from Gallup surveys and the Current Population Survey have been cited elsewhere (CDC 1987a; US DHHS 1988, Appendix A).

Changes in measures of smoking behavior (e.g., prevalence, quitting, initiation), like any quantitative variables, can be calculated as absolute or relative changes. For changes in percentages, the absolute change would be in percentage points; the relative (percent) change would be calculated by subtracting the “new” percentage from the base percentage, dividing the difference by the base percentage, and multiplying the quotient by 100. Each measure of change has advantages and disadvantages. Throughout Part of this Chapter, changes in smoking prevalence, quitting, and initiation are described primarily in terms of absolute changes.

Nature and Quality of Data

A number of sources of information provide insight into smoking behavior in the United States. These sources fall into two main categories: those based on excise taxation of cigarettes and those based on population surveys of self-reported smoking.

Excise Tax and Sales Data

The Economic Research Service of the U.S. Department of Agriculture (USDA) has estimated total and adult per capita consumption of cigarettes for a number of years. These estimates are based on data from the Bureau of Alcohol, Tobacco and Firearms (Department of Treasury), the Bureau of Commerce (Department of Commerce), the Tobacco Institute, and other private and industry sources.

The Tobacco Institute reports the number of packs of cigarettes on which State taxes are paid; the Bureau of Alcohol, Tobacco and Firearms reports the number of cigarettes on which Federal taxes are paid; and the Bureau of Commerce reports the number of cigarettes imported into the United States. Both Federal and State taxes are excise taxes collected at the wholesale level (on removals) and are not standard sales taxes.

The estimated level of consumption is based on both Federal and State taxes on removals, as well as on imports, and is adjusted for estimated inventory changes. Adult per capita consumption is customarily calculated in the United States by dividing total consumption by the total estimated population 18 years of age and older. (The World Health Organization (1988) has published per capita cigarette consumption figures for countries throughout the world based on the population 15 years of age and older.)

Self-Reported Survey Data

A number of different data sources are available to assess national trends in smoking during the past 25 years. These surveys differ on the basis of sample size, method of data collection (telephone interview versus face-to-face household interview versus questionnaire administered in school), population (adults versus adolescents), sampling frame (national versus State based), and the extent of information collected on tobacco use. Details of the methodology for the various surveys are provided in the Appendix to Chapter 4 and in Table 1 of that chapter. The amount of information provided varies from survey to survey depending on the availability of information.

Validity of Self-Reported Survey Data

The validity of self-reports of smoking status from surveys may affect the usefulness of these data in reporting historical trends. Respondents' sensitivity to the social stigma associated with smoking has been cited as a reason persons might underreport their smoking status (Warner 1978; Kozlowski 1986). Whereas biochemical assessment is generally more reliable than self-report in assessing level of nicotine intake (US DHHS 1988) self-reported data appear valid for estimating prevalence of smoking in the population. For example, studies of patients in several settings (Petitti, Friedman, Kahn 1981; Pojer et al. 1984), as well as two large community studies (Fortmann et al. 1984; Pierce, Dwyer et al. 1987b), have shown that measurement of smoking by self-report or by biochemical markers gives approximately the same estimates of prevalence. A more recent study of 1,317 Hispanics, however, showed that self-reported cigarette use underestimated biochemically validated use (Coultas et al. 1988).

It is possible that the accuracy of self-reported data will vary depending on whether the data collection method is face to face or by telephone interview. Although biochemical-validation data do not exist to allow the quantification of such a difference, comparisons of smoking prevalence estimates derived from surveys using telephone versus in-person interviews have shown that the former are generally 1 to 3 percentage points below the latter (CDC 1987a; see below and NCHS 1987). In addition, concerns have been expressed about the validity of data reported by one person on behalf of another ("proxy response") (NCHS 1985, p. 54). For adults, these concerns relate more to measures of the number of cigarettes smoked per day than to the classification of whether a person is a current smoker (US DHEW 1969, p. 794; Rogot and Reid 1975; National Research Council 1986, pp. 110-112). For adolescents, proxy reporting may also affect prevalence estimates (Millar 1985).

Correlation Between Self-Reported Survey Data and Sales Data

Warner (1978) compared self-reported data on cigarette consumption with USDA consumption data for the years 1964-75. He found that self-reported cigarette consumption increasingly underestimated the USDA estimates, possibly because of the increasing social stigma associated with smoking. Changing social acceptability of smoking would not be expected to affect the USDA estimates. To the extent that a "social acceptability" bias in self-reported data may have increased in recent years, the dramatic decrease in smoking prevalence observed during the past 25 years could be in part artifactual.

Hatziandreu et al. (in press) analyzed more recent data to determine whether the trend reported by Warner (1978) has continued. Self-reported consumption data for adults and teenagers were obtained from the National Health Interview Survey (NHIS) (National Center for Health Statistics (NCHS)) and the National Household Survey on Drug Abuse (National Institute on Drug Abuse (NIDA)). Self-reported cigarette consumption was estimated based on the smoking prevalence, the average self-reported number of cigarettes smoked per day, and the U.S. population size each year. A "consumption ratio" was calculated by dividing self-reported consumption by USDA estimates ob-

tained from cigarette tax data. This ratio has been relatively stable recently, varying from 0.73 in 1974 to 0.69 in 1976 with a mean of 0.72 (Table 1). A least-squares regression analysis was used to identify any trend. The slope of the regression line was not significantly different from zero ($p=0.85$), countering the hypothesis that self-reported data are increasingly underestimating actual cigarette consumption. These results suggest that national surveys provide a reliable estimate of U.S. smoking trends. The reasons for the consistent difference between cigarette consumption based on excise tax data versus self-reported data are unclear; one possible explanation would be a systematic bias from "rounding down" of self-reported daily consumption to the nearest multiple of a half-pack (see Table 14 and related discussion and Kozlowski 1986).

TABLE 1.--Estimates of cigarette consumption in the United States, based on cigarette excise taxes and self-reports, 1974-85

Year	Excise taxes (billions)	Self-reported (billions)	Fraction
1974	599.0	434.9	0.73
1976	613.5	424.4	0.69
1978	616.0	438.4	0.71
1979	621.5	441.2	0.71
1980	631.5	459.1	0.73
1983	600.0	467.8	0.78
1985	594.0	414.4	0.70

NOTE: Estimated by the U.S. Department of Agriculture. Self-reported consumption includes estimated consumption for adults (NHIS, NCHS) and estimated consumption for adolescents (National Household Survey on Drug Abuse, NIDA).

SOURCE: Hatziandreu et al., in press.

The difference in the findings reported by Hatziandreu et al. (in press) and Warner (1978) may relate to differences in methodology. For example, Warner used data from the 1964, 1966, 1970, and 1975 Adult Use of Tobacco Surveys (AUTSs). He found that the major decrease in the consumption ratio occurred between 1966 and 1970. This may have occurred because the 1964 and 1966 AUTSs were in-person surveys, whereas the 1970 and 1975 AUTSs were telephone surveys. As mentioned above, telephone surveys generally provide slightly lower estimates of smoking prevalence than in-person surveys. On the other hand, Hatziandreu et al. (in press) used only in-person interview data (NHIS) for adults and the NIDA Household Interview Survey on Drug Use for adolescents. The consumption ratios obtained by Warner for 1964 and 1966 (0.73 and 0.72, respectively) using in-person survey data were similar to the mean ratio (0.72) reported by Hatziandreu et al. for the period 1974-85. In addition, the 1974 in-person estimate was 0.73 (Hatziandreu et al., in press), whereas the 1975 telephone estimate was 0.64 (Warner 1978). This difference provides further evidence that the decrease in the consumption ratio reported by Warner was an artifact of the change in the AUTS methodology.

Trends in Cigarette Sales

Total cigarette consumption in the United States (as estimated by sales data) increased steadily from 1900 until 1981, when an estimated total of 640 billion cigarettes were smoked (Table 2). Since 1981, there has been a steady decline in consumption despite increasing population size. The number of cigarettes smoked in 1987 is estimated at 574 billion.

These figures refer to manufactured cigarettes and do not include roll-your-own cigarettes. Roll-your-own cigarettes have accounted for a declining proportion of total cigarettes consumed through the 20th century. By 1950, the estimated per capita consumption of roll-your-own cigarettes was 126, or 3.4 percent of total cigarettes consumed; in 1987, these figures were 23 and 0.7 percent, respectively (USDA, unpublished data).

Cigarette consumption data are divided by the population of adults 18 years of age and older to give an estimate of adult per capita consumption. This estimate represents the average number of cigarettes sold per adult in the population, not per smoker. It should be noted that trends in adult per capita consumption are somewhat biased because there has been a trend over time for more people to start smoking regularly under age 18 (see section below on Trends in the Initiation of Smoking).

Per capita consumption of manufactured cigarettes increased dramatically from its level of 54 cigarettes in 1900 to 4,171 cigarettes in 1960 (Table 2). From 1960-73, this figure remained relatively stable (compared with the previous rates of change) at about 4,000 cigarettes per year. Since 1973, there has been a yearly decline in per capita consumption. From 1973-87, this figure fell more than 23 percent to 3,196 cigarettes per year. Although there has been a decline in every one of these 15 years, the rate of decline has varied. From 1974-79, the magnitude of the yearly change increased rapidly until it reached a 2-percent decrease per year. In the 10 years since 1979, this decrease has fluctuated with a mean of 2.4 percent per year (standard deviation (S.D.) = 1.9). The large drop from 1982-83 (7.2 percent) was more than two standard deviations above the mean and is thought to be related, to a significant degree, to the March 1983 increase in the Federal cigarette excise tax from 8 cents per pack to 16 cents per pack (see Chapter 7).

Trends in cigarette sales are also presented in Chapter 8 (Figure 3).

Trends in Smoking Prevalence Among Adults

Cigarette Smoking by Sex, Race (Whites and Blacks), and Educational Attainment
(National Health Interview Surveys: 1965-87)

Table 3 presents smoking prevalence from NHIS data for the years 1965, 1966, 1970, 1974, 1976-80 inclusive, 1983, and 1985, and preliminary data for 1987. These data are presented for the total adult population (aged 20 years and older) and by sex, race (whites and blacks), and educational attainment. They differ slightly from estimates published by NCHS (NCHS 1988c) because the data presented here are adjusted to the

TABLE 2.--Total manufactured U.S. cigarette consumption and per capita consumption, adults aged 18 years and older, 1900-87

Year	Total consumption (billions)	Per capita consumption	Percentage change in per capita consumption from previous year
1900	2.5	54	
1910	8.6	151	+10.8 ^a
1920	44.6	665	+16.0 ^a
1930	119.3	1,185	+5.9 ^a
1940	181.9	1,976	+5.2 ^a
1950	369.8	3,552	+6.0 ^a
1960	484.4	4,171	+1.6 ^a
1961	502.5	4,266	+2.3
1962	508.4	4,266	0
1963	523.9	4,345	+1.9
1964	511.3	4,194	-3.5
1965	528.8	4,258	+1.5
1966	541.3	4,287	+0.7
1967	549.3	4,280	-0.2
1968	545.6	4,186	-2.2
1969	528.0	3,993	-4.6
1970	536.5	3,985	-0.2
1971	555.2	4,037	+1.3
1972	566.8	4,043	+0.1
1973	589.7	4,148	+3.0
1974	599.0	4,141	-0.2
1975	607.2	4,123	-0.4
1976	613.5	4,092	-0.8
1977	617.0	4,051	-1.0
1978	616.0	3,967	-2.1
1979	621.5	3,861	-2.7
1980	631.5	3,844	-0.4
1981	640.0	3,836	-0.2
1982	634.0	3,739	-2.6
1983	600.0	3,488	-7.2
1984	600.4	3,446	-1.2
1985	594.0	3,370	-2.3
1986	583.8	3,274	-2.9
1987 (estimate)	574.0	3,196	-2.4

^aAnnualized rate of change during preceding decade.

SOURCE: USDA (1987).

TABLE 3.--Trends in smoking prevalence (%), NHISs, United States, 1965-87, adults aged 20 years and older

Year	Overall population	Sex		Race		Educational level			
		Males	Females	Whites	Blacks	Less than high school graduate	High school graduate	Some college	College graduate
1965 ^a	40.4	50.2	31.9	40.00	43.0				
1966	40.7	50.8	32.0	40.4	42.9	36.5	41.1	42.5	33.7
1970	37.0	44.3	30.8	36.5	41.4	34.8	38.3	36.7	28.1
1974	36.9	43.4	31.4	36.1	44.0	36.5	37.6	36.9	28.3
1976	36.1	42.1	31.3	35.6	41.2	35.8	37.8	36.4	27.4
1977	35.6	40.9	31.4	34.9	41.8	35.8	38.4	35.2	25.6
1978	34.0	39.0	29.6	33.6	38.2	35.3	36.5	32.7	23.8
1979	33.5	38.4	29.2	33.2	36.8	34.9	35.4	33.3	23.4
1980	33.3	38.5	29.0	32.9	37.2	35.5	35.7	31.2	24.6
1983	31.8	35.5	28.7	31.4	36.6	34.7	35.6	30.0	19.9
1985	30.4	33.2	28.0	29.9	36.0	35.7	34.2	28.1	18.4
1987 ^b	29.1	31.7	26.8	28.8	34.0	35.7	33.1	26.1	16.3
Trend information (1965-85)									
Change ^c /year	-0.50	-0.84	-0.21	-0.50	-0.39	-0.06	-0.32	-0.70	-0.76
Standard error	0.03	0.04	0.03	0.03	0.08	0.03	0.05	0.07	0.08
R ²	0.97	0.98	0.81	0.97	0.74	NA ^d	0.87	0.94	0.93

^aFor 1965, data stratified by education were not available.

^bProvisional data only.

^cIn percentage points.

^dThe slope of the regression line was not significantly different from zero, making the R² computation inappropriate.

SOURCE: NHISs 1965-87: unpublished data, Office on Smoking and Health.

1985 age distribution, whereas the previously published figures were adjusted to the 1970 age distribution.

For each group, observed smoking prevalence for each survey year is reported. Additionally, to assess time trends from 1965-85, weighted least-squares regression analyses have been applied to these data. The 1987 data were not included in the regression analyses because these data are preliminary estimates. These estimates can be used to provide a measure of predictive validity of the model; in general, the preliminary 1987 estimates are similar to projections from the model (Pierce, Fiore et al. 1989a).

The R^2 statistic was used for each trend analysis and is a measure of how well the linear model fits the observed data values. R^2 values may range from 0 (no linear trend) to 1.0 (a perfect fit between the observed values and a linear model).

The data on overall smoking prevalence, as well as for each sex and racial group presented in Table 3, demonstrate linear trends with R^2 values ranging from 0.74 to 0.98; thus, the models fit the data very well. Trends for three of the four educational categories are also fitted well by a linear model. For one category, less than high school graduation, no R^2 value is reported because the rate of change is very close to zero (making the R^2 statistic inappropriate as an index of the amount of variation explained by the model). The change (in percentage points) per year is the slope of the line of best fit calculated by the model. The standard error of the slope allows confidence limits to be placed around the estimate of change per year. Ninety-five-percent confidence limits around the estimate of a slope are approximately equal to the slope plus or minus two times the standard error.

Overall smoking prevalence declined from 40.4 percent in 1965 to 29.1 percent in 1987. The trend from 1965-85 is fitted almost exactly by a linear model ($R^2=0.97$). Smoking prevalence in the United States adult population is decreasing at a rate of 0.50 percentage points per year with a standard error of 0.03. Thus, the 95-percent confidence interval for the change per year is 0.44 to 0.56. There is no evidence of any sudden deviations from the identified trend such as that seen in the per capita consumption data in 1983 (Table 2).

The prevalence of smoking among men has decreased steadily from 50.2 percent in 1965 to 31.7 percent in 1987. The rate of decline between 1965 and 1985 was 0.84 percentage points per year (95-percent confidence limits, 0.76, 0.92). Female smoking prevalence remained stable at 31 to 32 percent from 1965-77. Subsequently, prevalence began to decline slowly and reached 26.8 percent in 1987. The overall rate of decline from 1965-85 was 0.21 percentage points per year (95-percent confidence limits, 0.15, 0.27). Fiore and coworkers (1989) have examined more recent trends in smoking by gender in greater detail. This analysis showed a rate of decline in prevalence among women of 0.33 percentage points per year between 1974 and 1985 (95-percent confidence limits, 0.21, 0.45) ($R^2=0.88$).

Although there has been a difference in smoking prevalence between blacks and whites, it may be explained by socioeconomic status (Novotny, Warner et al. 1988), and the rate of change in smoking prevalence in recent years has been similar between the races (Fiore et al. 1989). Smoking among whites decreased from 40.0 percent in 1965 to 28.8 percent in 1987. The rate of decline from 1965-85 was 0.50 percentage points per year (95-percent confidence limits, 0.44, 0.56; $R^2=0.97$).

For blacks the R^2 value for the simple linear model is 0.74, suggesting that the data should be reviewed more carefully. In 1965, 43.0 percent of blacks smoked. This number had changed little by 1977 when 41.8 percent smoked. From 1977-87, there was a considerable drop in smoking prevalence to 34.0 percent. Thus, the data suggest that there may be two trends among blacks. Fiore et al. (1989) fitted a linear model to the data for 1974-85 and reported a rate of change among blacks of -0.67 percentage points per year with 95-percent confidence limits of 0.37 and 0.97 ($R^2=0.80$). This rate of change was not significantly higher than that among whites for the same period (-0.57 percentage points per year). However, smoking prevalence among black men was decreasing at a faster rate than among white men (1.15 percentage points per year compared with 0.87, $p=0.03$). There were no significant differences noted in the rates of decrease among women of either race (blacks, 0.26 percentage points per year; whites, 0.32).

Trends in smoking among the various educational groups have differed markedly since 1966 (Pierce, Fiore et al. 1989b). College graduates have decreased their smoking level from 33.7 percent in 1966 to 16.3 percent in 1987. The rate of decline from 1966-85 was 0.76 percentage points per year (95-percent confidence limits, 0.60 to 0.92). Smoking prevalence in respondents who reported having attended some college decreased from 42.5 percent in 1966 to 26.1 percent in 1987 at a slightly lower rate of change (-0.70 percentage points per year) than that of college graduates. High school graduates who did not attend college reduced their smoking from 41.1 percent in 1966 to 33.1 percent in 1987 at a rate (-0.32 percentage points per year) less than half that for respondents who had attended college. Smoking prevalence in those respondents without a high school diploma did not change appreciably from 1966 (36.5 percent) to 1987 (35.7 percent); the rate of decline between 1966 and 1985 was only 0.06 percentage points per year. Thus, there is a twelvefold difference in rate of decline in smoking prevalence between the most and least educated groups in our society. The increasing gap in smoking prevalence by educational attainment is particularly evident when comparing the difference in smoking prevalence between the most and least educated groups in 1966 with the difference in 1987. In 1966, the prevalence rates were similar (33.7 and 36.5 percent, respectively); in 1987, prevalence in the most educated group (16.3 percent) was less than half that in the least educated group (35.7 percent).

Adult Use of Tobacco Surveys: 1964-86

In 1964, 1966, 1970, 1975, and 1986, the Office on Smoking and Health (formerly the National Clearinghouse for Smoking and Health) conducted detailed surveys of a representative sample of the U.S. adult population. The purpose of these surveys has been to study the population's knowledge, attitudes, and practices regarding the use of tobacco. The first two surveys primarily used in-person household interviews while the last three used telephone interviews. Prevalence of cigarette smoking in the United States as measured by the AUTSs has declined from 40.3 percent in 1964 to 26.5 percent in 1986 (Table 4). This decrease represents an overall decline in smoking of more than 34 percent during this 22-year period.

TABLE 4.--Trends in smoking prevalence (%), AUTS versus NHIS

Survey year	AUTS ^a	Estimated NHIS ^b	Difference (NHIS-AUTS)
1964	40.3	40.4	0.1
1966	42.2	39.4	-2.8
1970	36.2	37.4	1.2
1975	33.8	34.9	1.1
1986	26.5	29.4	2.9

^aFor all survey years, includes respondents aged 21 years and older except 1986, which includes respondents aged 17 years and older. All data weighted.

^bIncludes respondents aged 20 years and older. Values for each year are determined by extrapolating expected prevalence values based on regression analysis from Table 3.

SOURCE: Office on Smoking and Health (US DHEW 1969, 1973a, 1976; CDC 1987a).

Unlike the NHIS, for which data are collected during an in-person household interview, AUTSs collected data via telephone interviews in 1970, 1975, and 1986. The three AUTSs conducted since 1970 all produced prevalence estimates below those estimated (by regression analysis) from the NHISs (Table 4). The largest difference between the two surveys was 2.9 percentage points in 1986. The 95-percent confidence limits around the NHIS projection for 1986 are 27.8 to 31.7 compared with limits of 25.8 to 27.3 from the 1986 AUTS; thus, the difference in estimates between the two surveys is statistically significant. A difference in sampling modalities is among the most likely explanations for this discrepancy in prevalence estimates. A similar finding has been noted in State-specific prevalence estimates (see below). Telephone surveys have a small sampling bias by excluding households lacking telephones and may have a greater nonresponse bias because of generally lower response rates compared with household surveys (CDC 1987a).

Cigarette Smoking Among Different Occupational Groups

NHIS data have been published on smoking prevalence by occupation for the years 1970, 1978-80 combined, and 1985 (Table 5). There is a consistent pattern of higher smoking rates among blue-collar and service workers than among white-collar workers for all these survey years. For example, in 1985, the prevalence of smoking among blue-collar and white-collar workers was 40 and 28 percent, respectively. This difference was greater among males (14 percentage points) than among females (6 percentage points). Detailed data on smoking prevalence, percentage of former smokers, quitting attempts, and age of initiation within specific occupational categories for 1978-80 were published in the 1985 Surgeon General's Report (US DHHS 1985). Weinkam and Sterling (1987) also provided a detailed analysis of smoking by occupation using the 1970 and 1979-80 NHIS data.

Novotny, Warner, and colleagues (1988) performed multivariate logistic regression analyses on data from the 1985 NHIS (ages 25 to 64 years) to examine the independent

TABLE 5.--Prevalence of smoking (%) by occupation, 1970, 1978-80, and 1985

Occupation	1970 ^a		1978-80 ^a		1985 ^b		Total
	Males	Females	Males	Females	Males	Females	
Currently employed	47.9	36.5	39.9	33.3	33.8	30.0	32.1
White collar	40.8	36.1	33.0	31.9	26.4	28.0	27.5
Blue collar	55.0	37.1	47.1	38.1	40.1	33.9	39.7
Service	53.3	39.4	47.5	37.4	40.3	35.4	37.2
Unemployed	55.9	42.3	53.1	39.6	44.3	28.0	36.1

^aAged 20 to 64 years.

^bAged 20 years and older.

SOURCE: NHISs 1970, 1978-80 (combined), and 1985, NCHS (US DHHS 1985, 1988).

effects of socioeconomic status (SES) and selected demographic factors on the odds of ever smoking (versus never smoking) and current smoking (versus former smoking). The SES/demographic factors included in the models were: sex, employment status, occupation, education, marital status, and poverty status. The investigators found that when they simultaneously controlled for the effects of these factors, unemployed persons were more likely than employed persons to be ever smokers or current smokers. However, blue-collar and service workers were not found to have significantly increased odds of ever or current smoking compared with white-collar workers. Employed persons were more likely to have quit smoking than unemployed persons.

Special Populations: Hispanics

Information on smoking among Hispanics was collected as part of the Hispanic Health and Nutrition Examination Survey (HHANES) between 1982 and 1984. This was a geographically based sample of Hispanics from three areas of the United States designed to represent three large Hispanic groups (Puerto Ricans in the New York City area; Cuban-Americans in Dade County, Florida; and Mexican-Americans in the Southwest). Sample sizes were 9,000 Mexican-Americans, 4,000 Puerto Ricans, and 1,500 Cuban-Americans.

According to the HHANES, the age-adjusted smoking rates for males aged 20 to 74 years were 43 percent for Mexican-Americans, 42 percent for Cuban-Americans, and 40 percent for Puerto Ricans. Among females, the smoking prevalence was 24 percent for Mexican-Americans and Cuban Americans and 30 percent for Puerto Rican Americans (Haynes 1987). A birth-cohort analysis of these data showed that smoking rates have decreased among successive cohorts of men, but increased among successive cohorts of women (Escobedo and Remington 1989).

These rates are higher than those obtained from the NHISs for the years 1979 and 1980 (Marcus and Crane 1985; Rogers and Crank 1988) and 1985 (Marcus and Crane 1987). However, the number of Hispanics in these NHIS samples was small, making prevalence estimates less reliable. Haynes (1987) suggests that NHIS data may underestimate smoking prevalence among Hispanics because questions about smoking were not asked in Spanish. The first estimates of smoking behavior among Hispanics that are both national and statistically reliable will be available from the 1987 NHIS, which oversampled for this population group.

Special Populations: American Indians and Alaskan Natives

There are no reliable national estimates of smoking prevalence among American Indians. Several surveys have assessed smoking rates among specific Indian tribes or on certain Indian reservations (CDC 1987b). Smoking prevalence is highest among Northern Plains Indians (42 to 70 percent) and Alaskan Natives (56 percent), where rates greatly exceed the rate in the general U.S. population. Much lower rates have been reported for Indians from the Southwest (13 to 28 percent). High rates of smokeless tobacco use have also been reported among some American Indian groups, especially in Indian youth. According to a survey of approximately 5,000 children 5 to 18 years of age in rural Alaska conducted by the Indian Health Service, 28 percent of girls and 34 percent of boys reported using smokeless tobacco products (CDC 1987c). Similar findings were obtained in other surveys of Native Americans (Schinke et al. 1987; CDC 1988; Hall and Dexter 1988).

Special Populations: Asian Americans

There are no reliable national estimates of smoking prevalence among Asian Americans. A few local surveys provide estimates of smoking prevalence among Asian Americans in specific geographic regions.

The State of Hawaii has a population composed of 29 percent Caucasian, 26 percent Japanese, 15 percent Hawaiian, and 15 percent Filipino. The State conducted a Behavioral Risk Factor Survey (see below) of 1,002 people by telephone in 1984. Smoking prevalence estimates were 28 percent for Caucasians, 27 percent for both Hawaiians and Filipinos, and 23 percent for Japanese (Hawaii State Department of Health 1984). A similar survey of 1,557 residents of the State was completed in 1986. Prevalence estimates from this second survey were 29.3 percent for Caucasians, 28.8 percent for Hawaiians, 25.1 percent for Filipinos, and 20.6 percent for Japanese (Chung 1986).

Special Populations: Pregnant Women

National data on smoking during pregnancy are scarce, especially prior to 1980. Since 1980, several national surveys have directed smoking questions to previously pregnant women, but survey methodologies vary widely and it is not possible to study secular changes in behavior.

Probably the best source of national data on smoking among pregnant women has been the National Natality Surveys (NNSs), which were conducted among national samples of married mothers of live infants born in 1967 and 1980. Data from these surveys were used by Kleinman and Kopstein (1987) to document changes in smoking behavior during pregnancy over that period of time. Among teenagers, smoking rates remained fairly constant over time at about 38 percent among whites and 27 percent among blacks. Among women over age 20, there were decreases in smoking prevalence that varied markedly by race and by educational attainment of the mother. Smoking prevalence among white women over age 20 declined from 40 percent in 1967 to 25 percent in 1980; among black women over age 20, it declined from 33 percent to 23 percent. Among white women over age 20, there was an increase in the proportion quitting smoking during pregnancy (11 percent to 16 percent), while among blacks the proportion quitting actually decreased (17 percent to 11 percent). Among white women with less than 12 years of education, the prevalence of smoking during pregnancy declined from 48 percent to 43 percent, while for women with 16 or more years of education, it declined from 34 percent to 11 percent. Among white smokers with less than 12 years of education, there was relatively little change in the proportion quitting during pregnancy (11 percent to 9 percent), but among smokers with 16 years or more of education, the proportion more than doubled (12 percent to 27 percent). Insufficient numbers of black women were sampled to study trends by education among blacks.

A study similar to the NNS, the National Maternal and Infant Health Survey, was begun in 1988. Data from that study will provide the best estimates of smoking during pregnancy for the late 1980s. At this time, however, no comparable national data exist to study women after 1980. Studies that have asked about smoking behavior during pregnancy have not asked about behavior during specific years, so it is not possible to

calculate estimates of the prevalence of smoking in any particular time period. However, it is possible to use these data sources to examine general patterns of smoking during pregnancy. In general, women in the lowest age and socioeconomic categories have the highest likelihood of smoking during pregnancy.

The earliest data available to examine these patterns are from the Collaborative Perinatal Study (Niswander and Gordon 1972), which included women who obtained prenatal care at selected university centers in the early 1960s. White women were more likely to smoke than black women (53 percent versus 43 percent), and among smokers, whites smoked more cigarettes per day than blacks. By comparison, the national prevalence of smoking among women 25 to 44 years of age was 44 percent in 1965 (NCHS 1988c).

The National Survey of Family Growth (NSFG) collected data in 1982 on the smoking behavior of women, 15 to 44 years of age, during their most recent pregnancy, regardless of when the pregnancy occurred (NCHS 1988a). Of these women, 32 percent smoked during the pregnancy. Women who were aged 15 to 19 years when pregnant, who had less than 12 years of education, who were at 149 percent or less of poverty level, or who were unmarried had the highest smoking rates.

In the 1985 NHIS, questions related to smoking were asked of women aged 18 to 44 years who had given birth within the past 5 years (NCHS 1988b). Of these women, 32 percent reported having smoked during the 12 months preceding the birth; 21 percent of smokers reported quitting smoking and 36 percent reported reducing the number of cigarettes smoked after learning they were pregnant. Women under 25 years of age, with low income, of black race, unmarried, or unemployed were more likely to smoke than others. These same groups of women were less likely to quit smoking or to reduce the number of cigarettes smoked.

The 1990 Health Objectives for the Nation (US DHHS 1980a) state that "The proportion of women who smoke during pregnancy should be no greater than one-half the proportion of women overall who smoke." At the time of the midcourse review of the objectives (US DHHS 1986c) no data were available to evaluate progress directly. According to the 1985 NHIS, approximately 31 percent of women aged 18 to 44 years smoked cigarettes in 1985 (31.7 percent of 18- to 29-year-olds and 31.2 percent of 30- to 44-year-olds) (NCHS 1988c). In the same survey, as mentioned above, 32 percent of women who had given birth in the preceding 5 years reported smoking in the 12 months preceding the birth, 21 percent of whom reportedly quit after learning they were pregnant. This indirect evidence seems to indicate that the smoking prevalence among pregnant women was much more than half the prevalence among nonpregnant women in the early 1980s. Unless major changes in smoking behavior have occurred in the latter half of the decade, the 1990 objective will not be met. Analysis of data from the Behavioral Risk Factor Surveillance System supports this conclusion (Williamson et al. 1989).

Special Populations: Military Personnel

In 1980, 1982, 1985, and 1988, the Department of Defense (DOD) performed worldwide surveys of alcohol and nonmedical drug use among military personnel.

These surveys assessed cigarette smoking among personnel by asking, "During the past 30 days, how many packs of cigarettes did you usually smoke during a typical day?" (The 1980 survey question used the phrase "in one day.") There were five possible responses: 3 or more packs; 2 or more, but less than 3 packs; 1 or more, but less than 2 packs; less than 1 pack, but smoked some; did not smoke in the past 30 days. Sample sizes ranged from 15,000 to 21,000. The number of military installations participating in the surveys ranged from 58 to 81. The surveyed population was proportionally representative of all DOD active duty members for sex, race/ethnicity, marital status, education, and age (Herbold 1987; US DOD 1987, 1988).

Overall smoking prevalence among military personnel declined steadily from 53 percent in 1982 to 46 percent in 1985 to 42 percent in 1988 (Table 6). These prevalence figures, although declining, are considerably higher than among all males or young males in the general population (Tables 3 and 18). This disparity may reflect socioeconomic differences between military personnel and the general population, although one study suggests that smoking initiation may often occur among recruits after entering the military (see below). The 1988 estimates for the individual military branches were: Air Force, 37 percent; Marine Corps, 42 percent; Army, 44 percent; and Navy, 45 percent (US DOD 1988).

TABLE 6. --Prevalence of cigarette smoking among U.S. military personnel, 1980, 1982, 1985, and 1988

Rank ^b	Percentage of current smokers ^a			
	1980 (N=15,016)	1982 (N=21,412)	1985 (N=17,328)	1988 ^c (N=18,673)
E1-3	55	56	47	47
E4-6	55	55	52	45
E7-9	56	61	56	48
W1-4			40	34
O1-O3				19
O1-O2	24	25	17	
O3	23	24	18	
O4-O10			21	20
O4-O6	27	28		
Total	52	53	46	42

^aPersons who had smoked cigarettes during the past 30 days.

^bIn ascending rank, from enlisted personnel (E1-9) to warrant officers (W1-4) to commissioned officers (O1-O10)

^cPreliminary data (not adjusted for nonrespondents).

SOURCE: Herbold (1987); US DOD (1986, 1987, 1988).

Smoking prevalence rates among enlisted personnel (ranks E1-9) are at least twice the rates among commissioned officers in each survey year (Table 6). In 1988, for instance, smoking prevalence estimates ranged from 47 percent for the lowest ranks of enlisted personnel (E1-3) to 20 percent for the higher ranks of commissioned officers (O4-O10). The proportion of smokers smoking a pack or more a day was 55 percent; there was no consistent association between this proportion and military rank (US DOD 1988).

Cronan and Conway (1987) collected smoking information from 687 recruits entering the Navy and from 1,357 Navy servicemen stationed aboard ships in the San Diego area. The prevalence of smoking was 27.6 percent among recruits and 49.8 percent among shipboard men. The investigators concluded that the Navy is not attracting a higher than expected percentage of smokers from the U.S. population, but that many men start to smoke after they enter the Navy.

Reasons for higher smoking rates among military personnel include the inexpensive price of cigarettes in military facilities, peer pressure heightened by conditions of group living, stress, boredom, and lack of other forms of recreation (Cronan and Conway 1987; Blake 1985). In addition, there has been a historical connection between cigarettes and the military: cigarettes have been a part of the K-rations and C-rations provided to soldiers and sailors, and cigarette advertisements on radio and in the print media during World War II commonly featured military themes (Blake 1985). Cigarette advertising continues to appear in military-oriented publications (Davis 1987). In September 1988, Philip Morris Tobacco Company began to publish a monthly newsletter, "Military Smoker," which features articles opposing restrictions on smoking and on cigarette sales in military facilities; readers are urged to call a toll-free "Military Smoker" hotline telephone number (Philip Morris 1988).

Recent DOD initiatives to reduce smoking among military personnel are described in Chapter 6.

State-Specific Smoking Prevalence

Behavioral Risk Factor Surveillance System: 1982-87

The Behavioral Risk Factor Surveillance System (BRFS) has provided State-specific smoking prevalence estimates for adults 18 years of age and older for about half of the States since 1982 (Table 7). Data are collected through random-digit-dialed telephone

interviews. Since 1984, the number of States participating in this surveillance system has increased steadily. For reporting States, median prevalence declined from 37 percent in 1982 to 24 percent in 1987. This decline exceeded the decline in national prevalence in the NHIS (Table 3), probably because of the nonrepresentative mix of States included in the BRFSS in different years. In 1987, prevalence ranged from 15 percent in Utah to 32 percent in Kentucky.

Current Population Survey: 1985

In 1985, the Current Population Survey (CPS), a population-based, in-person household survey of more than 114,000 adult Americans, conducted by the U.S. Bureau of the Census, collected information about smoking and smokeless tobacco use. About 45 percent of interviews were conducted with proxy respondents. The survey estimated adult smoking prevalence (20 years of age and older) at 29.5 percent. Table 8 presents estimates of prevalence of cigarette smoking according to region of the country, census division, and State. Among the nine census divisions, prevalence was lowest in the Pacific (26.3 percent) and Mountain (27.2 percent) divisions and was highest in the East South Central (31.8 percent) and South Atlantic (31.3 percent) divisions.

Overall gender-specific prevalence was reported as 32.9 percent for males and 26.5 percent for females. Prevalence of smoking among males exceeded that among females in all States except Oregon and Wyoming (where the prevalence rates among men and women were either very similar or the same). Overall education-specific prevalence was 35.4 percent for persons with 12 years or less education (high school diploma or less) and 22.2 percent for persons with 13 or more years of education (some college or more education). Persons with 13 or more years of education reported lower smoking prevalence rates than those with 12 years or less education in all 50 States by a range of 20.2 percentage points in Tennessee to 5.7 percentage points in Hawaii.

TABLE 7.--State-specific smoking prevalence (%), Behavioral Risk Factor Surveillance System, adults aged 18 years and older, 1982-87

State	1982	1984	1985	1986	1987
Alabama	31			25	27
Alaska	36	34			
Arizona	32	28	26	24	26
Arkansas	27				
California	28	26	26	25	21
Colorado	34				
Connecticut			27		
Delaware	31				
District of Columbia	33	38	26	27	24
Florida	32		27	28	28
Georgia	29	37	29	27	25
Hawaii				25	23
Idaho		25	24	23	21
Illinois		34	26	28	26
Indiana	33	28	32	27	29
Iowa	30				
Kansas	22				
Kentucky	37		29	35	32
Maine					28
Maryland					25
Massachusetts				27	25
Michigan	31				
Minnesota		27	28	25	24
Missouri				26	29
Montana	26	29	25	23	22
Nebraska	23				
New Hampshire	29				
New Jersey	32				
New Mexico	29			26	21
New York			31	27	23
North Carolina	38	31	27	27	26
North Dakota		28	26	26	24
Ohio	30	29	29	28	27

TABLE 7.--Continued

State	1982	1984	1985	1986	1987
Pennsylvania	34				
Rhode Island		31	29	39	
South Carolina		26	29	27	25
South Dakota					25
Tennessee	32	32	28	28	28
Texas	30				
Utah		16	16	18	15
Virginia	34				
Washington					24
West Virginia	32	33	27	29	29
Wisconsin		27	25	26	26
Minimum	22	16	16	18	15
Maximum	38	38	32	35	32
Median	37	29	27	26	24
Number of States ^a	27	19	22	26	29

^aIncludes the District of Columbia.

NOTE: No data were available for the following States: LA, MS, NV, OK, OR, VT, and WY

SOURCE: CDC (1986a,b, 1987f, unpublished data).

BRFS and CPS Comparison

In 1985, both the BRFS and the CPS collected State-specific information on adult smoking prevalence. Among the 22 States (including the District of Columbia) where comparisons can be made, the CPS (an in-person household survey) estimated higher smoking prevalence in 13 States and lower prevalence in 8 States than the BRFS (a telephone survey). The median difference in smoking prevalence between the CPS and the BRFS was +1.8 percentage points. This pattern is similar to that observed in comparisons between the in-person NHIS and the telephone AUTS (see above).

TABLE 8.—Smoking prevalence rates according to region of the country, census division, and State, adults aged 20 years and older, by gender and education, United States, CPS, 1985

	Overall	Males	Females	Education	
				≤12 years	>12 years
United States	29.5	32.9	26.5	35.4	22.2
Northeast Region	28.9	31.3	26.8	34.5	22.1
New England Division	29.5	30.6	28.6	36.3	22.5
Maine	30.3	31.8	29.1	37.0	17.3
New Hampshire	30.7	35.2	26.7	37.4	21.0
Vermont	30.7	31.8	29.7	37.7	21.4
Massachusetts	28.2	28.4	28.1	35.0	22.9
Rhode Island	34.4	35.8	33.3	39.9	26.3
Connecticut	29.6	30.9	28.5	36.3	23.1
Mid-Atlantic Division	28.7	31.6	26.2	34.0	22.0
New York	28.7	31.4	26.3	34.1	22.3
New Jersey	27.9	31.0	25.2	33.6	21.7
Pennsylvania	29.3	32.3	26.6	34.0	21.7
North Central Region	30.2	32.4	28.1	36.2	22.2
East North Central Division	31.0	33.0	29.3	37.5	22.5
Ohio	32.2	34.4	30.3	38.6	22.0
Indiana	32.8	35.7	30.1	38.4	23.8
Illinois	28.7	31.5	26.3	35.0	22.7
Michigan	34.0	34.4	33.7	40.9	24.7
Wisconsin	26.3	27.6	25.2	32.6	17.9
West North Central Division	28.1	31.1	25.4	33.1	21.7
Minnesota	28.7	30.0	27.4	34.6	21.6
Iowa	28.1	33.0	23.7	31.8	22.2
Missouri	27.7	31.1	24.6	32.0	21.4
North Dakota	26.4	28.3	24.7	31.3	21.8
South Dakota	28.6	30.7	26.8	34.5	21.0
Nebraska	24.9	26.6	23.6	29.2	19.4
Kansas	30.2	34.6	26.6	37.1	23.1
South Region	31.2	36.4	26.8	36.5	23.3
South Atlantic Division	31.3	36.3	27.1	36.6	24.0
Delaware	31.8	34.9	29.1	39.1	19.0
Maryland	29.7	31.5	28.1	36.3	20.1

TABLE 8.—Continued

	Overall	Males	Females	Education	
				≤12 years	>12 years
District of Columbia	31.4	34.2	29.3	38.5	24.2
Virginia	32.7	37.8	28.5	38.5	26.3
West Virginia	34.0	38.6	30.0	38.1	22.9
North Carolina	31.6	39.7	24.6	37.0	24.0
South Carolina	27.1	34.2	21.5	31.7	18.4
Georgia	31.8	38.5	26.5	36.4	25.1
Florida	31.7	35.5	28.4	36.8	25.4
East South Central Division	31.8	37.6	26.9	37.3	21.8
Kentucky	35.3	37.8	33.4	40.2	22.5
Tennessee	30.8	36.6	26.0	38.6	18.4
Alabama	30.6	38.5	23.5	35.3	23.6
Mississippi	31.1	38.8	24.8	34.9	25.3
West South Central Division	30.6	35.5	26.3	35.9	22.8
Arkansas	31.3	37.2	26.5	34.8	25.0
Louisiana	29.1	35.4	23.8	34.1	21.1
Oklahoma	33.0	35.7	30.4	41.5	22.7
Texas	30.6	35.5	26.3	35.9	22.8
West Region	26.5	29.3	23.9	32.8	20.9
Mountain Division	27.2	30.1	24.6	34.7	20.2
Montana	25.9	26.1	25.9	32.2	19.3
Idaho	24.1	26.6	21.7	29.6	17.8
Wyoming	31.7	31.9	31.9	40.9	21.0
Colorado	28.6	30.6	26.9	37.9	21.9
New Mexico	28.5	32.6	24.3	32.8	24.4
Arizona	29.5	34.3	25.3	37.4	21.5
Utah	14.1	18.2	10.2	22.5	8.0
Nevada	35.7	37.6	33.9	39.0	31.4
Pacific Division	26.3	29.0	22.7	32.0	21.1
Washington	28.6	29.9	27.4	36.1	21.8
Oregon	27.1	26.8	27.5	34.7	21.2
California	25.6	28.9	22.5	28.3	20.8
Alaska	34.3	40.9	28.0	41.1	27.2
Hawaii	27.6	30.7	24.7	30.6	24.9

NOTE: Percentages are age adjusted to the total U.S. population.
 SOURCE: Office on Smoking and Health, unpublished data.

Summary

A number of national and State-based surveys provide information on cigarette smoking. These surveys have varying methodologies and response rates. The data of highest quality (large sample size, high response rate) are from the NHIS, and this source also has the best series of data for analyzing trends in smoking prevalence since 1965. Trend analysis demonstrates that smoking prevalence among adults overall is declining by 0.50 percentage points per year and this rate of decline has been consistent since 1965. If this rate of change continues for the next few years, overall prevalence will be 27 to 28 percent in 1990, which is higher than the 1990 Health Objective for the Nation (less than 25 percent) (US DHHS 1980a; see Chapter 1). Although there are differences between whites and blacks in smoking prevalence, the rate of change within each race has been similar in recent years. The decline has been much higher in men than in women and much higher in the more educated than in the less educated.

The consistency of the trends in these smoking prevalence data contrasts with the lack of year-to-year consistency in the consumption (excise tax) data presented in an earlier section. Given that both data sets report cigarette usage in the population, reasons for this difference need to be addressed. Each data set has its advantages. Excise tax data have the advantage of being an objective measure of manufactured-cigarette sales and are not subject to questions of validity that must be addressed with self-reported smoking from survey data. On the other hand, survey data provide information on smoking behavior in specific subpopulations within society.

Cigarette sales data, and trend analyses of these data, reflect both the number of people who smoke and the number of cigarettes each smoker consumes (plus a wastage and stock error term). On the other hand, trend analyses of self-reported smoking prevalence reflect only the number of people who smoke. Antismoking interventions may affect an individual's smoking status or daily cigarette consumption. For example, worksite smoking restrictions may induce some smokers to quit, whereas others who continue to smoke may smoke fewer cigarettes per day because of fewer opportunities to smoke. Similarly, increases in cigarette price (e.g., mediated by increased excise taxation) may induce price-sensitive smokers to quit or to reduce daily consumption.

While consumption data are often used as a more sensitive index of the relative impact of differing antismoking strategies, the primary goal of these strategies is a change in smoking prevalence. Smokers who reduce their daily cigarette consumption will reduce their health risks, but to a lesser extent compared with quitting entirely (see Chapters 2 and 3).

Trends in Quitting

Introduction

As the 1988 Surgeon General's Report documented (US DHHS 1988), cigarettes and other forms of tobacco are addicting. This addiction, including both pharmacologic and behavioral components, helps to explain the difficulty that most smokers experience in quitting and then maintaining abstinence. Smokers can be on a quitting cycle in which they are abstinent for a while, followed by a relapse to smoking for a period of time, after which they may quit again, and so on. Given this pattern, no single statistic can fully describe trends in quitting activity. Three interrelated statistics are:

1. *Percentage of former smokers.* The percentage of the population who are former smokers has been used as one indicator of quitting activity. For example, the total number of living persons who have quit smoking is often cited and is calculated by multiplying the proportion of the population who are former smokers by the size of the population. This figure, as calculated from the 1986 AUTS, is 43.2 million adults 17 years of age and older. However, the prevalence of former smokers is of limited value in assessing quitting activity because it does not take into account the number of people in the population who have ever smoked, because it does not include former smokers who have died, and because of marked differences in the initiation of smoking between males and females in different birth cohorts (Harris 1983; Warner and Murt 1982).
2. *Quit ratio.* This statistic is defined as the proportion of people who have ever smoked who are former smokers at a specific point in time; that is, the number of former smokers divided by the number of ever smokers (Pierce et al.1987a). Thus, this statistic is to quitting activity what smoking prevalence is to smoking activity. Both statistics consider the size of the population undertaking a behavior as a proportion of those who could undertake that behavior.

However, the quit ratio does not provide all the information needed when describing quitting activity. It does not distinguish between a person who has been a former smoker for 3 days and a person who has been off cigarettes for 10 years. It does not distinguish between a current smoker who has just relapsed after 6 years of abstinence and a current smoker who has never tried to quit. In addition, the quit ratio does not reflect the magnitude of smoking prevalence; for example, a group in which 10 percent are current smokers and 10 percent are former smokers has the same quit ratio as a group in which 30 percent are current smokers and 30 percent are former smokers.

3. *The smoking continuum.* This is a 10-category index of the total population derived from the smoking status variable (current, former, or never smoker) and timing and duration of quit attempts. This index is particularly relevant for describing which segments of the population are trying to quit.

Trends in the quit ratio using NHIS data and an analysis of the smoking continuum using data from the 1986 AUTS are presented below.

Trends in the Proportion of Smokers Quitting (Quit Ratio) (NHIS)

Quit ratios for the total U.S. adult population and stratified by sex, race, and education, as derived from the 1965-87 NHISs, are presented in Table 9. Linear regression analyses of the weighted data from those surveys conducted between 1965 and 1985 are also provided to assess time trends. The 1987 data are not used in the regression analyses because they are preliminary. The linear models for the observed data in the subpopulations defined by sex, race, and education had R^2 values all between 0.78 and 0.95.

In 1965, 29.6 percent of ever smokers had quit. By 1987, this proportion had increased to 44.8 percent. The rate of increase in the quit ratio between 1965 and 1985 is 0.68 percentage points per year. Almost half (48.7 percent) of male smokers had quit by 1987 compared with 40.1 percent of female smokers. The rate of increase in the quit ratio is the same among men and women.

Regarding racial differences, 46.4 percent of whites who had been smokers had quit by 1987 compared with 31.5 percent of blacks. For whites, the rate of change in the quit ratio from 1965-85 was 0.72 percentage points per year, and the linear model fits the data exceedingly well. For blacks, the rate of change during this period was 0.43 percentage points per year. As with smoking prevalence, the quit ratio for blacks did not change between 1965 and 1974 but did change between 1974 and 1985. Fiore and colleagues (1989) have reported trends from 1974-85; during this period the rate of increase in the quit ratio among blacks (0.75 percentage points per year) was similar to that among whites (0.77). However, this similarity masks a difference between the sexes. The change in the quit ratio among blacks from 1974-85 was mainly seen in males, where the rate increased at 1.04 percentage points per year (compared with 0.67 in white males). Among black females, the quit ratio increased at 0.46 percentage points per year from 1974-85 (compared with 0.95 in white females). Thus, in recent years, black males have been quitting smoking at a significantly higher rate of change than white males ($p=0.01$). The difference in the rate of change between black and white females is in the opposite direction but is not statistically significant ($p=0.31$) because of the reduced linearity of the trends and smaller sample sizes of ever smokers among females than among males.

In 1966, about 40 percent of college graduates who had ever been smokers had quit. This proportion was 20 to 40 percent higher than the other educational groups. By 1987, the quit ratio among college graduates had risen to 61 percent, and the rate of change from 1966-85 (+0.85 percentage points per year) was greater than in any other educational category. Quitting has been increasing in all the other educational categories, with the slowest rate of change (0.41 percentage points per year) among persons without a high school diploma.

Smoking Continuum (AUTS)

The process of quitting smoking has been categorized by Prochaska and DiClemente (1983) according to smokers' intention to quit and the status of their most recent quit attempt. They labeled five stages of the quitting process as follows: precontemplation,

TABLE 9.--Trends in smoking quit ratio (%), NHISs, United States, 1965-87, adults aged 20 years and older

Year	Overall population	Sex		Race		Educational level			
		Males	Females	Whites	Blacks	Less than high school graduate	High school graduate	Some college	College graduate
1965 ^a	29.6	31.4	24.6	30.5	22.8				
1966	29.5	31.4	24.2	30.4	22.6	33.3	28.0	28.7	39.7
1970	35.3	37.9	29.2	36.7	23.2	38.1	33.6	34.9	48.2
1974	36.3	39.3	30.8	38.0	21.8	38.0	35.2	36.6	47.9
1976	37.1	39.9	32.1	38.4	26.3	39.5	35.0	37.2	46.1
1977	36.8	40.3	31.3	38.2	24.8	38.3	34.0	36.8	48.6
1978	38.5	41.3	33.8	39.9	27.5	38.7	36.3	41.0	49.7
1979	39.0	41.5	34.0	40.3	28.0	40.8	36.7	37.5	50.6
1980	39.0	41.5	34.0	40.4	27.7	39.4	36.5	40.6	48.7
1983	41.8	44.1	37.6	43.3	29.3	42.1	38.7	41.2	54.9
1985	45.0	49.0	40.0	46.7	31.8	41.3	40.5	46.0	61.1
1987 ^b	44.8	48.7	40.1	46.4	31.5	39.7	40.9	46.9	61.4
Trend information (1965-85)									
Change ^c / year	+0.68	+0.73	+0.73	+0.72	+0.43	+0.41	+0.57	+0.73	+0.85
Standard error (±)	0.05	0.06	0.05	0.06	0.07	0.06	0.07	0.10	0.16
R²	0.95	0.94	0.96	0.94	0.82	0.85	0.89	0.88	0.78

NOTE: Quit ratio = (Former Smokers/Current + Former Smokers)

^aFor 1965, data stratified by education were not available.^bProvisional data only.^cIn percentage points.

SOURCE: NHISs 1965-87; unpublished data, Office on Smoking and Health

contemplation, action, maintenance, and relapse. This categorization has proven useful in longitudinal research studies (see Part II of this Chapter and also Chapter 6); however, for cross-sectional population studies, this process of quitting can be analyzed according to current smoking status and the timing and duration of previous quit attempts. Thus, everyone can be classified on a smoking continuum.

This continuum is presented in Table 10. It is based on questions from the AUTS (see Appendix to this Chapter). Ten different categories are presented as percentages of the total population and as percentages of ever smokers. Categories of current smokers can also be described as percentages of all current smokers. These percentages are not provided below because of the possibility of misinterpretation. In particular, the percentage of those attempting to quit during the past year should not be calculated using current smokers as the denominator because this percentage excludes those who successfully quit during the past year. Instead, a more appropriate denominator (used below) would be those who were smokers at any time during the past year (including former smokers who quit during the past 12 months).

TABLE 10.--Smoking continuum, adults aged 17 years and older, United States, 1986

		Percentage of population	Percentage of ever smokers
Category 1	Never smokers	47.3	
Category 2	Former smokers who had quit 5 or more years ago	14.7	27.9
Category 3	Former smokers who had been abstinent for 1 to 5 years	5.7	10.8
Category 4	Former smokers who had been abstinent for 3 to 12 months	2.0	3.8
Category 5	Former smokers who had quit within the last 3 months	3.2	6.1
Category 6	Current smokers who had quit for 7 or more days in the past year	3.9	7.4
Category 7	Current smokers who had quit for 1-6 days in the past year	2.0	3.8
Category 8	Current smokers who had quit previously but not in the last year	11.6	22.0
Category 9	Current smokers who had never tried to quit but who had thought about it or would quit if there was an easy way to do so	5.4	10.2
Category 10	Current smokers who had never tried to quit, had not thought about it, and would not try to quit even if there was an easy way to do so	4.5	8.5

SOURCE: AUTS 1986 (US DHHS, in press, a).

The first category on this continuum includes those who have never smoked cigarettes. In 1986, 47.3 percent of the U.S. population 17 years of age and older was in this category. Former smokers who had quit smoking 5 or more years previously made up 14.7 percent of the population and 27.9 percent of ever smokers. Those in this category can be considered to be confirmed ex-smokers who are unlikely to relapse. Former smokers who had been abstinent for 1 to 5 years represented 10.8 percent of ever smokers. Former smokers who had been abstinent for less than a year represented 9.9 percent of ever smokers (categories 4 and 5 combined). Current smokers who had quit smoking for 7 or more days during the past year made up 7.4 percent of ever smokers. Another 3.8 percent of ever smokers had quit during the past year but were not able to stay off cigarettes for a week or more. Combining categories 4 through 7, 21.1 percent of ever smokers stopped smoking for at least 1 day during the year prior to the 1986 survey. This is 34 percent of all those who smoked that year.

Of ever smokers, 22.0 percent were current smokers who had previously made a serious quit attempt but not during the past year. Approximately 19 percent of ever smokers were current smokers who had never tried to quit; 45 percent of these have never thought about quitting and say that they would not quit even if there was an easy way to do so. Of those who had smoked during the past year, 70 percent had made at least one quit attempt (categories 4 through 8 divided by categories 4 through 10).

For the sake of convenience, category 10 is referred to below as the “hard-core smokers” category. However, it should be noted that others might also use this term to describe smokers who have failed to quit despite repeated attempts.

Tables 11 and 12 give the distribution for this smoking continuum by gender, education, race, and age. There are large differences between the subgroups in the proportion of ever smokers who are long-term abstainers (category 2). Males are more likely to be in this category than females, whites more than blacks, older people more than younger people, and the most highly educated more than the less well educated. The percentages of ever smokers in the categories reflecting recent quitting activity (4 through 7) and no recent quitting activity (8 through 10) were slightly higher for women than for men, probably resulting from the higher percentage of men in the combined categories 2 and 3 (abstinence for a year or more).

Educational differences in the smoking continuum are generally consistent with educational differences in smoking prevalence and quit ratio mentioned above. The proportion of ever smokers who have *not* tried to quit during the past year (categories 8 through 10) is 43.5 percent for the least educated group compared with 29.1 percent for the most educated group. The proportion in the hard-core smokers category is 9.8 percent for the least educated group compared with only 5.7 percent for the most educated group. However, the proportion of those who have made a quit attempt during the past year (categories 4 through 7) is also higher for the least educated group than for the most educated group (21.8 percent and 17.2 percent, respectively); this latter difference may reflect a lower success rate for quitting attempts among the least educated group. The differences between the least and most educated in these categories (4 through 7) become progressively smaller and then disappear as one moves from failed quit attempts during the past year (categories 6 and 7) to successful quit attempts

TABLE 11.—Smoking continuum by sex and education, percentage of ever smokers, United States, 1986

	Sex		Education			
	Males (%)	Females (%)	≤11 years (%)	12 years (%)	13–15 years (%)	≥16 years (%)
Smoking continuum						
Smokers who never tried to quit (10) ^a	8.3 (8.3) ^b	9.1 (9.1)	9.8 (9.8)	9.5 (9.5)	7.7 (7.7)	5.7 (5.7)
Smokers who never tried to quit (9)	9.1 (17.4)	9.6 (18.7)	9.8 (19.6)	9.5 (19.0)	10.9 (18.6)	5.7 (11.4)
Smokers not quitting in the last year (8)	21.5 (38.9)	23.9 (41.7)	23.9 (43.5)	22.5 (41.5)	22.5 (41.1)	17.7 (29.1)
Smokers quitting 1–6 days in the last year (7)	3.4 (42.3)	4.6 (46.3)	4.4 (47.9)	4.9 (46.4)	2.6 (43.7)	1.5 (30.6)
Smokers quitting 7 or more days in the last year (6)	6.5 (48.8)	8.6 (54.9)	7.4 (55.3)	7.9 (54.3)	8.6 (52.3)	5.0 (35.6)
Ex-smokers 0–3 months (5)	6.8 (55.6)	5.2 (60.1)	6.6 (61.9)	5.4 (59.7)	6.0 (58.3)	7.0 (42.6)
Ex-smokers 3–12 months (4)	3.6 (59.2)	4.3 (64.4)	3.4 (65.3)	4.1 (63.8)	4.7 (63.0)	3.7 (46.3)
Ex-smokers 1–5 years (3)	10.9 (70.1)	10.7 (75.1)	7.8 (73.1)	10.7 (74.5)	12.8 (75.8)	14.0 (60.3)
Ex-smokers ≥5 years (2)	30.1 (100)	25.1 (100)	27.2 (100)	25.3 (100)	24.4 (100)	39.2 (100)

^aCategory on the smoking continuum (see Table 10 for definitions).

^bNumbers in parentheses are cumulative percentages.

SOURCE: AUTS 1986 (US DHHS, in press, a).

TABLE 12.—Smoking continuum by race and age, percentage of ever smokers, United States, 1986

	Race		Age			
	Whites (%)	Blacks (%)	18–24 years (%)	25–44 years (%)	45–64 years (%)	≥65 years (%)
Smoking continuum						
Smokers who never tried to quit (10) ^a	8.7 (8.7) ^b	8.6 (8.6)	9.1 (9.1)	6.9 (6.9)	8.3 (8.3)	7.4 (7.4)
Smokers who never tried to quit (9)	8.9 (17.6)	12.3 (20.9)	18.4 (27.5)	10.6 (17.5)	7.5 (15.8)	3.6 (11.0)
Smokers not quitting in the last year (8)	22.2 (39.8)	22.2 (43.1)	16.3 (43.8)	26.4 (43.9)	21.6 (37.4)	14.5 (25.5)
Smokers quitting 1–6 days in the last year (7)	3.6 (43.4)	6.9 (50.0)	7.2 (51.0)	4.4 (48.3)	3.2 (40.6)	2.1 (27.6)
Smokers quitting 7 or more days in the last year (6)	7.0 (50.4)	10.7 (60.7)	19.3 (70.3)	8.6 (56.9)	4.7 (45.3)	2.0 (29.6)
Ex-smokers 0–3 months (5)	5.9 (56.3)	7.5 (68.2)	7.2 (77.5)	5.8 (62.7)	6.2 (51.5)	8.2 (37.8)
Ex-smokers 3–12 months (4)	4.0 (60.3)	3.3 (71.5)	9.0 (86.5)	4.3 (67.0)	3.2 (54.7)	2.5 (40.3)
Ex-smokers 1–5 years (3)	10.8 (71.1)	9.4 (80.9)	10.3 (96.8)	11.4 (78.9)	9.9 (64.6)	10.1 (50.4)
Ex-smokers ≥5 years (2)	28.8 (100)	19.0 (100)	3.0 (100)	20.6 (100)	35.6 (100)	49.7 (100)

^aCategory on the smoking continuum (see Table 10 for definitions).

^bNumbers in parentheses are cumulative percentages.

SOURCE: AUTS 1986 (US DHHS, in press, a).

during the past year (categories 4 and 5). For prolonged abstinence (1 or more years) (categories 2 and 3), the proportions then become greater for the more educated.

Among ever smokers, about two-fifths of both blacks and whites have not tried to quit during the past year, with 9 percent in the hard-core smokers category. Twenty-one percent of white ever smokers have made a quit attempt during the past year compared with 28 percent of blacks.

A person's likelihood of being in different categories of the smoking continuum differs considerably with age. About 44 percent of ever smokers between the ages of 25 and 44 years are smokers who have not made an attempt to quit during the past year, compared with 26 percent of those 65 years of age and older. However, there are roughly equal proportions of each age group in the hard-core smokers category. The proportion of ever smokers who made a quit attempt in the last year was highest (42.7 percent) in the youngest age group (18 to 24 years old) and is progressively smaller for each older age group (23.1 percent, 17.3 percent, and 14.8 percent, respectively, in those aged 25 to 44 years, 45 to 64 years, and 65 years and older).

Summary

As with trends in smoking status, trends in quitting activity have exhibited a consistent pattern since 1965. Almost half of the population who have ever been smokers have quit. Although the proportion of males who have quit is higher than that of females and the proportion of whites who have quit is higher than that of blacks, the rate of increase in the quit ratio is similar between these categories. The only diverging trend over time is the quitting activity for the less educated compared with the more educated.

One-third of those who smoked during the year prior to the 1986 AUSTS quit smoking for at least 1 day during that year. Health education and motivational campaigns targeted at these individuals could help maintain them in "contemplation" and "action" stages (Prochaska and DiClemente 1983) and move them toward repeated quit attempts (see Part II).

Trends in the Proportion of Smokers Who Are Heavy Smokers

Although all the NHISs have included information on the number of cigarettes smoked per day, respondent rules on this question changed in 1974. Prior to that date, smoking information was obtained from either the sampled individual or a proxy adult living in the same household. For each survey since the 1974 NHIS, smoking information has been accepted only from the sampled individual. Proxy respondents have been shown to be less accurate in reporting daily cigarette consumption than self-respondents (US DHEW 1969, p. 794; Rogot and Reid 1975; National Research Council 1986, pp. 110-112). Proxy responses can be eliminated from analyses of the pre-1974 data to examine long-term trends in daily cigarette consumption. However, excluding proxy responses may make the sample nonrepresentative (see Chapter 3). Accordingly, in considering trends in the proportion of the smoking population who smoke 25 or more cigarettes per day, only NHIS data from 1974-85 are used here.

The proportion of smokers who smoked 25 or more cigarettes per day in each survey is presented in Table 13 and is shown in Figure 1. This proportion ranged from 25.5 to 29.8 percent and did not change significantly from 1974 through 1985 ($p=0.4$). In addition, this proportion did not change among sex- and race-specific subgroups of the smoking population (Figure 2) or in different age groups (NCHS 1988c). Heavy smoking has been consistently more common among whites compared with blacks, and among men compared with women; the differential by race has been greater than the differential by sex (Figure 2).

It is theoretically possible that the proportion of the “heaviest” smokers is increasing even though the proportion of “heavy” smokers (25 or more cigarettes per day) has not changed. However, no major increase occurred from 1974-85 in the proportion of smokers smoking 40 or more cigarettes per day (Table 14). The overall proportion smoking 40 or more cigarettes per day was 12.6 percent in 1974 and 13.2 percent in 1985. Table 14 also demonstrates respondents’ inclination to report their daily cigarette consumption in round numbers related to the size of a cigarette pack (e.g., 10 or 20 cigarettes per day) (see Kozlowski 1986).

Because the sales-weighted average nicotine yield declined from 1974-83 (see Figure 14 in Chapter 2), one might expect to have observed an increase in average daily cigarette consumption. Compensatory changes in smoking behavior to maintain relatively constant nicotine intake have been shown to occur when smokers switch from high-yield to lower yield cigarettes (US DHHS 1988). Although daily cigarette consumption did not increase from 1974-85, other compensatory changes may have occurred (e.g., increased frequency of puffing or depth of inhalation) as the smoking population moved toward lower yield brands.

TABLE 13.—Self-reported cigarettes smoked per day (percentage of current smokers), United States, aged 20 years and older, 1974–85

Year	Number of cigarettes smoked per day		
	1–14	15–24	≥25
1974	30.8	43.2	26.0
1976	30.1	44.4	25.5
1977	30.3	43.2	26.5
1978	28.1	42.8	29.1
1979	28.2	43.0	28.8
1980	27.6	42.6	29.8
1983	28.5	44.9	26.6
1985	31.0	41.9	27.1

SOURCE: NHISs 1974–85; unpublished data, Office on Smoking and Health.

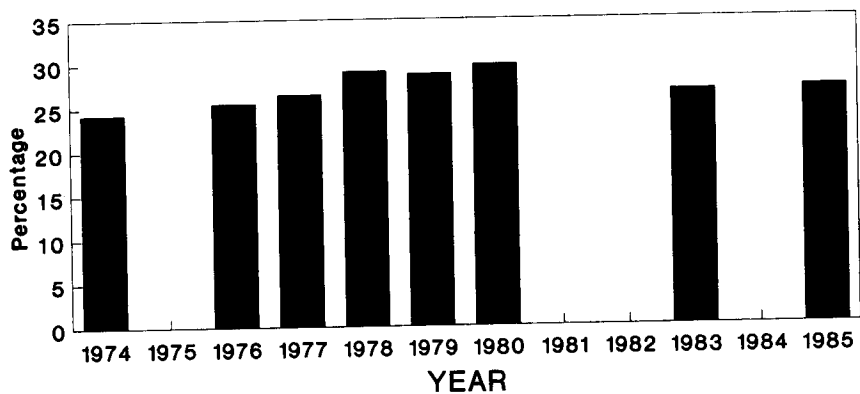


FIGURE 1.—Percentage of current smokers smoking ≥ 25 cigarettes per day, adults aged 20 years and older, United States, 1974-85

SOURCE: NHISs 1974-85; unpublished data, Office on Smoking and Health.

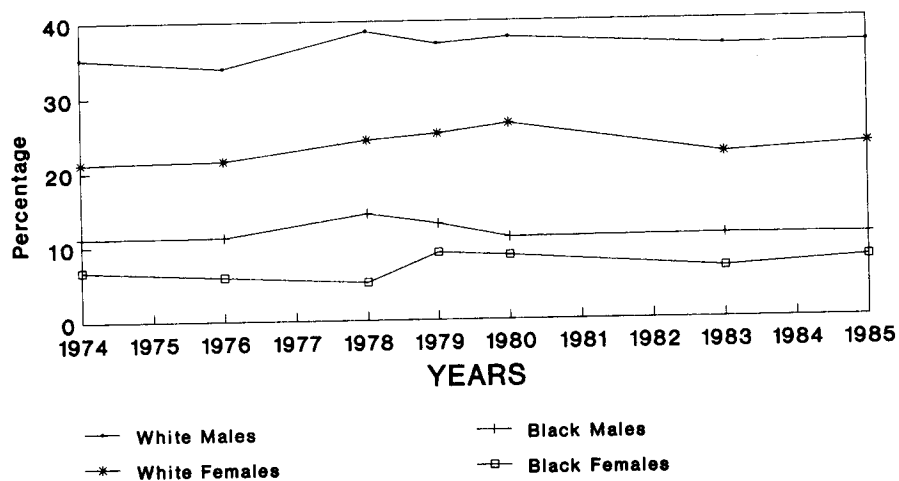


FIGURE 2.—Percentage of current smokers smoking ≥ 25 cigarettes per day, by race and gender, adults aged 20 years and older, United States, 1974-85

SOURCE: NHISs 1974-85; unpublished data, Office on Smoking and Health.

TABLE 14.—Self-reported cigarettes smoked per day (percentage of current smokers) by sex and race, United States, aged 20 years and older, 1974 and 1985

Cigarettes per day	Sex						Race			
	Overall		Males		Females		Blacks		Whites	
	1974	1985	1974	1985	1974	1985	1974	1985	1974	1985
1-9	15.0	15.0	12.0	12.5	18.3	17.7	30.0	28.1	12.7	12.8
10	12.6	12.6	9.9	10.2	15.6	15.1	21.9	21.3	11.4	11.2
11-19	10.9	11.3	10.0	10.9	12.0	11.7	14.8	14.1	10.3	10.9
20	35.1	32.9	35.5	32.4	34.5	33.5	23.9	26.1	36.7	33.9
21-39	13.8	15.0	16.8	17.2	10.7	12.6	5.1	5.8	15.1	16.6
40	10.1	9.5	12.3	11.9	7.5	7.0	3.7	3.0	11.0	10.6
≥41	2.5	3.7	3.5	4.9	1.4	2.4	0.6	1.6	2.8	4.0

SOURCE: NHISs 1974, 1985 (unpublished data, Office on Smoking and Health).

Trends in the Initiation of Smoking

Information on smoking patterns during adolescence is important because smoking initiation usually occurs during this age. Presented below are data concerning three measures of smoking behavior during adolescence: (1) age of smoking initiation; (2) trends in smoking prevalence among persons 20 to 24 years of age, used as an indicator of smoking initiation; and (3) smoking prevalence among adolescents.

Data on age of initiation provide information on the ages during which initiation usually occurs, but provide no information on the extent of tobacco use within the adolescent population. The prevalence of smoking among those 20 to 24 years of age serves as an indicator of smoking initiation among adolescents during the several years preceding a particular survey. This measure offers the advantages that smoking initiation is relatively complete by the time one enters this age group, and a survey sample representative of the total age-specific population can be obtained readily. However, these data offer no information on the ages during which smoking initiation actually occurred and do not necessarily reflect the most current initiation patterns among adolescents. Data on smoking prevalence among adolescents provide direct and current information on smoking behavior in the population of concern. However, interpretation of adolescent survey data is complicated by the use of different definitions of regular and experimental smoking in different surveys and by the failure of some surveys (e.g., school surveys of high school seniors) to include groups known to smoke at higher rates (e.g., high school dropouts).

Age of Initiation

Age of smoking initiation is a critical variable in targeting prevention efforts. Information on self-reported age of initiation is available from surveys of adolescents and adults. Adolescent surveys offer the advantage of providing current information on age of initiation without concerns of recall bias. However, these surveys cannot provide complete information on age of initiation because the samples exclude those who may start smoking at older ages. Adult surveys provide complete information on age of initiation, but recall bias may occur because adults are asked about an event (smoking initiation) that typically occurred decades earlier. A major value of an adult survey is that, by using birth cohorts, one can assess whether smoking initiation has changed over time.

In the 1986 High School Seniors Survey sponsored by NIDA (see below), seniors who had ever smoked were asked the grade in which they had smoked their first cigarette. About one-quarter of seniors smoked their first cigarette by grade 6, one-half by grade 8, three-fourths by grade 9, and 94 percent by grade 11 (Table 15). Males and whites were more likely to smoke their first cigarette at earlier grades than females and blacks, respectively. The pattern of smoking initiation was similar for those with and without plans for higher education.

In addition, the 1987 National Adolescent Student Health Survey (NASHS) (see below) collected information on the grade in which 8th and 10th grade students had smoked their first cigarette. Data are presented in Table 16 for 10th graders only. Ap-

TABLE 15.--Grade by which ever smokers smoked their first cigarette (%), reported by high school seniors, United States, 1986

Grade	Total	Males	Females	Whites	Blacks	Higher education plans	
						Yes	No
6	25.8	31.1	20.7	26.8	23.3	25.3	25.7
8	57.3	59.5	55.3	59.0	50.2	56.5	58.0
9	72.5	72.7	72.5	74.0	65.8	70.8	75.3
10	84.2	83.8	84.7	85.0	78.4	83.0	86.7
11	94.3	93.8	95.0	95.3	89.9	93.5	95.9
12	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Sample size	3,079	1,423	1,526	2,308	302	1,791	972

SOURCE: Institute for Social Research, University of Michigan (Bachman, Johnston, O'Malley 1987).

proximately one-quarter of smokers reported that they had started smoking by grade 6 and approximately one-half of smokers had started by grade 7 or 8. Males were somewhat more likely than females to start smoking prior to grade 7, but females caught up by grade 9 due to their higher initiation rates in grades 7 to 9.

TABLE 16.--Recall of grade at smoking initiation by 10th-grade students, United States, 1987

	Males		Females	
	%	Cumulative %	%	Cumulative %
By grade 4	11.0	11.0	8.5	8.5
Grades 5 or 6	17.9	28.9	14.0	22.5
Grades 7 or 8	24.1	53.0	26.1	48.6
Grade 9	6.9	59.9	10.9	59.5
Grade 10	2.1	62.0	4.6	64.1
Not smoking by grade 10	38.1	100.0	35.9	100.0

SOURCE: National Adolescent Student Health Survey 1987 (US DHHS, in press, b).

Information on age of initiation is available for adults from NHISs conducted in 1978, 1979, 1980, and 1987. The 1987 data were not available for inclusion in the data presented below. The 1978-80 data are derived from responses to the question, "About how old were you when you first started smoking cigarettes fairly regularly?" These data have been used in previously published analyses of age of smoking initiation (US DHHS 1985; Harris 1983; McGinnis, Shopland, Brown 1987) and are again used below. The populations from the three NHISs were combined and grouped by 5-year birth cohorts. In the total sample, the average age of initiation among ever smokers (aged 20 to 64 years) was 17.2 for men and 19.1 for women (US DHHS 1985). The proportion of ever smokers (20 years of age and older) within each birth cohort who

had started smoking before different ages is presented separately for males and females in Table 17 and Figures 3 and 4.

Among smokers born since 1935, more than four-fifths started smoking before age 21 and almost half started before age 18. The data reveal few differences across birth cohorts in age of initiation before age 16. However, for more recent birth cohorts, there has been a tendency for a higher percentage of ever smokers to have initiated smoking before age 18 or 21. The proportion starting before age 18 has increased from 38 percent of ever smokers born from 1910-14 to approximately half of ever smokers born between 1950 and 1954. The proportion starting before age 21 has increased between these two birth cohorts from 66 to 87 percent (Table 17). Stratifying by sex shows that this tendency for more recent birth cohorts to initiate smoking at a younger age has occurred among both sexes but has been more striking among females (Figures 3 and 4).

The data from the earliest birth cohorts may be biased somewhat by differential mortality among smokers with different ages of initiation. Mortality rates for smoking-related diseases are higher for smokers with younger ages of initiation (US DHHS 1982, 1983, 1984). Thus, the age of initiation data may be biased upward among, for example, the 1910-19 birth cohort, whose members were 61 to 70 years old in the last survey year included in these data (1980). However, the trend noted above toward declining age of initiation, especially among females, is still apparent when considering only those born since 1930. As pointed out above, the decline in age of initiation among males is only seen in the proportion of ever smokers starting before age 21.

In summary, these data indicate that uptake of smoking is now a phenomenon that occurs almost entirely during the teenage years and that the initiation of smoking is occurring at younger ages among more recent birth cohorts, especially among females. Data from the 1986 AUTS on age of initiation of smokeless tobacco use are presented in the Section on Smokeless Tobacco later in this Chapter.

Prevalence in 20- to 24-Year Age Group

The most complete ascertainment of smoking initiation would involve the collection of longitudinal data on children from the ages of about 9 to 21 years. Such complete population-based information for the United States is not available. However, trends in smoking prevalence in the 20- to 24-year age group (Table 18), as determined by the NHIS, provide an indirect measure of trends in smoking initiation. Using this measure has the advantage that smoking initiation is relatively complete by age 20. However, there is a lag of several years between actual initiation during adolescence and prevalence in this group. The R^2 values for the regression lines derived from these data are above 0.70 for sex-, race-, and education-specific groups, except for females overall, among whom initiation rates varied considerably.

From 1965-87, smoking initiation, as measured by prevalence among those aged 20 to 24 years, decreased from 47.8 percent to 29.5 percent, at a rate of decline from 1965-85 of 0.69 percentage points per year. There are marked gender differences in this measure of initiation. Smoking prevalence among young males has fallen from 56.3 percent in 1965 to 31.1 percent in 1987 at a rate of change (1965-85) of -1.19 percentage points per year. In contrast, smoking prevalence among young females has fallen

TABLE 17.--Proportion of ever smokers (%) who started smoking before various ages, by gender, birth cohorts from NHISs

Age at smoking initiation		Year of birth								
		1910-14	1915-19	1920-24	1925-29	1930-34	1935-39	1940-44	1945-49	1950-54
14	Overall	8.9	11.0	9.2	8.1	8.8	8.3	8.5	8.5	8.6
	Male	13.0	16.3	12.5	11.7	12.8	11.1	11.1	10.1	10.3
	Female	2.6	3.4	4.2	2.7	3.7	4.7	5.1	6.1	6.6
<16	Overall	20.0	21.6	19.5	19.1	22.2	21.3	23.0	23.7	23.8
	Male	28.4	30.3	25.7	25.5	30.1	25.9	27.7	28.2	26.8
	Female	7.2	9.5	9.7	9.8	11.9	15.6	17.1	17.9	20.2
<18	Overall	38.3	42.1	40.0	42.9	45.0	46.0	48.5	47.2	52.0
	Male	49.9	53.1	48.7	54.0	56.9	53.8	55.6	52.2	56.6
	Female	20.6	26.7	26.2	26.8	29.8	35.6	40.1	40.9	46.7
<21	Overall	66.2	70.8	70.7	76.5	75.6	81.7	83.1	83.8	87.3
	Male	76.5	78.8	79.9	85.4	83.1	85.9	86.1	87.3	90.3
	Female	50.3	59.5	56.0	63.5	66.3	75.9	79.5	79.1	83.8
<25	Overall	78.0	83.2	86.9	88.8	90.0	92.7	93.8	95.5	97.7
	Male	88.7	90.4	93.8	95.2	95.0	95.0	96.3	97.8	98.5
	Female	61.9	72.6	75.8	79.5	83.7	89.5	90.9	92.7	96.7

SOURCE: NHISs 1978, 1979, 1980 combined (unpublished data, Office on Smoking and Health).

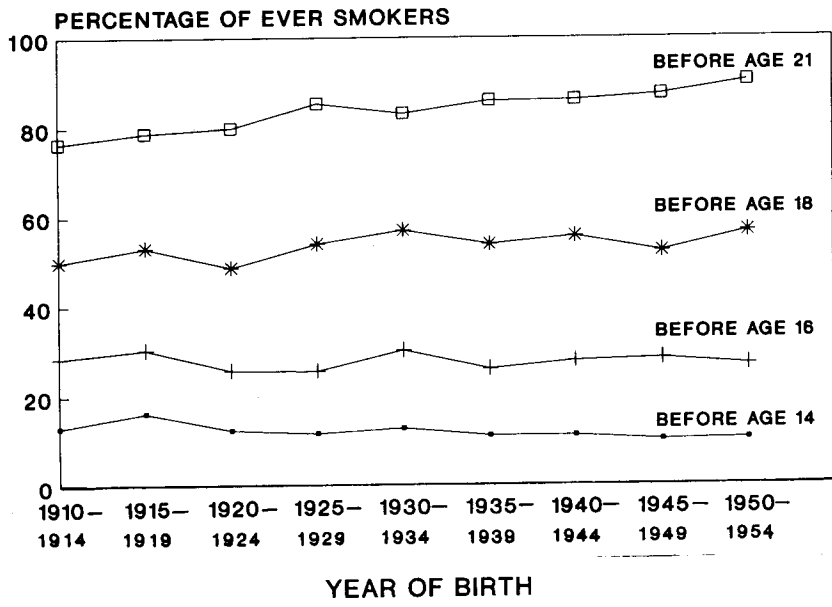


FIGURE 3.—Age by which males started smoking, by birth cohort
 SOURCE: NHISs 1978-80, combined (unpublished data, Office on Smoking and Health).

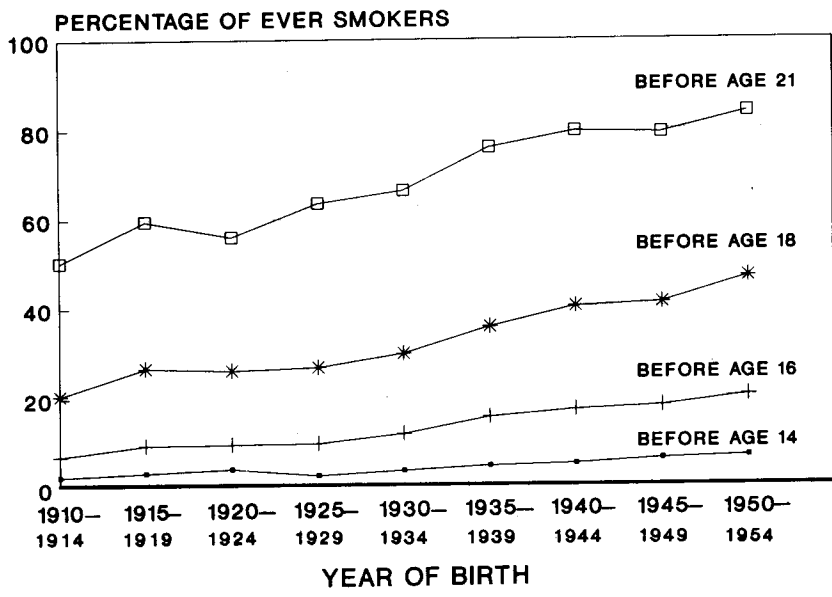


FIGURE 4.—Age by which females started smoking, by birth cohort
 SOURCE: NHISs 1978-80, combined (unpublished data, Office on Smoking and Health).

TABLE 18.--Trends in smoking initiation, NHISs, United States, 1965-87

Smoking prevalence (%), ages 20-24									
Year	Overall population	Sex		Race		Education level			
		Males	Females	Whites	Blacks	High school graduate or less		Some college or more	
						Males	Females	Males	Females
1965	47.8	56.3	40.5	47.5	50.8	63.6	42.6	42.7	34.5
1966	47.7	57.7	39.5	48.2	45.5	65.1	41.3	43.5	34.7
1970	41.5	48.5	35.8	41.2	45.2	60.0	40.2	33.2	26.8
1974	39.5	44.3	35.4	38.6	47.1	52.7	40.1	34.7	26.4
1976	39.6	45.9	34.2	39.5	42.3	54.1	41.0	34.4	23.0
1977	38.8	40.4	37.4	38.5	41.5	52.2	43.0	24.0	27.5
1978	35.4	38.5	32.5	35.7	34.8	46.8	39.3	25.9	21.1
1979	35.8	37.7	34.0	35.6	36.7	47.1	41.9	23.8	22.1
1980	36.1	40.0	32.5	35.9	37.9	50.1	40.3	20.1	19.4
1983	36.9	36.9	37.0	36.8	38.7	49.1	45.5	16.2	22.9
1985	31.8	31.0	32.5	32.5	28.2	43.0	43.6	15.5	17.2
1987 ^a	29.5	31.1	28.1	30.5	25.6	43.8	37.6	16.3	15.1
Trend information (1965-85)									
Change ^b /year	-0.69	-1.19	-0.28	-0.68	-0.79	-1.00	0.10	-1.51	-0.72
Standard error	0.09	0.10	0.12	0.09	0.17	0.13	0.10	0.13	0.15
R ²	0.86	0.94	0.40	0.85	0.71	0.87	NA ^c	0.95	0.75

^aProvisional data only.

^bIn percentage points.

^cThe slope of the regression line was not significantly different from zero, making the R² computation inappropriate.

SOURCE: NHISs 1965-87; unpublished data. Office on Smoking and Health.

only from 40.5 percent in 1965 to 28.1 percent in 1987 at a rate of change (1965-85) one-quarter that of young males (-0.28 percentage points per year). The slower rate of decline among women is due, in large part, to the increase in initiation rates in less educated young women (Pierce, Fiore et al. 1989b).

Smoking initiation patterns among whites and blacks have been similar during the past 20 years. From 1965-87, smoking prevalence among whites aged 20 to 24 years has decreased from 47.5 percent to 30.5 percent, while for blacks the decline has been from 50.8 percent to 25.6 percent. The rates of change between 1965 and 1985 among whites and blacks were similar (-0.68 and -0.79 percentage points per year, respectively). The prevalence of smoking had been higher among young blacks than among young whites for most survey years between 1965 and 1983, but whites had a higher prevalence in 1985 and 1987.

Marked differences in smoking initiation rates based on educational level have occurred. From 1965-87, the smoking initiation rate as measured by prevalence, ages 20 to 24, fell among males with 12 or fewer years of schooling (high school graduate or less) from 63.6 percent to 43.8 percent (-1.00 percentage point per year from 1965-85). In contrast, for males with 13 or more years of schooling (some college or more), prevalence has fallen from 42.7 percent to 16.3 percent, at a rate of decline (1965-85) of 1.51 percentage points per year. A similar difference in initiation rates by education was seen among women, although the rate of decline between 1965 and 1985 was less among women than among men of equivalent education. In the overall sample (men and women combined), the rate of decrease in initiation among persons with 13 or more years of education (1.10 percentage points per year) was three times that among persons with 12 or fewer years of education (0.35).

Trends in Adolescent Smoking

Several surveys have provided national estimates of smoking prevalence among adolescents. Because these surveys differ in terms of the definitions of smoking, ages of respondents, sample size, method of data collection (household versus school versus telephone interview), years in which the surveys were conducted, and overall results, the findings of the major surveys are presented below.

NIDA High School Seniors Surveys on Drug Use, 1976-87

Data from the NIDA-sponsored High School Seniors Surveys have been collected annually since 1975 and are presented in Table 19. These surveys have been carried out by the University of Michigan Institute for Social Research (Johnston, O'Malley, Bachman 1987). This data set is most useful for examining trends in smoking. Individual prevalence figures probably underestimate actual adolescent smoking prevalence because the survey does not include high school dropouts, who are known to have much higher smoking rates (Pirie et al. 1988; Yates et al. 1988).

Reported daily smoking of cigarettes has decreased among high school seniors from a peak prevalence of 29 percent in 1976 to 19 percent in 1987. However, the trend has not been linear. The majority of the change occurred between 1978 and 1980, after

TABLE 19.--Smoking status (%) of high school seniors, United States, 1975-87

Year	Daily smokers	Less than daily smokers	Previous smokers, not in last month	Never smokers
1975	27	10	37	26
1976	29	10	36	25
1977	29	10	38	24
1978	28	9	38	25
1979	26	9	40	26
1980	21	9	41	29
1981	20	9	42	29
1982	21	9	40	30
1983	20	9	41	29
1984	18	11	41	30
1985	19	11	39	31
1986	18	11	38	32
1987	19	11	38	33

SOURCE: Institute for Social Research, University of Michigan (Bachman, Johnston, O'Malley 1980a,b, 1981, 1984, 1985, 1987; Johnston and Bachman 1980; Johnston, Bachman, O'Malley 1980a,b, 1982, 1984, 1986, and unpublished data, 1987).

which prevalence has remained relatively stable. The proportion of high school seniors who have smoked within the last month, although not on a daily basis, has not changed substantially during this period. There is also rather little change in the proportion of this population who has previously smoked but not in the last 30 days. The proportion of high school seniors who have never smoked increased from 26 percent to 33 percent between 1975 and 1987.

Trends in smoking status by sex, race, and educational plans are presented in Table 20. The prevalence of daily smoking decreased in all major subcategories of high school seniors between 1976 and 1987. Daily smoking among males decreased from a peak prevalence of 28 percent in 1976 to 16 percent in 1987; most of this drop occurred between 1977 and 1980. Daily smoking among females decreased from a peak prevalence of 30 percent in 1977 to 20 percent in 1987, with the largest decrease occurring from 1979-81. Since 1981, the prevalence of daily smoking among high school students has remained fairly constant for both males and females. In each year since 1977, the prevalence of daily smoking has been higher in females than in males (median difference=4 percentage points).

The prevalence of daily smoking fell substantially among blacks, from 26 percent in 1976 to 8 percent in 1987. During the same period, prevalence declined among whites from 29 percent to 20 percent. The reasons for the dramatic decline among blacks are unclear. It does not appear to be due to increasing sampling bias over time-survey methods and sample sizes by race have been consistent. A substantial decrease in smoking initiation among blacks also occurred, as measured in the NHIS by prevalence in persons 20 to 24 years of age, between 1983 (38.7 percent) and 1985 (28.2 percent) (Table 18). This figure declined further to a preliminary estimate of 25.6 percent in 1987.

Students with plans to pursue higher education were much less likely to be daily smokers in 1976 than those without such plans (21 percent versus 37 percent). The ab-

TABLE 20.--Smoking status (%) of high school seniors by sex, race, and educational plans, United States, 1975-87

Year	Daily smokers						Less than daily smokers					
	Sex		Race		Plans for higher education		Sex		Race		Plans for higher education	
	M	F	W	B	Yes	No	M	F	W	B	Yes	No
1975	27	26					10	10				
1976	28	28	29	26	21	37	10	10	10	13	10	10
1977	28	30	28	25	20	38	10	10	9	11	10	9
1978	26	29	27	22	18	36	9	10	9	9	9	9
1979	22	28	26	19	17	35	9	9	9	9	9	9
1980	18	24	22	16	14	31	8	10	9	10	9	10
1981	18	22	20	13	13	30	8	10	9	9	9	9
1982	18	24	23	12	13	30	9	9	9	9	9	9
1983	19	23	22	12	14	30	9	10	9	9	10	9
1984	16	21	20	8	11	29	10	11	11	9	11	11
1985	17	21	20	11	13	31	10	11	11	8	10	11
1986	17	20	21	8	12	29	11	11	12	7	11	10
1987	16	20	20	8	14	30	11	11	12	6	11	11

TABLE 20.--Continued

Year	Previous smokers, not in last month						Never smokers					
	Sex		Race		Plans for higher education		Sex		Race		Plans for higher education	
	M	F	W	B	Yes	No	M	F	W	B	Yes	No
1975	38	36					24	28				
1976	38	36	37	36	39	35	24	25	25	24	31	19
1977	39	35	37	49	41	35	24	25	25	26	30	19
1978	40	38	38	40	42	35	26	24	25	29	31	20
1979	42	38	39	41	42	37	27	25	26	30	32	20
1980	43	39	40	45	44	37	30	28	29	30	34	23
1981	43	41	41	45	45	38	31	27	29	33	33	24
1982	41	39	40	43	43	37	32	28	29	36	35	24
1983	41	40	40	45	43	38	31	28	29	34	34	24
1984	41	39	40	42	42	38	33	29	29	40	35	24
1985	39	39	38	42	41	36	33	30	30	39	36	24
1986	38	38	38	41	39	37	34	31	30	44	37	25
1987	38	38	38	41	39	35	35	31	30	45	37	25

SOURCE: Institute for Social Research, University of Michigan (See Table 19 for citations).

solute difference (in percentage points) between the two groups remained constant between 1976 and 1987. In 1987, the prevalence of daily smokers among those with plans for higher education was less than half the prevalence among those without such plans (14 percent versus 30 percent).

The percentage of blacks who smoke on less than a daily basis exceeded the percentage of whites in 1976 (13 and 10 percent, respectively) but was lower than the percentage of whites in 1987 (6 and 12 percent, respectively). The percentage who have previously smoked but not in the past month has consistently been slightly higher among blacks than among whites and among those with plans for higher education than among those without college plans. Besides these findings, there have been few differences between subgroups and few changes between 1976 and 1987 in the proportion of high school seniors who are in these categories.

As mentioned above, the decrease in the proportion of high school seniors who smoke on a daily basis is reflected by a complementary increase in the proportion of high school seniors who have never smoked. This increase has been more marked among males compared with females and among blacks compared with whites.

1987 National Adolescent Student Health Survey

The 1987 NASHS collected data on prevalence of smoking within the last 30 days (US DHHS, in press,b). Respondents to this survey composed a random sample of the Nation's students in 8th and 10th grades. Sixty-three percent of the 8th graders were 13 years old and 27 percent were 14 years old. Sixty-two percent of the 10th graders were 15 years old and 28 percent were 16 years old. For each grade, 68 percent were white, 17 percent were black, and 9 percent were Hispanic.

Prevalence data are presented in Table 21. Eighty-four percent of the eighth graders reported that they had not even puffed on a cigarette in the last 30 days, with little difference between the sexes. Forty-nine percent of all eighth graders reported never having smoked a cigarette, with no difference between the sexes. Among 10th graders, the proportion not having puffed on a cigarette in the last 30 days was slightly lower: 76 percent among males and 71 percent among females. Thirty-eight percent of males and 36 percent of females in this grade reported that they had never had a cigarette.

TABLE 21.-30-day prevalence of smoking (%), United States, 1987, 8th and 10th grades

	8th grade		10th grade	
	Males	Females	Males	Females
Not even a puff	84.9	83.0	75.9	71.3
1-4 cigarettes	7.1	8.2	7.8	10.4
5-19 cigarettes	2.7	3.4	4.8	5.1
1-5 packs	2.4	3.5	5.6	7.4
More than 5 packs	2.9	1.9	6.0	5.8

SOURCE: National Adolescent Student Health Survey 1987 (US DHHS, in press, b).

Approximately equal proportions (7 to 8 percent) of males and females in the eighth grade reported smoking a pack or more in the last month. Among 10th graders, this proportion was more than twice as high, with 17 percent of males and 19 percent of females reporting that they smoked a pack or more in the last month.

US DHEW Teenage Smoking Surveys, 1968-79

Detailed questions on smoking were asked in five national telephone surveys of adolescents (ages 12 to 18 years) conducted by Chilton Research Services for the U.S. Department of Health, Education, and Welfare from 1968 through 1979 (US DHEW 1979b). Adolescents were classified by smoking status as follows: *never smokers*, had not taken even a few puffs of a cigarette; *experimental smokers*, had had a few puffs but had not smoked as many as 100 cigarettes; *ex-smokers*, had smoked at least 100 cigarettes but no longer smoked; *current occasional smokers*, smoked less than one cigarette per week; and *current regular smokers*, smoked at least one cigarette per week. In published results for these surveys, data for never smokers and experimental smokers were generally aggregated.

Summary data from each of the surveys are presented in Table 22 (males) and Table 23 (females). The proportion of both males and females of each age group who are classified as either never smokers or experimental smokers is substantially higher than the proportion of never smokers reported by other surveys. For example, the 1979 Teenage Smoking Survey showed that 75 percent of males and 82 percent of females aged 15 to 16 years had never smoked or had only experimented with cigarettes; in contrast, the 1987 NASHS (above) showed that only 38 percent of males and 36 percent of females in the 10th grade (15 to 16 years old) had never had a cigarette. Similarly, the 1979 Teenage Smoking Survey showed that 68 percent of males and 64 percent of females aged 17 to 18 years were either never smokers or experimental smokers; in contrast, the 1979 High School Seniors Survey showed that 27 percent of males and 25 percent of females were never smokers.

There are at least two possible explanations for the consistently and surprisingly high proportion of teenagers in the categories of never smokers and experimental smokers. First, 100 cigarettes may be too high a cutoff to use for classifying teenagers as never smokers or experimenters. Second, telephone interviewing may lead to more underreporting of cigarette smoking behavior than other survey modalities. Underreporting may be more important for some smoking categories than others—for instance, occasional smokers might be particularly sensitive about their smoking behavior and might be more likely to underreport the total number of cigarettes they have ever smoked.

Current smoking rates can also be compared between the Teenage Smoking Surveys and the High School Seniors Surveys. In the 1979 telephone survey, teenagers were classified on their reported smoking on a weekly basis. Of males aged 17 to 18 years, 19.3 percent were classified as current regular smokers (one or more cigarettes per week) and another 0.3 percent were classified as current occasional smokers (less than one cigarette per week). For females aged 17 to 18 years, these figures were 26.2 percent and 0.8 percent, respectively. In the High School Seniors Survey, students are

TABLE 22.--Cigarette smoking among teenage males, United States, 1968-79

Smoking status	Year	Age							
		12-14 years		15-16 years		17-18 years		Total	
		N	%	N	%	N	%	N	%
Never smoked or experimented only	1968	876	93.1	465	75.2	344	54.1	1,685	77.0
	1970	512	90.5	268	70.5	178	48.1	958	72.8
	1972	533	91.1	213	68.3	211	54.4	1,017	74.1
	1974	496	90.7	253	69.5	202	55.3	951	74.5
	1979	527	92.8	284	75.3	254	68.1	1,065	80.8
Former smoker	1968	25	2.7	34	5.5	71	11.3	130	5.9
	1970	21	3.7	35	9.2	52	14.1	108	8.2
	1972	20	3.4	50	12.5	56	14.4	126	9.2
	1974	28	5.1	45	12.4	44	12.1	117	9.2
	1979	23	4.0	38	10.1	46	12.3	107	8.1
Current occasional smoker	1968	13	1.4	14	2.3	24	3.8	51	2.3
	1970	1	0.2	3	0.8	2	0.5	6	0.5
	1972	5	0.9	6	1.5	4	1.0	15	1.1
	1974	0	0.0	0	0.0	6	1.6	6	0.5
	1979	0	0.0	4	1.1	1	0.3	5	0.4

TABLE 22.--Continued

Smoking status	Year	Age							
		12-14 years		15-16 years		17-18 years		Total	
		N	%	N	%	N	%	N	%
Current regular smoker	1968	27	2.9	105	17.0	190	30.2	322	14.7
	1970	32	5.7	74	19.5	138	37.3	244	18.5
	1972	27	4.6	71	17.8	117	30.2	215	15.7
	1974	23	4.2	66	18.1	113	31.0	202	15.8
	1979	18	3.2	51	13.5	72	19.3	141	10.7
Total	1968	941	100	618	100	629	100	2,188	100
	1970	566	100	380	100	370	100	1,316	100
	1972	585	100	400	100	388	100	1,373	100
	1974	547	100	364	100	365	100	1,276	100
	1979	568	100	377	100	373	100	1,318	100

SOURCE: US DHEW Teenage Smoking Surveys. 1968, 1970, 1972, 1974, 1979 (US DHEW 1979b).

TABLE 23.--Cigarette smoking among teenage females, United States, 1968-79

Smoking status	Year	Age							
		12-14 years		15-16 years		17-18 years		Total	
		N	%	N	%	N	%	N	%
Never smoked or experimented only	1968	919	97.9	552	84.4	462	73.0	1,933	86.8
	1970	536	95.0	312	81.5	264	70.0	1,112	84.0
	1972	569	95.3	312	77.0	277	66.7	1,158	81.7
	1974	495	90.2	250	69.3	228	62.1	973	76.2
	1979	514	92.3	319	81.8	239	63.9	1,072	81.2
Former smoker	1968	7	0.7	25	3.8	38	6.0	70	3.1
	1970	8	1.4	15	3.9	22	5.8	45	3.4
	1972	11	1.8	26	6.4	30	7.2	67	4.7
	1974	26	4.7	33	9.1	42	11.4	101	7.9
	1979	19	3.4	23	5.9	34	9.1	76	5.8
Current occasional smoker	1968	7	0.7	14	2.1	15	2.4	36	1.6
	1970	3	0.5	1	0.3	5	1.3	9	0.7
	1972	0	0.0	1	0.2	3	0.7	4	0.3
	1974	1	0.2	5	1.4	2	0.5	8	0.6
	1979	0	0.0	2	0.5	3	0.8	5	0.4

TABLE 23.--Continued

Smoking status	Year	Age							
		12-14 years		15-16 years		17-18 years		Total	
		N	%	N	%	N	%	N	%
Current regular smoker	1968	6	0.6	63	9.6	118	18.6	187	8.4
	1970	17	3.0	55	14.4	86	22.8	158	11.9
	1972	17	2.8	66	16.3	105	25.3	188	13.3
	1974	27	4.9	73	20.2	95	25.9	195	15.3
	1979	24	4.3	46	11.8	98	26.2	168	12.7
Total	1968	939	100	654	100	633	100	2,226	100
	1970	564	100	383	100	377	100	1,324	100
	1972	597	100	405	100	415	100	1,417	100
	1974	549	100	361	100	367	100	1,277	100
	1979	557	100	390	100	374	100	1,321	100

SOURCE: US DHEW Teenage Smoking Surveys, 1968, 1970, 1972, 1974, 1979 (US DHEW 1979b).

classified based on their reported smoking during the past 30 days. In the 1979 High School Seniors Survey (Table 22), 22 percent of males were classified as daily smokers and another 9 percent reported having smoked in the last month but not on a daily basis. In the same year, 29 percent of females were daily smokers and 9 percent smoked on less than a daily basis.

Comparing these two data sets shows that the telephone survey obtained lower estimates for *weekly* smoking than the school survey obtained for daily smoking (19 vs. 22 percent for males, 26 vs. 28 percent for females). The remaining current smokers (defined as less than one cigarette per week in the telephone survey and less than one per day in the school survey) were also estimated at lower rates in the telephone survey (0.3 vs. 9 percent for males, 0.8 vs. 9 percent for females). This suggests that the telephone survey underestimated both the number of daily smokers and the number of less-than-daily smokers. Most of the discrepancy appears to be due to a failure to identify the latter. It is unclear whether this difference is related to the system of classifying smokers or the telephone survey methodology.

NIDA National Household Surveys on Drug Abuse, 1979-85

NIDA conducted household surveys on drug abuse in 1979, 1982, and 1985. For each of these surveys, data were obtained from a stratified random sample of 8,000 U.S. households: approximately 2,000 in-person interviews were conducted with respondents in the 12- to 17-year-old age group. Questions included whether any cigarettes were smoked within 30 days as well as within the previous year. These surveys indicated that approximately 26 percent of the teenage population surveyed smoked at least one cigarette at some time during 1985 (Table 24). In 1985, 15.6 percent of this population had smoked within the previous month. Comparisons between data from the 1979 household survey and data from the more recent surveys are not appropriate, because in 1979 prevalence of use within the past year or past month was reported only for those who had smoked 100 cigarettes in their lifetime; this lifetime cutoff was not used in the later surveys.

TABLE 24.--Prevalence (%) of cigarette use among youth 12 to 17 years of age, 1979, 1982, and 1985, United States

Survey year	Any use in last year	Used in last 30 days
1979 ^a	13.3	12.1
1982	24.8	14.7
1985	26.0	15.6

^aThe 1979 estimates are not necessarily comparable to later estimates because the 1979 survey asked questions only of those who had smoked 100 cigarettes in their lifetime.

SOURCE: NIDA National Household Surveys on Drug Abuse 1979, 1982, 1985 (US DHHS 1988).

Summary

Several national surveys provide information on adolescent smoking. These surveys vary substantially in sample size, methodology, definitions of smoking, ages of respondents, and other factors that may appreciably affect prevalence estimates.

The best trend data are available from the annual high school seniors survey. This survey shows that prevalence of daily cigarette consumption declined from 29 percent of seniors in 1976 to 21 percent in 1980, after which prevalence leveled off at 18 to 21 percent. Smoking prevalence among females has consistently exceeded that among males since 1977. The leveling off of smoking prevalence among high school seniors raises concern that the steadily declining initiation rates as determined by prevalence among adults aged 20 to 24 (NHIS) may soon level off as well.

Smoking prevalence has been consistently lower for high school seniors with plans to pursue higher education than for those without such plans. In 1987, smoking rates were 14 and 30 percent in these two groups, respectively.

Differences in prevalence of smoking and smokeless tobacco use (see below) between young males and young females suggest that the prevalence of any tobacco use is similar in these two groups. Whereas the prevalence of smoking is higher among female high school seniors than among males, the prevalence of smokeless tobacco use is higher among young males than among young females.

Changes in the Types of Cigarettes Smoked

Data on the market share of filter and nonfilter cigarettes, cigarettes of different machine-determined “tar” and nicotine yields, menthol and nonmenthol cigarettes, and cigarettes of different length have been published by the Federal Trade Commission (FTC) from information supplied to the agency by the major cigarette companies.

Filtered Cigarettes

Filters are the design characteristic of commercial cigarettes that most affects their machine-measured yield of harmful constituents (US DHHS 1981). Filters selectively remove nitrosamines and semivolatile phenols from smoke. Thus, filters affect not only the absolute amounts of these constituents delivered in smoke but also their relative concentrations in cigarette “tar.”

Since the early 1950s, the proportion of cigarettes in the United States sold as filtered cigarettes has increased steadily. In 1950, less than 1 percent of cigarettes sold in the United States were filtered. That proportion rose to 19 percent in 1955, 51 percent in 1960, and 94 percent in 1986 (Table 25).

Low-Tar, Low-Nicotine Cigarettes

Trends in the sales-weighted average yield of tar and nicotine for cigarettes sold in the United States are shown in Figure 14 of Chapter 2. The sales-weighted average is based on the tar and nicotine yield of specific brands (as measured by the FTC machine-

TABLE 25.--Domestic market share of filter cigarettes as a proportion of total cigarettes sold, United States, 1950-86

Year	Market share (%)	Year	Market share (%)
1950	0.6	1969	77
1951	0.7	1970	80
1952	1	1971	82
1953	3	1972	84
1954	9	1973	85
1955	19	1974	86
1956	28	1975	87
1957	38	1976	88
1958	45	1977	90
1959	49	1978	90
1960	51	1979	91
1961	52	1980	92
1962	55	1981	92
1963	58	1982	93
1964	61	1983	93
1965	64	1984	93
1966	68	1985	94
1967	72	1986	94
1968	74		

SOURCE: FTC (1988).

testing method) multiplied by the quantity of sales for those brands. The sales-weighted average yield of tar fell from 35 mg in 1957 to 13 mg in 1987. For nicotine, the sales-weighted average fell from 1.3 mg in 1968 to 1.0 mg in 1985. However, the sales-weighted average yield of tar and nicotine leveled off between 1981 and 1987. As pointed out in Chapter 2, modifications in the makeup of commercial cigarettes have profoundly influenced these yields; for example, the steepest declines occurred in the late 1950s after introduction of filter tips.

Trends in the percentage of domestic sales of cigarettes yielding lower tar levels are shown in Table 26. The domestic market share of cigarettes yielding 15 mg or less tar increased from 2.0 percent in 1967 to 56.0 percent in 1981. Since 1981, this proportion has fallen slightly and has stabilized at 51 to 53 percent. About two-thirds of these cigarettes have tar yields between 9 and 15 mg.

It should be noted that the parameters used in the FTC machine-testing method (developed in the 1960s) do not necessarily reflect current smoking patterns. For example, the FTC method uses one puff per minute (Pillsbury et al. 1969), whereas human

TABLE 26.--Domestic market share of cigarettes with reduced tar, percentage of total cigarettes sold, United States, 1967-86

Year	Tar Yield				
	15 mg	12 mg	9 mg	6 mg	3 mg
1967	2.0				
1968	2.5				
1969	3.0				
1970	3.6				
1971	3.8				
1972	6.6				
1973	8.9				
1974	8.9				
1975	13.5				
1976	15.9				
1977	22.7				
1978	27.5				
1979	40.9		10.6	5.8	2.7
1980	44.8		16.8	7.3	3.3
1981	56.0		24.6	9.6	3.7
1982	52.2	43.8	27.8	8.9	2.9
1983	53.1	44.9	27.9	9.4	3.1
1984	51.0	43.4	26.3	9.4	2.9
1985	51.9	43.1	25.3	8.4	2.3
1986	52.6	44.5	22.3	9.9	2.6

SOURCE: FTC (1988); Kozlowski (1989).

studies of smoking patterns show an average interpuff interval of 34 seconds (that is, about two puffs per minute) (US DHHS 1988, Chapter 4, Table 2).

According to the 1986 AUTS, 41 percent of smokers smoke cigarettes yielding 15 mg or less tar (Table 27). The proportion of smokers smoking cigarettes yielding more than 15 mg tar is higher among males, blacks, and persons with less education compared with females, whites, and more educated persons, respectively. This proportion decreases with age; the higher proportion among those 17 to 19 years of age probably reflects the popularity of the higher tar Marlboro brand among adolescents (Hunter et al. 1986; Goldstein et al. 1987; Glantz 1985).

Increased consumer demand for lower yield cigarettes during the past two decades is probably attributed to consumer beliefs that lower yield brands are less hazardous. This impression may have resulted in part from cigarette advertising implying that low-yield brands are less hazardous or are safe (Davis 1987). According to the 1986 AUTS, 45 percent of current smokers believe that some kinds of cigarettes are probably more hazardous than others (see Chapter 4).

TABLE 27.—Percentage of current smokers, aged 17 years and older, who use cigarettes of varying tar yields and who use menthol cigarettes, by sex, race, and education, 1986

	Percentage of current smokers				Menthol cigarette smokers
	Tar yield (mg/cigarette)			Total	
	≤10	>10–15	>15		
Total	29.6	11.6	58.8	100	29.2
Sex					
Males	26.8	8.0	65.2	100	29.9
Females	32.7	15.6	51.7	100	34.0
Age					
17–19	31.7	2.7	65.6	100	29.3
20–24	30.4	4.9	64.8	100	24.1
25–44	31.5	8.8	59.7	100	34.4
45–64	26.3	17.8	55.9	100	23.7
≥65	26.3	22.6	51.1	100	21.1
Race					
White	31.8	12.3	55.9	100	23.1
Black	14.5	7.6	78.0	100	75.5
Other	26.2	5.3	68.5	100	24.9
Education					
≤11 years	23.5	11.6	64.8	100	27.6
12 years	29.4	11.9	58.7	100	29.7
13–15 years	36.8	9.7	53.5	100	32.0
≥16 years	36.4	13.2	50.4	100	27.1

SOURCE: Self-reported data on cigarette brand use, AUTS 1986 (US DHHS, in press, a). Sample sizes for each stratum are shown in Table 34.

The 1981 Surgeon General's Report (US DHHS 1981) concluded that although smoking lower yield cigarettes appears to reduce the risk of lung cancer, the benefits are minimal compared with giving up cigarettes entirely. Moreover, there is no definitive evidence that smoking lower yield cigarettes is associated with reduced risks of other cancers, cardiovascular disease, and fetal damage. Switching to low-yield brands may even increase the health risk for smokers who compensate for reduced nicotine intake by increasing the number of cigarettes smoked per day, the frequency of puffing, and the depth and duration of inhalation (US DHHS 1988).

The leveling off of sales-weighted tar and nicotine yields may be related to one or a combination of the following factors (US DHHS 1988): (1) a persistent brand loyalty of some smokers to moderate- or high-yield brands because of brand image; (2) a diminishing perception that low-yield brands are less hazardous (see Chapter 4); and (3) a tendency of some smokers to smoke cigarettes of such low tar and nicotine yields that further reductions in those yields may be unacceptable; that is, the “lower boundary” of comfortable cigarette use has been reached (Kozlowski 1987, 1989).

Menthol Cigarettes

From 1963-76, the domestic market share of menthol cigarettes increased gradually from 16 percent to 28 percent. Since 1976, this proportion has remained at 28 percent (FTC 1988). According to the 1986 AUTS, 29 percent of current smokers smoke menthol cigarettes. Seventy-six percent of black smokers smoke menthol cigarettes compared with 23 percent of whites (Table 27). Similar findings were reported by Cummings and colleagues (1987).

Menthol in cigarettes provides a sensation of cooling, which may promote deeper, prolonged inhalation of cigarette smoke. This may help to explain why blacks (who are much more likely to smoke menthol cigarettes) have higher mortality rates from certain smoking-related diseases (e.g., lung cancer, heart disease, and cerebrovascular disease) than whites despite smoking fewer cigarettes per day (Novotny, Warner et al. 1988). Increased lung cancer mortality rates among blacks may also relate to increased occupational or environmental exposures among blacks that promote the carcinogenic effects of smoking, or to the fact that blacks are more likely to smoke higher tar brands (Table 27), which are associated with higher lung cancer mortality rates (US DHHS 1981). There does not appear to be a positive correlation between the presence of menthol and higher tar yields in cigarette brands: in the FTC’s 1985 list of 207 brands (FTC 1985), 67 percent (51/76) of menthol brands had tar yields of less than 13 mg, compared with 56 percent (73/131) of nonmenthol brands.

Cigarette Length

From 1967-86, the domestic market share of cigarettes 68 to 88 mm in length decreased from 91 percent to 60 percent. During the same time, the domestic market share of cigarettes 94 to 101 mm in length increased from 9 to 37 percent (Table 28).

Because of the dose-response relationship between smoking and risk of disease (see Chapter 2), this increase in the average length of cigarettes has potentially important public health implications. However, smokers tend to compensate for changes in cigarette length by changing the number of cigarettes smoked per day, puffing frequency, and other measures of smoking behavior so as to minimize the change in overall nicotine intake (US DHHS 1988).

TABLE 28.--Domestic market share of cigarettes (%), by cigarette length, percentage of total cigarettes sold, United States, 1967-86

Year	68-72 mm	79-88 mm	94-101 mm	110-121 mm
1967	14	77	9	
1968	12	74	13	
1969	11	74	16	
1970	9	73	18	
1971	8	72	20	
1972	8	71	21	
1973	7	71	22	
1974	6	71	23 ^a	
1975	6	69	24	1
1976	5	69	24	2
1977	5	67	26	2
1978	5	65	27	2
1979	4	65	30	2
1980	3	63	32	2
1981	3	62	33	2
1982	3	61	34	2
1983	3	60	34	2
1984	3	59	36	2
1985	3	58	37	2
1986	2	58	37	3

NOTE: Because of rounding, the total of the individual percentages may not equal 100 percent in some instances.

^aThe 110- to 121-mm length was combined with the 94- to 101-mm length.

SOURCE: FTC (1988).

Summary and Comment

During the past 40 years, filtered cigarettes have virtually replaced nonfiltered cigarettes in the United States. The domestic market shares of lower (15 mg or less) tar cigarettes and menthol cigarettes have increased during the past two decades but have leveled off in recent years. The domestic market share of longer (94-101 mm) cigarettes has increased substantially since the mid- 1960s and still appears to be rising slowly.

Continued health concerns among smokers are likely to encourage the cigarette industry to continue to design new cigarettes that are perceived as less hazardous. Besides filtered, low-yield cigarettes, other "high-tech" cigarettes have been marketed that may appear to smokers to be less hazardous. These include one brand with a recessed filter and another with a "flavor-control filter" that apparently allows the smoker to regulate the tar yield of individual cigarettes (Davis 1987). The R.J. Reynolds Tobacco Company announced in September 1987 plans to market a new product that heats rather than burns tobacco. R.J. Reynolds asserts that the product is a cigarette, and it

has commonly been referred to in the press as a “smokeless cigarette.” In a press release, the company’s chief executive officer stated that “a majority of the compounds produced by burning tobacco are eliminated or greatly reduced, including most compounds that are often associated with the smoking and health controversy” (R.J. Reynolds 1987). The American Medical Association (1988) and the Coalition on Smoking OR Health (1988) have filed petitions with the U.S. Food and Drug Administration (FDA) seeking FDA regulation of this new product as a drug or medical device based on implicit health claims, among other reasons. As of November 1988, these petitions were under review by the FDA. In October 1988, R.J. Reynolds began test marketing the product, named Premier, in three cities (Phoenix and Tucson, AZ, and St. Louis, MO). (See Chapter 7.)

Other Types of Tobacco Use

Smokeless Tobacco Use

Smokeless tobacco (ST) use, including snuff and chewing tobacco, became a subject of concern in the United States during the 1980s (US DHHS 1986). Cross-sectional national surveys and various regional surveys have identified several demographic categories at high risk for the use of these products, including young white males, persons living in the Southern and North Central United States, American Indians, and Alaskan Natives (Rouse, in press; Boyd et al. 1987; CDC 1987c, 1988; Schinke et al. 1986). Trend data on ST use are available primarily through the AUTSs, which included persons aged 21 years or older in 1964, 1966, 1970, and 1975 (US DHEW 1969, 1973a, 1976), and persons aged 17 years and older in 1986 (Novotny, Pierce et al., in press). In addition, the 1970 and 1987 NHISs included data on ST use among persons aged 17 years and older and aged 18 years and older, respectively. The Behavioral Risk Factor Surveillance System of the Centers for Disease Control collected State-specific data on ST use among persons aged 18 years and older beginning in 1986 (CDC 1987d). The 1985 CPS of the U.S. Bureau of the Census included questions about ST use among persons aged 17 years and older (Marcus et al., in press). This survey also produced State-specific estimates for prevalence of use of these products. Definitions of ST use and questions asked about ST use in these surveys are listed in the Appendix to this Chapter.

Figure 5 compares age-specific data for men from the 1970 NHIS and the 1986 AUTS. Between 1970 and 1986, snuff use increased fifteenfold and chewing tobacco use more than fourfold among males aged 17 to 19 years. Smaller increases were observed among the middle-aged groups, and a decrease in the use of both products was noted for older men (age 50 and above). The NHIS used household interviews, and the AUTS used telephone interviews as their primary mode of data collection; however, this difference in methodology is unlikely to account for the substantial increase in ST use among teenage males.

Data on ST use among persons aged 21 years or older are presented below from the 1964-86 AUTSs. These surveys were based on in-person interviews in 1964 and 1966 and telephone interviews in 1970, 1975, and 1986. State-specific data from the 1985

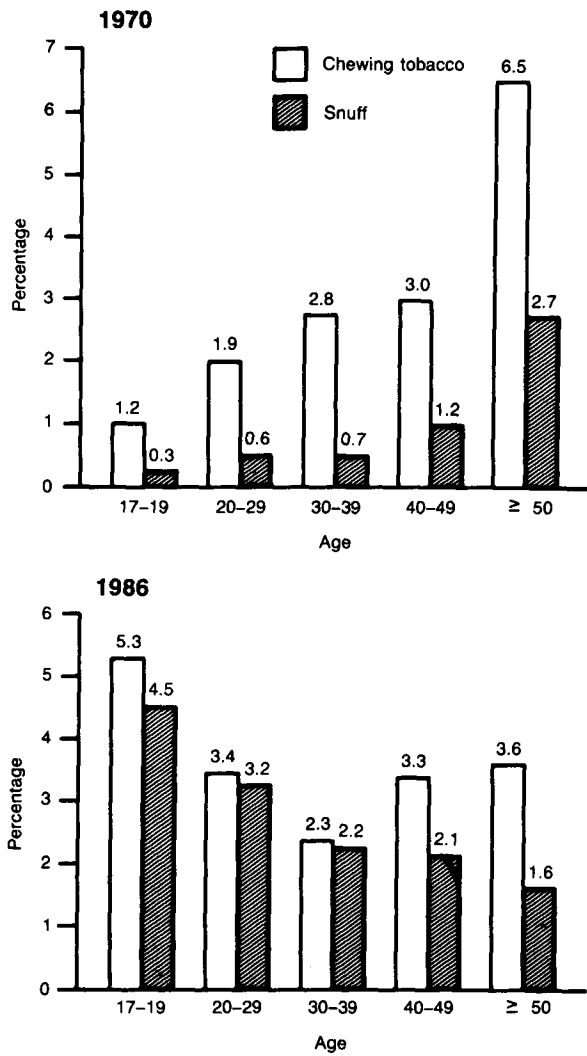


FIGURE 5.—Prevalence of chewing tobacco and snuff use among men, 1970 (NHIS) and 1986 (AUTS)

SOURCE: US DHHS (1986a); Novotny, Pierce et al., in press.

CPS are reported. Finally, data from a more detailed analysis of ST use from the 1986 AUTS for men aged 17 years and older (Novotny, Pierce et al., in press) are described.

The prevalence of current ST use from 1964-86 among persons aged 21 years and older, stratified by product and sex, is shown in Figure 6. For both products, there has been a steady overall decline in use by both men and women. It is possible that this decline is due in part to the change in the AUTS interview technique from in-person

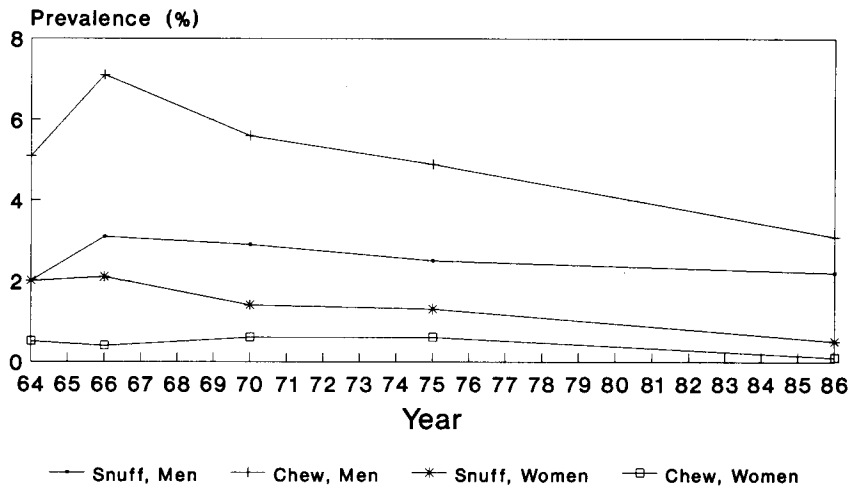


FIGURE 6.—Smokeless tobacco use among adults 21 years of age and older, United States, 1964–86

SOURCE: AUTSs (Novotny, Pierce et al., in press).

TABLE 29.—Prevalence (%) of ever use and current use of smokeless tobacco, males aged 17 years and older, United States, 1986

Product used	Ever use	Current use
Any smokeless tobacco	12.6	5.2
Snuff ^a	5.8	2.4
Chewing tobacco ^b	9.9	3.3
Both	3.1	0.5

^aIncludes those who also use chewing tobacco.

^bIncludes those who also use snuff.

SOURCE: AUTS 1986 (Novotny, Pierce et al., in press).

interview (1964 and 1966) to telephone interview (1970, 1975, 1986); telephone surveys generally provide slightly lower smoking prevalence estimates than in-person surveys (see above). The prevalence of ST use among women has consistently been very low. However, the use of snuff by older black women in the South is much more common than among women in the general population (Rouse, in press).

In 1986, the weighted prevalence of snuff use was 2.2 percent for men and 0.5 percent for women, and of chewing tobacco use, 3.1 percent for men and 0.1 percent for women among adults aged 21 years and older. For 1986, overall prevalence of ever and current use of ST among males, aged 17 years and older, is shown in Table 29. More than 10 percent of male respondents had ever used ST products; chewing tobac-

co appears to be used slightly more commonly than snuff. Few men (0.5 percent) use both products.

The prevalence of ever use and current use of any ST product by males, stratified by selected sociodemographic variables, is shown in Table 30. The prevalence of both current and ever use was highest among younger men, whites, men living in the Southeast, less educated men, men below the poverty level, unemployed men, and lower income men. Among males 17 to 19 years of age, 8.2 percent were current ST users. In a multivariate model using the sociodemographic variables as predictors of ST use (Table 31), white men were more than twice as likely to use ST as black men; men employed in blue-collar or service/laborer jobs or who were unemployed were 3 times more likely to use ST than white-collar workers; and men in the Southeast and West were more likely to use ST than men in other regions.

Two-thirds of men who ever used ST began use before age 21; more than one-third began before age 16 (Table 32). The median age of initiation of ST use for both snuff and chewing tobacco is 19 years (Novotny, Pierce et al., in press).

The State- and region-specific prevalence of current snuff and chewing tobacco use among men aged 16 years and older is shown in Table 33. These data are from the 1985 CPS. As mentioned earlier, 45 percent of interviews in the CPS were with proxy respondents. Proxy responses are known to affect the accuracy of information on smoking behavior, especially daily cigarette consumption (see above). The effect of proxy responses on data relating to ST use is unknown.

Overall prevalence for males in the 1985 CPS was 1.9 percent for snuff and 3.9 percent for chewing tobacco. Use of ST was lowest in the Northeast and highest in the South, with intermediate values reported for the North Central and Western regions. Among women, the overall prevalence of snuff use was only 0.5 percent, with all regions having prevalence rates of 0.5 percent or less except the South (1.4 percent). Prevalence of chewing tobacco use among women was 0.2 percent overall.

In summary, ST use is increasing among adolescent males and is decreasing slightly overall among men aged 21 years and older in the United States. It continues to be a rare behavior among women. According to national surveys, sociodemographic correlates of use include blue-collar and service/laborer employment, unemployment, and residence in the South. Local surveys have also shown high usage rates among American Indian youth (CDC 1987c 1988; Schinke et al. 1987; Hall and Dexter 1988). Because ST use is more common among young males than among young females, while the prevalence of smoking among high school seniors is higher among females than among males (see above), the prevalence of any tobacco use may be similar among young males and young females.

Cigar and Pipe Smoking

Table 34 presents data from the 1986 AUTS for cigar and pipe smoking. Cigar and/or pipe smoking mainly occurs among men, in whom prevalence of use is 8.7 percent. The highest proportion of users are between the ages of 45 and 64 years. Usage is slightly higher in the most and least educated groups than in the intermediate education categories.

TABLE 30.—Prevalence (%) of smokeless tobacco use by sociodemographic categories, males aged 17 years and older, United States, 1986

Category	Ever use	Current use
Age group		
17-19	12.3	8.2
20-29	11.4	5.9
30-39	7.3	4.1
40-49	9.7	5.0
≥50	11.5	4.8
Race		
White	11.1	5.6
Black	6.6	3.0
Other	7.7	2.9
Geographic area		
Southeast	14.5	7.5
West	9.6	4.5
Midwest	9.5	4.3
Northeast	5.5	3.0
Completed years of school		
≤11	14.6	7.3
12	11.1	5.6
13-15	9.1	3.8
≥16	4.8	2.9
Poverty level		
Below	16.1	8.5
Above	9.9	4.9
Employment		
Unemployed	13.0	8.3
Service/laborer	12.3	6.4
Blue collar	7.0	3.6
White collar	2.3	1.0
Household income (dollars per year)		
<10,000	16.1	8.6
10,000-29,999	4.7	2.2
≥30,000	3.0	1.6

SOURCE: AUTS 1986 (Novotny, Pierce et al., in press).

TABLE 31.—Significant sociodemographic correlates of current use of any smokeless tobacco, males aged 17 years and older, United States, 1986

Parameter	Odds ratio	95% confidence limits
Region		
Southeast	3.0	1.8, 4.8
West	1.9	1.1, 3.3
Midwest	1.4	0.8, 2.5
Northeast	Referent	
Race		
White	2.4	1.3, 4.3
Black	Referent	
Employment		
Unemployed	3.8	1.9, 7.6
Service/laborer	2.9	1.8, 4.6
Blue collar	3.0	2.1, 4.3
White collar	Referent	

SOURCE: AUTS 1986 (Novotny, Pierce et al., in press).

TABLE 32.—Reported age of initiation and median age of initiation of smokeless tobacco use among ever users, males aged 17 years and older, United States, 1986

Product	Age group at initiation (percentage reporting)				Median
	<16	16-18	19-20	≥21	
Any smokeless tobacco	37.1	7.8	21.4	33.8	19
Snuff ^a	35.5	8.6	23.0	32.8	19
Chewing tobacco ^b	36.6	6.7	20.3	36.3	19

^aIncludes those who also use chewing tobacco.

^bIncludes those who also use snuff.

SOURCE: AUTS 1986 (Novotny, Pierce et al., in press).

TABLE 33.--Prevalence (%) of current use of snuff and chewing tobacco by region, division, and State, males aged 16 years and older, United States 1985

	Snuff use	Chewing tobacco use	Any smokeless tobacco use
United States	1.9	3.9	5.5
Northeast Region	1.0	1.4	2.3
New England Division	0.4	0.8	1.2
Maine	0.9	1.5	2.3
New Hampshire	1.2	1.5	2.7
Vermont	0.9	4.7	5.5
Massachusetts	0.2	0.4	0.5
Rhode Island	0.5	0.6	0.9
Connecticut	0.3	0.5	0.8
Mid-Atlantic Division	1.2	1.6	2.7
New York	0.5	1.2	1.6
New Jersey	0.1	0.6	0.7
Pennsylvania	3.0	2.9	5.6
North Central Region	2.1	3.4	5.3
East North Central Division	1.8	2.9	4.4
Ohio	2.2	3.2	5.0
Indiana	2.6	3.2	5.6
Illinois	1.1	2.5	3.3
Michigan	0.8	2.7	3.4
Wisconsin	2.9	2.9	5.8
West North Central Division	2.9	4.7	7.5
Minnesota	3.5	2.8	6.1
Iowa	1.8	4.6	6.4
Missouri	3.1	3.6	6.7
North Dakota	6.1	5.1	10.7
South Dakota	1.9	6.1	7.9
Nebraska	1.4	6.8	8.0
Kansas	3.3	8.6	11.7
South Region	2.7	6.0	8.3
South Atlantic Division	1.8	5.2	6.7
Delaware	0.6	2.4	3.0
Maryland	0.4	2.1	2.4
District of Columbia	0.0	0.4	0.4
Virginia	2.3	6.2	7.8
West Virginia	11.5	13.5	23.1
North Carolina	1.8	8.6	9.8

TABLE 33.--Continued

	Snuff use	Chewing tobacco use	Any smokeless tobacco use
South Carolina	0.7	5.3	6.1
Georgia	1.4	7.3	8.7
Florida	1.1	1.9	2.9
East South Central Division	2.7	9.4	11.6
Kentucky	3.2	11.2	13.6
Tennessee	1.7	9.3	10.3
Alabama	1.7	6.6	8.3
Mississippi	5.7	11.4	16.5
West South Central Division	4.0	5.5	9.1
Arkansas	6.0	9.5	14.7
Louisiana	2.5	5.8	8.0
Oklahoma	4.8	6.7	11.0
Texas	4.0	4.6	8.2
West Region	1.4	3.3	4.5
Mountain Division	2.3	5.4	7.5
Montana	5.5	8.3	13.7
Idaho	2.3	6.7	8.7
Wyoming	3.4	13.0	15.8
Colorado	1.2	6.4	7.5
New Mexico	5.3	5.2	10.2
Arizona	2.0	3.8	5.4
Utah	0.9	3.0	3.7
Nevada	1.5	2.8	4.3
Pacific Division	1.0	2.6	3.4
Washington	1.8	6.1	7.1
Oregon	2.7	5.4	7.6
California	0.7	1.7	2.3
Alaska	2.5	6.3	8.8
Hawaii	0.2	0.4	0.7

SOURCE: CPS 1985 (Marcus et al., in press.)

From 1964-86, there was an 80-percent decline in prevalence of both cigar and pipe smoking among men (Figure 7). The prevalence of cigar smoking declined from 29.7 to 6.2 percent; the prevalence of pipe smoking declined from 18.7 to 3.8 percent. Reasons cited to explain the drop in cigar sales include the effects of the antismoking campaign (several airlines have completely banned cigar and pipe smoking on all flights for many years, but only one airline has done so for cigarette smoking), declining image of cigar smoking, failure to attract new smokers, insufficient free-sample distribution, mediocre advertising and promotional activities, and declining quality of the product (Lazarus 1979).

TABLE 34.—Cigar/pipe smoking status (%) by major sociodemographic variables, United States, 1986

	Cigar/pipe smoking status			Total	Sample size
	Current user	Former user	Never user		
Total	4.3	22.2	73.5	100	13,031
Sex					
Male	8.7	41.8	49.6	100	6,377
Female	0.3	4.5	95.2	100	6,654
Age					
17–19	1.5	13.6	85.0	100	560
20–24	2.0	16.6	81.4	100	1,086
25–44	4.4	22.2	73.3	100	5,802
45–64	5.9	26.5	67.6	100	3,616
≥65	3.9	22.6	73.5	100	1,967
Race					
White	4.4	23.4	72.2	100	11,563
Black	3.7	13.9	82.4	100	1,096
Other	3.5	19.4	77.1	100	372
Region					
Midwest	4.8	22.6	72.6	100	3,236
Northeast	4.6	19.6	75.7	100	2,968
Southeast	3.8	23.2	73.0	100	4,301
West	4.1	22.7	73.2	100	2,526
Marital status					
Married/cohabiting	4.8	25.3	69.9	100	8,364
Widowed	1.8	8.9	89.2	100	1,011
Divorced/separated	5.6	20.1	74.3	100	1,446
Never married	2.8	17.7	79.4	100	2,179
Unknown	12.4	27.5	60.1	100	31
Education					
≤11 years	4.9	22.8	72.3	100	2,431
12 years	3.6	20.0	76.5	100	4,872
13–15 years	3.9	22.5	73.6	100	3,118
≥16 years	5.3	26.0	68.7	100	2,610

TABLE 34.—Continued

	Cigar/pipe smoking status				Sample size
	Current user	Former user	Never user	Total	
Household income (dollars per year)					
<10,000	3.1	16.8	80.1	100	1,220
10,000–19,999	4.0	21.2	74.9	100	2,204
20,000–29,999	4.3	23.1	72.6	100	2,853
30,000–39,999	5.0	24.2	70.8	100	1,735
≥40,000	5.5	28.1	66.4	100	2,947
Unknown	3.3	17.1	79.6	100	2,072
Poverty level^a					
Above	4.7	23.9	71.4	100	9,913
Below	3.0	18.6	78.3	100	1,046
Unknown	3.3	17.1	79.6	100	2,072

^aPoverty level is based on the definition provided by the U.S. Bureau of the Census.

SOURCE: AUTS 1986 (US DHHS, in press, a).

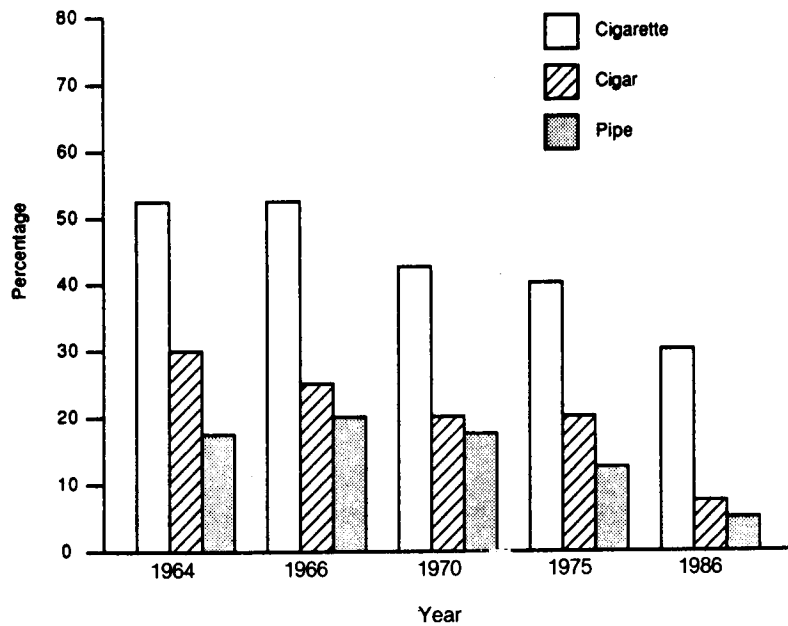


FIGURE 7.—Trends in prevalence of using cigarettes, cigars, and pipes, adult men, United States, 1964–86

SOURCE: AUTSs (US DHHS 1988).

PART II. CHANGES IN KNOWLEDGE ABOUT THE DETERMINANTS OF SMOKING BEHAVIOR

Introduction: Historical and Conceptual Overview

This Section reviews the past 25 years' growth in scientific knowledge of the determinants of smoking. Broad conceptual shifts in understanding smoking are first reviewed by comparing current knowledge, as reflected in the 1988 Surgeon General's Report as well as in more recent investigations, with that reflected in two previous Surgeon General's Reports during the past 25 years: the 1st Report, issued in 1964, and the 15th Anniversary Report, issued in 1979.

1964 Surgeon General's Report

The first Surgeon General's Report devoted a chapter to the psychosocial aspects of smoking and another to the issue of smoking as drug addiction or drug habituation. These topics continue to receive contemporary attention. A third chapter in the 1964 Report discussed morphological characteristics of smokers as important determinants of smoking (e.g., physique, somatotype, and weight). With the exception of body weight, there has been a decline in the attention paid to these variables. The relationship between body weight and smoking cessation, especially among women, has received much recent attention (US DHHS 1988).

The 1964 Report's Chapter on Psychosocial Aspects of Smoking related smoking to a variety of demographic factors including socioeconomic status (smoking being more prevalent among "lower or working classes" but less prevalent among extremely poor, e.g., unemployed groups) and gender (smoking being more prevalent among men). With regard to gender, the Report anticipated contemporary concerns about smoking by women (US DHHS 1980b), noting that "The proportion of women smokers has increased faster than that of men smokers in recent years" (US PHS 1964, p. 363).

The 1964 Report's chapter on psychosocial aspects also linked smoking to such broad personality factors as extraversion and orality. While some research continues to show relationships with extraversion (e.g., Eysenck 1980; Mangan and Golding 1984), most contemporary research focuses on more specific psychological, biological, and social variables and their interactions. The 1964 Report noted that smoking might function to reduce tension but reported little research related to this possibility. In contrast, the 1988 Report on nicotine addiction reviews considerable laboratory and field research on the relationship between smoking and stress and concludes that stress increases cigarette consumption among smokers and is related to initiation of smoking among adolescents and relapse among abstainers (e.g., US DHHS 1988).

The 1964 Report devoted much attention to the role of nicotine in smoking behavior, an issue that continues to be of central interest, as reflected in the 1988 Report. Both reports concluded that nicotine is a critical and substantial determinant of smoking. The focus in 1964, however, centered on whether smoking fit the World Health Organization's (WHO) definition of addiction, which emphasized the importance of physical dependence (WHO 1957). The Report concluded that there was no proof of

physical dependence and that smoking was a habit, as was use of cocaine, amphetamines, and other drugs. More recent perspectives (e.g., Pomerleau and Pomerleau 1984), culminating in the 1988 Report, have integrated psychosocial and pharmacologic processes into a single model of addiction or dependence. The 1988 Report demonstrated that there have been substantial data amassed since 1964 that confirm that by the criteria defining addiction, nicotine should be categorized as addicting.

Although the 1964 Report did conclude that “. . . there is no single cause or explanation of smoking . . .” (US PHS 1964, p. 376), its discussion of research reflected an expectation that one or a very few key causes of smoking might be found. Along these lines, the Report emphasized the extent to which evidence demonstrated a cause to be sufficient. For example, in discussing evidence that smoking as a sign of masculinity may motivate many men to smoke, it labeled as “troublesome” the fact that “. . . some, but not so many others choose this particular means [that is, smoking] of giving evidence of their masculinity” (US PHS 1964, p. 373). Since the 1964 Report, models of causal inference in the behavioral sciences have changed to emphasize multiple causes interacting to bring about complex behavior patterns, and not one cause in itself that is necessary or sufficient.

1979 Surgeon General's Report

The 1979 Report gave much attention to prevention and to the determinants of smoking and smoking cessation, devoting 9 of 23 chapters to these topics. Thus, there was recognition of different stages of smoking behavior and of determinants varying as the stages change. Since the 1979 Report, researchers have continued to elaborate on multiple stages in the development and cessation of smoking.

The 1979 Report also recognized that multiple factors interact to encourage and support smoking. The Chapter “Behavioral Factors in the Establishment, Maintenance and Cessation of Smoking” posited smoking as “. . . a behavior—a highly complex act . . . based on various biochemical and physiological processes . . .” (US DHEW 1979a, pp. 16-25). It included research on drug and nondrug factors and called smoking “the prototypical substance-abuse dependency.” The Chapter “Smoking in Children and Adolescents: Psychosocial Determinants and Prevention Strategies” explicitly viewed the initiation of smoking as determined by an array of factors. Likewise, the Chapter “Psychosocial Influences on Cigarette Smoking” linked multiple factors to maintenance and cessation of smoking, including personality characteristics, multiple drug use, coexisting chronic disease, price “elasticity” of consumer demand for cigarettes, and differences among cultures in their attitudes toward smoking as personal gratification. The importance of identifying multiple, interacting factors had been enunciated by Schwartz and Dubitzky in 1968 in their research on smoker profiles and the influence of multiple variables on smoking cessation, maintenance of cessation, and relapse (Schwartz and Dubitzky 1968).

The 1979 Report's recognition of an array of determinants was reflected in a recommendation for future research: “There are multiple psychosocial influences on cigarette smoking. Multivariate research is needed . . .” (US DHEW 1979a, pp. 18-25). Multiple regression analyses and causal modeling have now become much more common in

smoking research (e.g., McAlister, Krosnick, Milburn 1984; Mosbach and Leventhal 1988).

The 1979 Report also was noteworthy in focusing attention on systematic cessation efforts, taking both pharmacologic and psychosocial factors into account. The extensive treatment of cessation research in a separate chapter was a first for the Surgeon General's Report and set a precedent for reviewing the intervention literature in subsequent reports.

Current Views

Current explanations assume that smoking is determined by multiple causes, no one of which is sufficient. The interplay of psychosocial and pharmacologic forces continues to occupy investigators of nicotine addiction as it does investigators of other drug addictions. While the 1964 Report tended to see such factors as mutually exclusive, the 1988 Report (US DHHS 1988) viewed these various pharmacologic, biochemical, and psychosocial processes, such as conditioning, as interacting in the determination of nicotine addiction. In fact, conditioned drug-taking behavior is now thought to be central to the concept of addiction; physical dependence is neither necessary nor sufficient (US DHHS 1988). The biological power of nicotine may make the learned behaviors that form smoking patterns stronger and more resistant to change. At the same time, the plentitude of daily circumstances, activities, and emotions to which smoking is conditioned ties this behavior to numerous rituals of daily life and contributes to the difficulty of breaking this addiction (Fisher, Bishop et al. 1988a; Pomerleau and Pomerleau 1987; Russell, Peto, Patel 1974; US DHHS 1988). This interplay between behavior and the pharmacologic effects of nicotine is mirrored in research on smoking cessation, in which nicotine-containing chewing gum and behavioral interventions have been shown to enhance one another (e.g., Hall et al. 1985; Killen, Maccoby, Taylor 1984; Schneider et al. 1983). In reviewing the evidence for defining smoking as an addiction, the 1988 Report made the important point that the interplay between social, behavioral, and pharmacologic factors that define tobacco addiction is similar to that seen with other drug addictions.

The continuum of smoking behavior can be viewed as occurring in different stages. The 1964 Report identified two stages (or processes): "Taking Up" and "Discontinuation." Current work identifies three major stages—development, maintenance of regular smoking, and cessation. Several investigators have offered descriptions of various smaller stages within smoking development (e.g., Leventhal and Cleat-y 1980; Flay et al. 1983). These include, for example, preparation, initiation, experimentation, and transition to regular smoking (Flay et al. 1983). Similarly, the process of cessation has been specified in smaller stages (e.g., Marlatt 1985; Prochaska and DiClemente 1983; Rosen and Shipley 1983). These include, for example, precontemplation (not yet considering quitting), contemplation, action, and maintenance or relapse (Prochaska and DiClemente 1983).

Evolution of theoretical models of stages in smoking over the past 25 years is depicted in Figure 8, indicating the stages described around three periods of time, the 1960s,

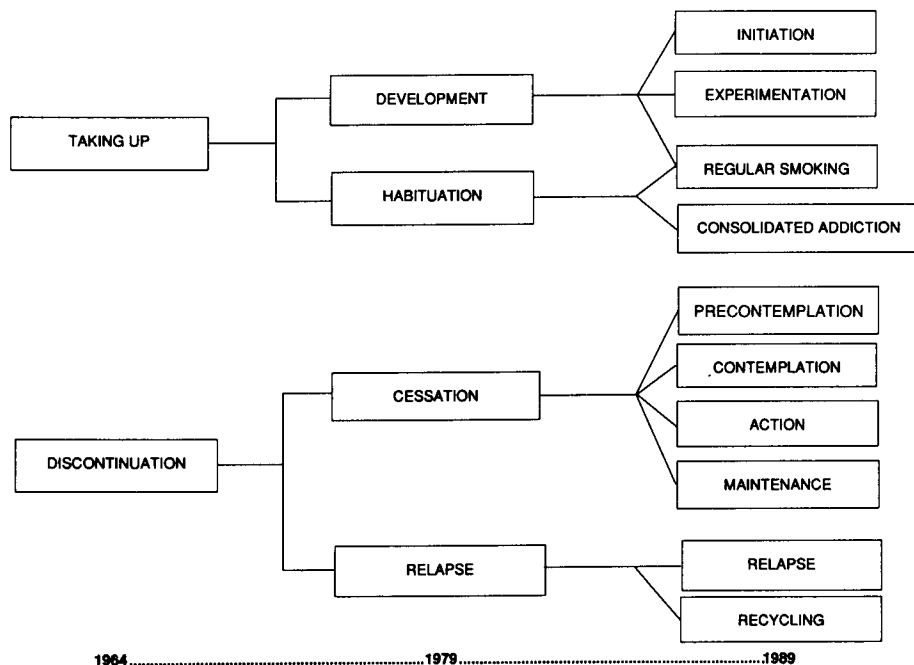


FIGURE 8.—Evolving theoretical concepts of the natural history of smoking, 1964–89

1970s, and 1980s. In 1964, only two broad stages were noted, while in 1989, as many as nine can be observed.

Stages are not explanations of attitudes or behaviors. For example, precontemplation is a description of the attitudes toward smoking and likely responses to incoming messages of the individual uninterested in stopping. It is not an explanation or a cause of that lack of interest. Neither the sequence of stages nor the boundaries among them are rigid. For example, a young experimenter may stop smoking without ever making the transition to regular smoking. A smoker in the regular smoking stage is, at the same time, a precontemplator or contemplator in the cessation stage. The regular smoking stage is abandoned when the smoker moves into action and stops smoking. Although the boundaries among stages and their sequence may be blurred, the concept serves as a framework for understanding the determinants of smoking behavior. Different determinants are operative to different degrees during each stage.

The three broad stages of smoking and their multiple interacting determinants provide the organization for the remainder of this Chapter. Within the stage framework, historical trends in determinants are discussed primarily within three general domains. The three domains do not constitute a model; they are a useful way to organize the determinants of smoking. The first domain is composed of pharmacologic processes and conditioning, the basic factors that interact to support smoking. The combining of these into one domain reflects present awareness that pharmacologic processes and conditioning interact to produce addiction (US DHHS 1988). The second domain includes cognition and decisionmaking. The stages of smoking reflect appraisals of oneself, of social experiences, and of information, such as that presented in campaigns to deter

smoking. The ways in which individuals process such information and make choices about smoking have been the foci of substantial research. The third domain includes personal characteristics (e.g., personality and demographic factors) and social context, which includes the important influences of the social, cultural, and economic environment. Personal characteristics themselves are affected by these environmental influences and mediate their effect rather than independently determine smoking.

Table 35 presents some of the determinants, within each of the domains, that have a strong effect on the indicated stage of smoking. As such, the table provides an outline of the discussion that follows.

Development of Smoking

Pharmacologic Processes and Conditioning

Historically, little attention was paid to the role of pharmacologic effects of nicotine and conditioning in the initial development of smoking behavior. For example, among teenagers, psychosocial determinants have been assumed to play a dominant role (Table 35), as for other dependence-producing substances. Once a smoker starts to inhale, however, it is possible that the pharmacologic properties of nicotine contribute to continued smoking (Kozlowski 1988). A few studies have investigated the potential role of individual-specific psychophysiological responses to nicotine and the development of smoking (Kozlowski and Harford 1976; Silverstein et al. 1982). Reactions to initial cigarettes and the interpretation of these reactions may predispose individuals to continuing or not continuing smoking. Hirschman, Leventhal, and Glynn (1984), for example, found that the initial early physical reaction was predictive of continued smoking. Dizziness was related to a rapid progression to a second cigarette, while coughing and a sore throat were related to discontinuation.

It is not clear how long it takes for the transition from experimental to regular smoking, and there is likely to be much variation (e.g., Hirschman, Leventhal, Glynn 1984). However, results from several recent studies suggest that teenagers become more addicted to smoking than was previously believed. Survey data (Green 1979; Johnson 1986) indicate that teenagers make frequent and often unsuccessful quit attempts. Other studies confirm that teenagers have difficulty stopping and report reasons for the difficulty—social pressure, urges, withdrawal symptoms—similar to those seen with adults (Biglan and Lichtenstein 1984; Hansen et al. 1985; Weissman et al. 1987). Because smoking among children and adolescents is generally confined to relatively few situations, the level of nicotine dependence is limited in this group. Nevertheless, the reports of withdrawal symptoms and relapses among teenage smokers attest to the strength of nicotine dependence even among those still in the early stages of smoking.

More work is needed in this area to facilitate our understanding of the development of smoking addiction. Research on adolescent initiation has not applied the same biobehavioral concepts and measurement tools (e.g., plasma nicotine or cotinine levels) as have been applied to adult smoking. Sensitive human subjects issues related to work-

TABLE 35.--Determinants of smoking within each domain by stage

Domain	Stage		
	Onset/development	Regular use	Cessation
Pharmacologic processes and conditioning	Initial psychopharmacologic effects encourage transition from experimental to regular use	Numerous conditioned associations among smoking, environmental events, and pharmacologic effects of nicotine	Withdrawal symptoms and conditioned and reinforcing effects of nicotine encourage relapse
Cognition and decision-making	Poor awareness of long- and short-term health consequences and addictive nature of smoking	Health consequences are minimized or depersonalized	Increased awareness of smoking-related symptoms or illness
	Positive characteristics are attributed to smokers and smoking	Positive characteristics are attributed to smokers and smoking	Perceived benefits of cessation Belief in one's ability to stop
Personal characteristics and social context	Inclination toward problem behaviors	Stress/negative affect are reduced by nicotine	Social norms and support for stopping and maintained abstinence
	Extraversion		
	Peer and family norms and values support smoking	Social acceptability and peer and family norms support continued smoking	Skills for coping with stimuli associated with smoking
	Youth-oriented advertising	Cigarette marketing encourages and legitimizes smoking	Economic, educational, and personal resources to minimize stress and maintain cessation

ing with minors must be resolved; these have slowed understanding of how dependence develops.

Cognition and Decisionmaking

Knowledge of the health effects of smoking is likely to influence initiation for some teenagers. Teenagers reported that one-third of their earliest refusals of cigarettes were based on fear of the effects of smoking on health, attractiveness, or athletic performance (Friedman, Lichtenstein, Biglan 1985). In early adulthood, British medical students' rating of smoking as a "major" or "not major" health risk was associated with their smoking status as reflected by surveys in 1972 and 1981 (Elkind 1982). Heavy smokers among college women evaluated health outcomes of smoking less negatively than did nonsmokers (Loken 1982). The latter two cross-sectional studies, however, may possibly reflect the effect of behavior on cognition rather than the effect of cognition on behavior.

Cognitive appraisals of the attractiveness or desirability of smoking or of smokers are associated with current smoking or intentions to smoke (Barton et al. 1982; McAlister, Krosnick, Milburn 1984), as are beliefs or attributions of the functional role of smoking (Murray and Perry 1984). Tenth graders inclined to smoke indicated greater congruity between the value they place on interest in the opposite sex and the extent to which they ascribe such interest to smokers (Barton et al. 1982). Intentions to smoke were also associated with congruity between the personal value of a characteristic and its attribution to smokers. Murray and Perry's analyses (1984) of the functional meaning of substance use by youth elucidated a variety of attributions correlating with young people's substance use. The report that smoking was useful for relieving boredom was most highly correlated with smoking. Data from England (Charlton 1984) demonstrate that children who smoke compared with nonsmoking children are more likely to agree that "Smoking keeps your weight down." This attribution was especially prominent among older girls.

School health education programs to discourage smoking have traditionally assumed that knowledge of the health consequences of smoking would deter adolescents from smoking (Chapter 6). This assumption has received limited support in the prevention literature (Thompson 1978). Despite school health education programs, children, especially those who smoke, continue to harbor several misconceptions about smoking. These misconceptions include overestimating the prevalence of both peer and adult smoking, underestimating the negative attitudes of their peers, and minimizing the addictive nature of smoking (Leventhal, Glynn, Fleming 1987). The overestimating of prevalence may represent the combined influence of social context and cognitive factors in determining smoking.

Contemporary smoking prevention programs ("psychosocial prevention curricula") emphasize knowledge of short-term consequences of smoking likely to be more pertinent to adolescents who have limited future orientations (Glasgow et al. 1981), and knowledge about the variety of social influences (parental, peer, and media) that affect the development of smoking (Flay 1985; Evans et al. 1978; Chapter 6). Decisionmak-

ing skills (Botvin and Wills 1985) and analysis of cigarette marketing strategies (Evans et al. 1978) also are now taught to help youth make more informed choices.

Personal Characteristics and Social Context

Personal Characteristics

The 1964 Surgeon General's Report described as "one of the best designed studies" (US PHS 1964, p. 365) an investigation in which heavy smokers were found to be more extraverted than were medium smokers, who were in turn more extraverted than were light smokers (Eysenck et al. 1960). The 1964 Report also cited two other papers with similar findings (McArthur, Waldron, Dickinson 1958; Schubert 1960). More recent work by Cherry and Kiernan (1976, 1978) found that neuroticism and extraversion measured at age 16 were positively related to smoking status at age 25, suggesting a causal relationship. Their combined effects showed substantial ability to predict subsequent cigarette use. Eysenck (1980) has argued that the association between smoking and the personality dimensions of extraversion and neuroticism implies a constitutional predisposition for smoking analogous to that seen with other drug addictions (US DHHS 1988). Work on extraversion and smoking does seem to reflect a consistent relationship between them (US DHEW 1979a; Ashton and Stepney 1982).

Studies have linked initiation of smoking with rule breaking in school, general delinquency, age at first intercourse, inadequate contraceptive use, low levels of child compliance within the family, low levels of responsibility, nonconventionality, impulsivity, rebelliousness, and previous use of alcohol and other substances (Brook et al. 1983; Chassin et al. 1984; Jessor and Jessor 1977; Mittelmark et al. 1987; Russell 1971; Zabin 1984). Academic success, as measured by grade point average, is strongly linked to the rate of smoking (Johnson 1986). High school dropouts (Pirie, Murray, Luepker 1988) and high school seniors not planning to go to college (Johnston, O'Malley, Bachman 1987) are much more likely to smoke than are those planning higher education, and this difference has increased over the past 10 years (Table 20). Similar factors are observed with other drug addictions (US DHHS 1988). Jessor (1987) views this covariation as reflecting a problem behavior syndrome. Biglan and Lichtenstein (1984) questioned this interpretation, arguing against the inference of underlying personality factors to explain the acknowledged covariation among smoking and other problem behaviors.

Peer and Family Influences

The influences of peers and parents were considerations in the 1964 Report and remain a major contemporary issue (e.g., Krosnick and Judd 1982). Understanding of the effect of peers has increased since the 1964 Report noted little available evidence of their influence on the onset of smoking. It acknowledged that imitation ". . . may play a role in inducing some, and perhaps many children to take up smoking" (US PHS 1964, p. 372). Studies noted that children of smoking parents were more likely to smoke

than children of nonsmoking parents (NIH 1975; Wohlford 1970); and smoking teenagers were more likely to have friends who smoked than were nonsmoking teenagers (Gordon and McAlister 1985; Levitt and Edwards 1970). The chapter on children and adolescents in the 1979 Report (US DHEW 1979a) reviewed the influence of social learning theory on models of the initiation of new behavior. More recent studies have supported the importance of peer models (e.g., Antonuccio and Lichtenstein 1980; Kniskern et al. 1983). The 1988 Report discussed similar factors in the determination of other drug dependence.

The impact of peer smoking on adolescent smoking has been identified in a number of studies (e.g., Chassin et al. 1984; Hundleby and Mercer 1987; McAlister, Krosnick, Milburn 1984; Mittelmark et al. 1987), including their impact on initial smoking episodes (Friedman, Lichtenstein, Biglan 1985) and continuation of smoking among those who already have experimented with cigarettes (Biglan and Lichtenstein 1984). These influences seem to rest on the importance of modeling of smoking, as well as on the setting of norms among subgroups of adolescents. The importance of bidirectional influences in smoking and smoking cessation among young people has been noted by Chassin, Presson, and Sherman (1984). In some cases, a young person's membership in a particular peer group may expose him or her to the example to smoke or to quit; however, in other cases, a young person may actively seek membership in a peer group that represents or is consistent with his or her established intentions about smoking.

More recent research has both reaffirmed the importance of parent and peer influences and attempted to explore the points at which they exert their influence during the process from onset-the initial smoking episode-to regular use (e.g., Friedman et al. 1985; Hirschman, Leventhal, Glynn 1984). The literature has tended to underscore the role of parental example and influence for initiation of smoking by young children and adolescents, and the primacy of peer influences among older youth. In application, this emphasis has often translated into an almost exclusive intervention focus on the social influences of peers for older adolescents (see Chapter 6). Some of the intervention programs include peer leaders chosen by their classmates (Murray et al. 1987). Krosnick and Judd (1982) found no evidence for decreases in parental influences on smoking during adolescence, although they did find that peer influence increases during this period. These studies often include important methodological advances wherein interviews and self-monitoring are used to augment questionnaire data.

A growing body of literature implicates family climate or family interaction patterns in smoking. Family characteristics such as indifference, low levels of trust, parental restrictiveness, and low levels of parental involvement are associated with smoking as well as with marijuana and alcohol use (Hundleby and Mercer 1987). Other research has demonstrated that low levels of adolescent involvement in family decisionmaking predict subsequent experimentation with cigarettes among adolescents (Mittelmark et al. 1987). A variety of characteristics in fathers, including harsh criticism, impulsivity, stereotyped male interests, poor ego integration, and lower levels of interpersonal relatedness has also been demonstrated to be associated with a greater likelihood of sons' smoking (Brook et al. 1983). A decreased likelihood of sons' smoking was associated with paternal affection, emotional support, attentiveness, participation in meaningful

conversations, and higher expectations for the sons. It appears that adolescent smoking is more likely in restrictive, punitive, and unempathetic families in which children are uninvolved in decisionmaking. On the other hand, families who provide multiple avenues for identity formation and expression of feelings may obviate the utility of smoking or other problem behaviors as a mode of identity expression (Jessor 1987).

Personal characteristics and attitudes may mediate peer influence on smoking as well as other drug dependencies (US DHHS 1988). Research indicates greater impact of peer smoking among adolescents scoring low on a measure of obedience to parental authority and high on a measure of rebelliousness (McAlister, Krosnick, Milburn 1984). The interactions among social influences, personality, and smoking were highlighted in a study in which seventh and eighth graders described the informal reference or affiliation groups they observed among their schoolmates and identified the group with which they felt the closest affiliation (Mosbach and Leventhal 1988). Two of the four groups that emerged, "hot-shots" (78 percent female, popular leaders in academic and extracurricular activities) and "dirts" (63 percent male, characterized by problem behaviors such as drinking, poor academic performance, and cutting classes), were identified as primary reference groups by only 14.7 percent of respondents but accounted for 55.6 percent of the smokers. In discriminant function analyses, a "macho" dimension was highly associated with one high smoking prevalence group, the "dirts," but not with the "hot-shots." In contrast, academic and social leadership was associated with the "hot-shots" but not with the "dirts." As were the "dirts," the "jocks" were also 63 percent male and high on the macho dimension but low on use of both hard liquor and cigarettes. Adolescent smoking, then, is closely related to individual identification with groups, but these groups differ markedly in their association with other problem behaviors and psychosocial characteristics. Depending on group affiliation, different personality and attitudinal characteristics may be related to smoking.

Social class differences in the onset of smoking continue to be observed as noted in Part I of this Chapter. Racial differences in onset and prevalence and historical shifts in these differences are also well demonstrated in the first part of this Chapter. Sussman and colleagues (1987) in their study of psychosocial predictors of cigarette smoking onset by approximately 1,000 white, black, Hispanic, and Asian adolescents in Southern California demonstrated that different variables predict onset in these different groups. A good predictor for whites but not for other ethnic groups was adult and peer models of smoking behavior, while for blacks, risk-taking preference was a good predictor. These findings possibly reflect unique cultural and social contexts and suggest that tailoring socially relevant treatment components to adolescent subgroups may be beneficial (Sussman et al. 1987).

Cigarette Marketing

Beyond the family and peer group, an important social context determinant of the onset of smoking is the marketing of cigarettes. There have been longstanding concerns about the impact of cigarette advertising on both children and adults as evidenced by the ban on radio and television advertisements, effective in 1971. Yet, "cigarette

advertisements continue to appear in publications with large teenage readerships” (Davis 1987, p. 730).

Marketing campaigns seem designed to appeal to specific personality characteristics of groups of potential buyers. In this respect, they exemplify interactions between personal characteristics and the environment. The Marlboro brand was the leading choice of a group of white adolescent male (48 percent) and female (38 percent) smokers surveyed in Louisiana in 1981 (Hunter et al. 1986). In a sample of 306 high school students in Georgia, Marlboro was the preferred brand of 76 percent of smokers who identified a single preferred brand (Goldstein et al. 1987). Similar findings were reported by Glantz (1985). These figures contrast with the overall domestic market share of Marlboro, which was 24 percent in 1987 (Ticer 1988). Given the associations of rebelliousness and behavioral problems with adolescent smoking, as reviewed above, there may be a relationship between the noted disparity of overall brand preference and the emphasis on the tough independence of the “Marlboro Man.” In fact, this pattern may be a reflection of extensive market segmentation, in which specific brands are marketed for specific gender or ethnic groups, often with campaign messages and symbols aimed at those groups (Davis 1987). Teenage girls, relative to boys, are more likely to believe that smoking controls weight (Charlton 1984) and are good targets for advertisements that emphasize the desirability of being slender (Gritz 1986).

Some market segmentation appears more subtle, guided by smoker characteristics not as apparent as race and gender. McCarthy and Gritz (1987) surveyed students in grades 6, 9, and 12 regarding their attitudes about cigarette advertisements. Among their findings was the closer relationship, for those youth more likely to be smokers, between personality self-ratings and personality ratings assigned to models in cigarette advertisements. Thus, the way adolescents see themselves appears to be related to their attraction to certain advertisements. This congruity among psychological correlates of teenage smoking, marketing themes, and teenage preferences is especially striking when one considers that the tobacco industry denies that campaigns are aimed at teenagers (Davis 1987).

Summary

The increased understanding of the multiple and interacting determinants of the development of smoking and of the relation of these determinants to the stages of development of smoking is a reflection of progress over the last 25 years. The delineation of stages—from onset to regular use—has been an especially influential development (Figure 2). The development of the addictive processes in teenagers has recently become better appreciated and understood (Biglan and Lichtenstein 1984; Hirschman, Leventhal, Glynn 1984). While information about the long-term disease consequences of smoking has an important role in adolescent smoking initiation, awareness of the short-term health consequences and the influence of peers and advertising are now seen as more critical for adolescent decisionmaking. The effects of peers and family are both supported. Cigarette marketing appears to target teenagers despite the cigarette companies’ reported policy efforts to restrict such advertising.

Regular Smoking

Pharmacologic Processes and Conditioning

Pharmacologic processes and conditioning play complementary and major roles in maintaining regular smoking. Early theories of smoking tended to view pharmacologic processes and conditioning as separate explanations of regular smoking (e.g., Hunt 1970; Table 35). They are now viewed as complementary and interacting processes (US DHHS 1988). The 1988 Surgeon General's Report on nicotine addiction affirmed the critical role of nicotine and its varied and powerful pharmacologic effects on the central nervous system (CNS) in the development and maintenance of regular smoking. This acknowledgment and its implications for intervention represent a significant shift in perspective over the 25-year history of the Surgeon General's Reports. Concurrently, increased knowledge of smoking as an addiction has clarified the important role of conditioning in addiction. Conditioning and related processes link the biological effects of nicotine to the many behaviors that make up smoking and to the many concurrent physical and environmental stimuli that guide it.

Nicotine Addiction

The 1964 Report distinguished between drug addiction and drug habituation (US PHS 1964; Table 36) and concluded that smoking is habituation. As noted in the 1988 Report, the addiction/habituation distinction was dropped in 1964 by the WHO shortly after the release of the 1964 Report (US DHHS 1988).

The 1988 Surgeon General's Report on nicotine addiction noted the following three major conclusions: (1) cigarettes and other forms of tobacco are addicting; (2) nicotine is the drug in tobacco that causes addiction; (3) the pharmacologic and behavioral processes that determine tobacco addiction are similar to those that determine addiction to drugs such as heroin and cocaine (US DHHS 1988, p. 9). These conclusions were based on a thorough review of research on addictive aspects of smoking extending over nearly a century.

The criteria that guided the 1988 Report's conclusion that smoking is an addiction are summarized in Table 36. As documented by extensive research cited in the Report, smoking meets all the criteria. Smoking is continued despite a desire to quit and, in many cases, despite clear harm to the individual. A central criterion concerns psychoactive effects of a drug on the CNS. Rapid absorption of nicotine into the bloodstream and consequent delivery to the CNS are features common to all popular forms of tobacco use. Recent evidence confirms that nicotine is absorbed by the brain, which contains receptors specific for this agent (e.g., London et al. 1985; London, Waller, Wamsley 1985); has euphoric effects and perhaps sedative or other anxiolytic effects mediated by neurohormonal processes (e.g., Henningfield, Miyasato, Jasinski 1985); and reinforces behavior, even among animals or human subjects blind to whether they received saline placebo or nicotine (Henningfield, Chait, Griffiths 1983,1984). As with other addictive drugs, prolonged ingestion of nicotine leads to tolerance, a tendency to consume increasing amounts of a drug, presumably to achieve a desired euphoric or

TABLE 36.--Comparison of characteristics of addiction, habituation, and dependence in 1964 and 1988 Surgeon General's Reports

Characteristics of drug addiction and habituation in 1964 Surgeon General's Report ^a	Characteristics of drug addiction in 1988 Surgeon General's Report ^b	
<p>Drug addiction</p> <p>A state of periodic or chronic intoxication produced by the repeated consumption of a drug (natural or synthetic).</p> <p>Its characteristics include:</p> <p>(1) an overpowering desire or need (compulsion) to continue taking the drug and to obtain it by any means;</p> <p>(2) a tendency to increase the dose;</p> <p>(3) a psychic (psychological) and generally a physical dependence on the effects of the drug; and</p> <p>(4) detrimental effects on the individual and on society.</p>	<p>Drug habituation</p> <p>A condition resulting from the repeated consumption of a drug.</p> <p>Its characteristics include:</p> <p>(1) a desire (but not a compulsion) to continue taking the drug for the sense of improved well-being it engenders;</p> <p>(2) little or no tendency to increase the dose;</p> <p>(3) some degree of psychic dependence on the effect of the drug, but absence of physical dependence and hence of an abstinence syndrome; and</p> <p>(4) detrimental effects, if any, primarily on the individual.</p>	<p>Primary Criteria</p> <p>Highly controlled or compulsive pattern of drug use.</p> <p>Psychoactive or mood-altering effects involved in pattern of drug taking.</p> <p>Drug functioning as reinforcer to strengthen behavior and lead to further drug ingestion.</p> <p>Additional Criteria</p> <p>Tolerance (increased doses either tolerated without discomfort or needed to achieve desired effects).</p> <p>Physical dependence (withdrawal syndrome upon termination of drug taking).</p> <p>Use despite harmful effects.</p> <p>Pleasant (euphoric) effects.</p> <p>Stereotypic patterns of drug use.</p> <p>Relapse following drug abstinence.</p> <p>Recurrent drug cravings.</p>

^aSOURCE: US PHS (1964,p. 351).

^bSOURCE: US DHHS (1988, pp. 194, 250-253).

other effect. Prolonged use also leads to physical dependence, as indexed by various psychological and physical withdrawal symptoms following cessation of smoking. The inclusion of tobacco dependence as a disorder in the Diagnostic and Statistical Manual of Mental Disorders III, the official diagnostic reference for the American Psychiatric Association (1980), was another major marker in the shift of scientific opinion about the addictive nature of cigarette smoking.

Central to the 1964 view was the distinction between compulsive use (addiction) and the less compulsive “desire” (habituation). The difference was noted to rest primarily on the source of the desire or compulsion. The 1964 Report emphasized “serious personality defects from underlying psychologic or psychiatric disorders” (US PHS 1964, p. 351) as a defining factor in compulsive use and therefore in addiction. Evidence gathered since the early 1960s contradicts the assumptions that underlying pathology drives the compulsive use seen in addiction. Drugs commonly viewed as addictive, e.g., heroin, may be abandoned with little apparent effort as with many Vietnam veterans addicted to heroin who gave it up after their return to the United States (Robins, Helzer, Davis 1975; US DHHS 1988). On the other hand, the extent to which smoking can be highly compulsive is suggested by its continuance in the face of substantial awareness of its harm, as by cardiac patients (Baile et al. 1982; Burling et al. 1984; Ockene et al. 1985; US DHHS 1984). The generality of nicotine’s effects argues against its compulsive use resting on individual psychopathology; the basis for nicotine addiction rests on the interaction of conditioning processes and nicotine action in the brain.

Mechanisms of Nicotine Action

Much research in the 1970s on the behavioral effects of nicotine has been guided by the nicotine regulation (or titration) model put forth over the years by Jarvik (1977), Jarvik, Glick, and Nakamura (1970), Russell (1976), and Schachter, Silverstein and colleagues (1977). According to this model, smokers regulate their smoking to maintain a certain level of blood nicotine within a range of upper and lower limits (Herman and Kozlowski 1979; Kozlowski and Herman 1984). This includes the avoidance of withdrawal symptoms or anticipated withdrawal by maintaining a nicotine level above a lower limit and avoidance of toxicity by maintaining it below an upper limit.

This formulation has been criticized as failing to explain the self-perceived positive effects or benefits of smoking that may promote use (Pomerleau and Pomerleau 1984; Leventhal and Cleary 1980). Interestingly, the 1964 Surgeon General’s Report devoted only 1 1/2 pages to such effects. In the last few years, several investigators (e.g., Ockene et al. 1988; Pomerleau and Pomerleau 1984) have proposed that smoking, by virtue of the varied actions of nicotine, provides several positively perceived effects and is employed by many smokers as a responsive and effective coping strategy. This implies that smokers can be reinforced for continued smoking without maintaining a minimum blood nicotine level. The 1988 Report devoted an entire chapter to this topic.

An influential and historically important model of perceived positive effects of smoking stressed the psychological effects of nicotine and other pharmacologic aspects of smoking (Pomerleau and Pomerleau 1984). This model holds that nicotine increases the release of a number of neuroregulatory hormones, conferring on smoking the ability

to act as stimulant or sedative depending on level of ingestion, background hormone levels, and the like. Nicotine thus can serve to reduce anxiety or produce euphoria (US DHHS 1988) and enhance vigilance for certain cognitive tasks (e.g., Warburton et al. 1986). The work of Grunberg (1986; US DHHS 1988) also suggests that nicotine may aid smokers in maintaining lower body weight. Although objective judgment indicates that the health effects of smoking are more important than the weight maintenance effects (Abrams et al. 1987), the latter seem to be of particular importance to some women (Klesges and Klesges, in press; US DHHS 1988). This growing recognition that smokers may value several effects of cigarettes can be used not so much to justify the behavior but rather to direct intervention strategies (e.g., physical activity) that might help people meet needs previously served by cigarettes. Interventions also are likely to be seen as more credible to smokers if the coping value of cigarettes is recognized (Ockene et al. 1988).

Conditioning and Smoking

What most distinguishes recent analyses of the conditioning of smoking from earlier views (e.g., Hunt 1970) is their emphasis on the conditioning of the biological effects of nicotine. The occurrence of stimuli previously associated with the effects of nicotine will tend to evoke responses related to those effects or cues for further consumption (e.g., Abrams et al., in press; Herman 1974; Niaura et al. 1988; Rickard-Figueroa and Zeichner 1985). Such conditioned effects may link smoking to aversive states alleviated by nicotine. For example, investigations described earlier (e.g., Schachter, Silverstein et al. 1977) suggested that smoking covaries with stress, which is hypothesized to deplete nicotine. Leventhal and Cleary (1980) suggested that stress as well as other emotions may be alleviated by nicotine and would then come to serve as cues for smoking. Pomerleau and Pomerleau (1984, 1987) identified neurohumoral effects of nicotine as the paths of its impact and elaborated on the ways such effects might be conditioned to circumstances surrounding smoking so as to regulate it in the future.

Two influential theories of addiction emphasize the role of relief of withdrawal or anticipated withdrawal in smoking. As suggested by Wikler's classic work with opioids (Wikler 1973; Wikler and Pescor 1967), withdrawal symptoms may be conditioned to the circumstances in which they occur. This would set the stage for stimuli associated with prior drug taking to elicit withdrawal symptoms and urges. With smoking, greater withdrawal symptoms have been noted when cessation occurs in natural rather than artificial environments, presumably because those natural environments contain numerous cues associated with prior smoking (Hatsukami, Hughes, Pickens 1985). Within this model, return to smoking after brief or extended abstinence is reinforced by the reduction in such conditioned withdrawal symptoms.

Opponent-process theory (Solomon and Corbit 1973) suggests that the reduction of aversive withdrawal symptoms may be the result of the interaction of the immediate response to a drug, called the "A" state, and the delayed response, the "B" state. The B state is "opposed" to or opposite the A-hence "opponent process"; if the A is pleasurable, the B will be aversive. Initially, the A state is stronger. While initial, pleasurable responses to nicotine may encourage increased smoking, regular smoking

leads the aversive B state to become stronger, which in turn may be reduced or avoided by the A-state consequences of further smoking. After regular smoking has been established, the A state serves only to avoid or reduce the aversive B state. That is, regular smoking is pursued to reduce displeasure rather than to bring about the pleasure that may have been its initial appeal. It is important to note that there is little evidence on the validity of the Wikler theory or opponent-process theory as applied to smoking.

In contrast to models emphasizing relief of withdrawal, a recent review (Niaura et al. 1988) proposes an “appetitive” model of responses to cues associated with smoking. Evidence indicates that cues surrounding smoking are more strongly conditioned to its positively perceived effects than to withdrawal symptoms. That is, cues associated with intake of nicotine (e.g., holding a cigarette or inhaling) come to elicit conditioned responses similar to the effects of nicotine (e.g., relaxation, heightened arousal). These effects are strong reinforcers and encourage continued efforts to obtain or ingest the drug. These reinforcing effects may be more critical than the reduction of withdrawal symptoms after periods of abstinence.

Critical to understanding the appetitive model is the idea that negative emotions are not necessarily withdrawal symptoms. However, negative emotions previously alleviated by nicotine may serve as cues for seeking repetition of smoking’s reinforcing effects (Stewart, DeWit, Eikelboom 1984). For example, social anxiety may be the occasion for smoking, which is then reinforced by nicotine’s ability to reduce anxiety. The anxiety, however, is a response to a stressful situation, not a symptom of withdrawal from cigarettes. Smoking is reinforced by the anxiety reduction, not by reduction of withdrawal symptoms.

The many ways smoking is conditioned to circumstances around it may explain “the thorough interweaving of the smoking habit in the fabric of daily life” (Pomerleau and Pomerleau 1987, p. 119). The sheer repetition of smoking also strengthens such interweaving. It is estimated that the average pack-a-day smoker of 20 years’ duration has inhaled cigarette smoke over 1 million times (Fisher and Rost 1986; Pomerleau and Pomerleau 1984), each inhalation providing an opportunity for conditioning smoking to numerous circumstances of daily life. Moreover, with years of smoking, the emotional states and daily circumstances conditioned to it may continue to increase, resulting in urges to smoke being conditioned to almost every circumstance encountered and complicating the task of maintaining abstinence.

Cognition and Decisionmaking

Cognitive and decisionmaking processes play a lesser role in the maintenance of regular smoking relative to the other factors discussed here. Smokers have long believed that they derive positive effects from smoking. The “pros” of smoking have been embodied in the instruments used in decisionmaking studies (Mausner and Platt 1971; Velicer et al. 1985) and in the Horn and Waingrow (1966) Reasons-for-Smoking Scale.

As documented in Chapter 4 of this Report, public knowledge of the health consequences of smoking has increased steadily over the past 25 years. Eighty-seven percent of current smokers now report that they understand that smoking is harmful to their

health (ALA 1985) and two-thirds of high school seniors report “great risk” being associated with pack-a-day smoking (Johnston, O’Malley, Bachman 1987). Why, then, do so many persist in regular smoking? One reason may be that they do not appreciate just how dangerous smoking is. For example, 75 percent of current smokers agreed that smoking is a cause of lung cancer (ALA 1985), while 94 percent of nonsmokers and 90 percent of former smokers agreed to this. For emphysema, the parallel figures were 75 percent of current smokers compared with 91 percent and 90 percent of former smokers and nonsmokers, respectively (ALA 1985). Surveys indicate a general insensitivity to the relative level of risk associated with smoking. Health professionals rated nonsmoking as the first priority among things Americans can do to protect their health. The public rated nonsmoking as 10th, behind such worthy but, for most Americans, less critical behaviors as consuming adequate vitamins and minerals and drinking water of acceptable quality (Fisher and Rost 1986). As discussed below, the health belief model (Rosenstock 1974) requires that smokers believe they are personally vulnerable to a threat before they will be motivated to attempt change. It has been suggested that personalized acceptance (“Cigarette smoking is dangerous to *my* health”) always lags behind general acceptance (“Cigarette smoking is dangerous to health”) (Fishbein 1977; Lichtenstein and Bernstein 1980; Shiffman 1987) (See Chapter 4). These considerations suggest that many smokers still find it possible to discount the riskiness of their behavior.

Another possible reason for some smokers’ insensitivity to smoking risks is that they have not always been given the full message, or they have been given mixed messages, including prosmoking messages (advertising) from the cigarette industry. Factors that impede public awareness and acceptance of the health hazards of smoking include cigarette advertising and promotion and cigarette companies’ public relations and lobbying activities, which are also reviewed in Chapters 6 and 7.

Other issues related to persistence of smoking will be covered in the Section on Quitting and Relapse.

Personal Characteristics and Social Context

Personal Characteristics

The 1964 Surgeon General’s Report linked smoking in adulthood and adolescence to extraversion, or as it defined it, a tendency “to live faster and more intensely” (US PHS 1964, p. 366), and this relationship has been confirmed in later studies (e.g., Ashton and Stepney 1982). However, reviews indicate that there is no consistent evidence relating smoking to neuroticism or emotional instability (Smith 1970; US DHEW 1979a). More recent studies have continued to find relationships with smoking and behaviors linked to extraversion: coffee and alcohol consumption (Istvan and Matarazzo 1984); circadian phase differences, being an “evening type” as opposed to a “morning type” (Ishihara et al. 1985); alcohol consumption, driving accidents, divorce, frequent job changes, low levels of vocational success, and impulsivity (Eysenck 1980).

Another personality construct that received a great deal of attention earlier in the smoking literature was Rotter's (1966) internal versus external locus-of-control dimension (e.g., Foss 1973; Best and Steffy 1975; Best 1975; Straits and Sechrest 1963). Two general hypotheses characterized work in this area. The first noted that smokers tended to have a more external locus of control, that is, perceive that things occur because of fate, not because of one's own actions, compared with nonsmokers. The second held that smokers with a greater internal locus of control, that is, a perception that things happen because of one's own actions, would be more successful in quitting. A review of this literature revealed inconsistent support for both hypotheses (Baer and Lichtenstein 1988b).

The multidimensional health locus of control scale (Wallston, Wallston, DeVellis 1978) was an attempt to anchor the locus of control construct specifically to health behavior consistent with the trend away from broad, dispositional traits (Mischel 1973). Most studies using this scale examined the effect of health locus of control on cessation attempts. Three investigations reported small but significant prospective relationships between subscales of the Health Locus of Control Scale and maintenance of abstinence (Kaplan and Cowles 1978; Rosen and Shipley 1983; Shipley 1981).

A popular approach to understanding social or psychological problems has been through typologies. Tomkin's typology of smoking and affect regulation was very influential in the 1960s and early 1970s (Ikard and Tomkins 1973; Tomkins 1966, 1968). Tomkins originally proposed a fourfold typology including positive affect, negative affect, habitual, and addictive smoking. This model gave rise to the Reasons-for-Smoking Scale (Horn and Waingrow 1966), which continues to be used widely in public education and cessation programs despite receiving little empirical support (Shiffman 1988). Validity studies have yielded the most consistent support for the negative affect smoking construct (Ikard and Tomkins 1973; Pomerleau, Adkins, Pertschuk 1978; Joffe, Lowe, Fisher 1981).

The support demonstrated for negative affect smoking is also consistent with recent reviews' emphasis on stress reduction as being among those biological effects of nicotine that maintain regular smoking (e.g., Leventhal and Cleary 1980, Pomerleau and Pomerleau 1987). Much evidence for such effects comes from the retrospective reports of relapsers and smokers attempting to stop, which are reviewed later in this Chapter. However, relatively few data demonstrate that heightened stress leads to greater smoking. Among them are Ikard and Tomkin's observations (1973) of greater incidence among race track spectators during horse races—presumed to be times of stress—than in the periods before and after races, and Silverman's observations of nicotine-induced reductions in aggression among rats (1971). A number of other studies reviewed in the 1988 Surgeon General's Report link smoking and negative affect but, as noted in that review, are not conclusive as to whether reduction of negative affect makes a substantial contribution to regular smoking. Design problems include comparisons of smokers smoking with smokers who are deprived, leaving unclear, for instance, whether smoking reduces negative affect or whether, for regular smokers, *not* smoking merely causes an aversive, deprivation state. As concluded in the 1988 Report, "... caution must be exercised in generalizing about smoking and nicotine's effects on stress and mood . . ." (US DHHS 1988, p. 405).

Less direct support for effects of stress on smoking lies in studies of smoking prevalence among groups who are disadvantaged in our society, including psychiatric outpatients (Hughes et al. 1986) and male users of soup kitchens (McDade and Keil 1988). Of the 38 subgroups defined by gender and economic, educational, vocational, or marital status listed in the 1988 Report, divorced or separated men had the highest prevalence of smoking, 48.2 percent (US DHHS 1988). Other social problems such as alcoholism and suicide are also more prevalent in this group (Kaplan and Sadock 1985).

Beyond those groups with significant disadvantages such as psychopathology and very low income, the more general effects of income and education are quite substantial. For instance, preliminary data from the 1987 NHIS indicate a 35-percent smoking prevalence among adults with less than a high school education, more than twice the 16.3 percent prevalence among those with postgraduate college training (see Part I). Prevalence among both women and men declines with increases in income range. Among unemployed men, the prevalence is 44.3 percent (US DHHS 1988). Such trends indicate that the social and economic context affects the relationship of personal characteristics with smoking. Consistent with this, trends presented in Part I of this Chapter indicate that observed differences of race and sex are attributable to effects of income and education (see also Novotny, Warner et al. 1988).

Social Context Influences

The arrival at regular use roughly corresponds to the period of transition from adolescence to adulthood. At least until very recently, the social changes that accompany this passage—entering a university, the military, or the workforce—have been associated with a marked change in the acceptability of smoking. For high school students, smoking is often prohibited on school property, even if the prohibition is poorly enforced. In the workforce, community college, and university setting, smoking has been widely accepted. The military until recently had supported smoking among its men and women, as reflected in low prices for cigarettes at military exchanges and commissaries and by the announcement of breaks with “The smoking lamp is lit.” The extent to which smoking is a part of the role of the serviceman was shown in a survey of Navy enlisted men with a mean age of 22.6 years and a mean of 3.9 years’ service. Seventy-two percent were self-reported smokers (Burr 1984). That the military has an effect on creating rather than attracting smokers is suggested by a comparison of prevalence among naval recruits, 27.6 percent, and shipboard men, 49.8 percent (Cronan and Conway 1988). The military has recently recognized the enormous costs attendant to the high prevalence of smokers within its ranks and has begun efforts directed at reducing the percentage of smokers among its personnel (See Chapters 6 and 7).

Cigarette marketing, discussed above and in Chapter 7, continues to be an important influence encouraging adult smoking, with several possible direct and indirect influences on smoking patterns (Warner 1985).

Summary

The past 25 years have seen a deepening appreciation of the importance of nicotine in maintaining regular smoking. In contrast to the 1964 Surgeon General's Report, cigarette smoking is now defined as an addiction (US DHHS 1988). Earlier emphasis on the maintenance of blood nicotine levels as a means to avoid withdrawal has been balanced by the awareness that nicotine's varied effects make smoking an efficient coping strategy for affect regulation and perhaps weight regulation. Conditioning models of smoking have become more sophisticated and firmly integrated with the pharmacologic actions of nicotine to explain addiction. While the public is now better informed about the health consequences of smoking, many smokers still minimize their perception of their vulnerability amid extensive marketing of tobacco products. Broad, dispositional traits or motives are now seen to be of limited value in understanding smoking. The role of social settings and social influence in encouraging regular smoking is also better understood.

Cessation and Relapse

A large body of literature on determinants of cessation has evolved, driven by the need to provide empirical and theoretical guidelines for intervention programs. All three sets of determinants—pharmacologic processes and conditioning, cognition and decisionmaking, and personality and social context—play an important role in the cessation stage (Table 39). It is with respect to cessation, especially, that the concept of stages—treating stopping as a process over time—has evolved (Figure 8) and now guides research and interventions (e.g., Marlatt 1985). The influential and well-articulated cessation stage model of Prochaska and DiClemente (1983) defines four stages of cessation. Precontemplation is the stage in which the smoker is neither considering stopping nor actively processing smoking-and-health information. During the contemplation stage, smokers are thinking about stopping and are processing information about the effects of smoking and ways to stop. In the action or cessation stage, the smoker is no longer smoking and has been without cigarettes for less than 6 months. The maintenance phase involves establishment of long-term abstinence, while relapse is the resumption of smoking. When relapse occurs, the smoker recycles to any one of the three previous stages.

Specific cognitive and behavioral processes are employed during the different stages of cessation (Prochaska and DiClemente 1983). Determinants of each stage are also different. Thus, factors that affect an initial decision to stop smoking may not predict success in stopping or sustained maintenance after stopping. Working from a related but different stage model—initial decision, initial control, maintenance—Rosen and Shipley (1983) used health locus of control, desire to stop, and self-esteem to predict self-initiated smoking reduction. Using regression analysis, a different set of predictors was demonstrated at each stage, suggesting the possible need for different intervention techniques at each stage of the smoking reduction process.

An important implication of a stage model is that interventions may need to address cessation's several stages. The precontemplator's tendency to ignore quitting strategies

may need to be met with continued personalized information on smoking and health; the contemplator may need social support to attempt cessation; and the abstainer may need help that emphasizes the development of relapse prevention skills. There are as yet no data available to demonstrate the effect of interventions tailored to specific stages of cessation. Thus, a model like the Prochaska and DiClemente stage model is best viewed as a tentative conceptualization, useful for guiding research and interventions. The next section considers changes in our understanding of the determinants of cessation in relation to the stages in the cessation process.

Pharmacologic Processes and Conditioning

Pharmacologic processes and conditioning exert a strong influence on the process of quitting. One indicator of the role of addiction is that heavier, more dependent smokers in intervention programs are less likely to quit than are lighter, less dependent smokers (e.g., Hall et al. 1984; Ockene et al. 1982b), especially when smokers with much variability in baseline smoking are studied, as in the Multiple Risk Factor Intervention Trial (MRFIT) (Hughes et al. 1981). As is noted in the 1988 Surgeon General's Report, "Withdrawal symptoms, whether elicited by acute deprivation or by conditioned stimuli, are hypothesized to be the link between dependence and relapse" (p. 523), although some analyses (e.g., Niaura et al. 1988) place greater emphasis on positive effects of smoking in motivating relapse. Further evidence of the influence of addiction comes from intervention studies evaluating nicotine-containing gum. Several studies have found that nicotine polacrilex gum is more effective when used with nicotine-dependent smokers (as measured by the Fagerstrom (1978) addiction questionnaire) than with less dependent smokers (Hall et al. 1985; Killen et al. 1984; Schneider et al. 1983). Nicotine polacrilex gum most likely is effective because it reduces withdrawal symptoms frequently noticed in the first days and weeks of abstinence (Hughes et al. 1984; West et al. 1984). Recently, more work has focused on nicotine replacement strategies or other pharmacologic treatment adjuncts reflecting the importance of biological factors in smoking and cessation (Grabowski and Hall 1985; US DHHS 1986b; US DHHS 1988).

Conditioning mediates the role of the pharmacologic effects of nicotine in cessation. As noted in the discussion of regular smoking, numerous conditioned environmental stimuli are likely to evoke urges or cues to smoke. Recent work by Abrams and colleagues demonstrates that former smokers manifest psychophysiological reactivity to smoking cues long after they have quit (Abrams et al., in press; Abrams 1986). Conditioned reactivity to environmental cues, then, may be more decisive in the later stage of maintenance after withdrawal symptoms have subsided.

Research on relapse triggers reflects current interest in specific, situational variables. Primary triggers include stress, interpersonal conflict, dysphoria, presence of other smokers, and alcohol consumption (Marlatt and Gordon 1980; Shiffman 1982). Although the data are primarily retrospective reports from relapsed or tempted subjects, there is convincing consistency on the importance of stress and negative affect in determining maintenance or relapse (Baer and Lichtenstein 1988a; Marlatt and Gordon 1980; Ockene et al. 1982a; Shiffman 1982; US DHHS 1988). The mechanism whereby

a lapse becomes a full return to smoking has also recently been analyzed as a series of stages (Marlatt 1985). These include a high-risk occasion that triggers a smoking lapse (that is, a brief return to smoking) and a subsequent interpretation of the lapse that may lead to abandoning the cessation effort and a return to regular smoking. Much recent attention has been paid to the importance of coping responses in dealing with both high-risk situations and lapses (e.g., Shiffman 1984; Shiffman and Wills 1985). The available data suggest that the absence of any coping response is predictive of relapse but there are few differences that relate to the use of specific coping strategies used (Shiffman 1984).

Cognition and Decisionmaking

The role of cognitions in smoking cessation is evident in the relapse model noted above (Marlatt 1985). In this model, a lapse diminishes self-efficacy or self-confidence and expectations for long-term success. These diminished efficacy expectations then become the basis for an individual to abandon the effort and return to regular smoking (Marlatt 1985). In fact, lapses are highly predictive of subsequent relapse (Brandon, Tiffany, Baker 1986; Baer et al. 1988).

Researchers have long noted the relationship of knowledge about the health consequences of smoking, beliefs about personal susceptibility, attitudes toward smoking, and expectations about the benefits of quitting to cessation efforts and their long-term success or failure. Cognitive-behavioral models of smoking cessation emphasize the importance of an individual's interpretation of health risks and perceived self-efficacy for refraining from smoking (Pechacek and Danaher 1979), as well as attributions about addiction and lapses during the maintenance stage (Marlatt 1985).

Expectancy-Value Models

Expectancy-value models have guided approaches to smoking cessation for many years (e.g., Kirscht 1983; Mausner and Platt 1971; Sutton 1987). Outcome expectations refer to expected consequences that would occur if one continued smoking or quit smoking (Bandura 1977). Their value refers to the personal importance or weight given to the various possible outcomes and can be extended to perceptions about what significant others wish one to do (Fishbein 1982). Expectations include the positive (e.g., enjoyment) and negative (e.g., disease) consequences of smoking and the positive (e.g., enhanced lung capacity) and negative consequences (e.g., loss of enjoyment, withdrawal symptoms) of quitting. Expectancy-value models tend to assume that human behavior is rationally guided by logical or at least internally consistent thought processes (Henderson, Hall, Linton 1979).

Decisionmaking models represent one variant of the expectancy-value approach and have been (e.g., Mausner and Platt 1971) and continue to be (Velicer et al. 1985) applied to smoking cessation. The more recent applications (Velicer et al. 1985) may prove more useful because they take into account stage of change (Prochaska and DiClemente 1983). Changes in the relative level of pro and con views of smoking, for example, appear related to stages of quitting. Smokers not contemplating quitting report substantially higher levels of pro than con views, while those contemplating quit-

ting report equal pro and con views. For quitters, con views were higher than pro views. These relative pro and con views also predicted subsequent change in smoking (Velicer et al. 1985).

Since the 1960s the health-belief model (Kirscht 1983; Rosenstock 1974; Swinehart and Kirscht 1966) has been a popular approach to understanding expectancy-value concepts applied to smoking cessation. According to this model, attempting to stop smoking is a function of three factors: beliefs about the health consequences of smoking and perceived susceptibility to the disease consequences, perceptions of available actions that can reduce one's risk, and perceptions of the costs and benefits of accomplishing these actions (Kirscht and Rosenstock 1979). Johnston (1985) and his colleagues (Bachman, Johnston, O'Malley, and Humphrey 1988), for example, have shown that changes in perceived risk have accounted for a considerable reduction in adolescent marijuana use-particularly regular use. They suggest that effects of such beliefs may be more limited in the case of cigarettes because of the addictive properties of nicotine. As described in the next section, some recent models have addressed individuals' belief in their ability to change behaviors, or self-efficacy (Bandura 1977; Eiser 1983; Eiser and Sutton 1977; Sutton and Eiser 1984).

Self-Efficacy and Smoking

Bandura (1977, 1982) defines self-efficacy as an individual's belief in his or her ability to perform a specific behavior and proposes that efficacy beliefs represent a final common pathway mediating behavior change. Information from past behavior, modeling, affective states, and instruction combine to produce a performance expectation, which then predicts future behavior. This behavior would, in turn, influence subsequent efficacy; behavior and efficacy are reciprocally related (Bandura 1982).

The belief in one's ability to stop smoking has been implicated in the health-belief model and in Eiser's (1983) analysis of decisionmaking about stopping smoking. Self-efficacy theory, then, can be viewed as a historical descendant of the health-belief model and recently has had a major impact on models of smoking cessation. It is a major construct in Marlatt's (1985) influential relapse prevention model, which has spawned several intervention studies (e.g., Brown et al. 1984; Curry et al., in press). In Marlatt's model, self-efficacy is the key variable in the stage of maintenance (or relapse). It helps determine how well the individual will deal with high-risk situations or urges and is, in turn, influenced by successful or unsuccessful coping (Marlatt 1985).

Consistent with Marlatt's (1985) model, significant results with self-efficacy primarily pertain to client ratings after intervention, and thus predict smoking during followup periods. When all clients in treatment are considered, posttreatment self-efficacy ratings correlate strongly with short-term maintenance (Condiotte and Lichtenstein 1981; Coelho 1984; McIntyre-Kingsolver, Lichtenstein, Mermelstein 1983). For the most part, efficacy scores seem to correlate with outcome most highly when the followup interval is shorter (e.g., 3 months) and diminish over time (Coelho 1984; McIntyre-Kingsolver, Lichtenstein, Mermelstein 1983).

In order to view efficacy as a determinant of maintenance of cessation, it is necessary to demonstrate that it influences the latter independent of performance (level of

smoking) at the time efficacy is assessed. Results using partial correlations suggest that efficacy scores do provide limited information above and beyond that of current smoking behavior (Baer, Holt, Lichtenstein 1986). A second approach is to correlate self-efficacy measured postintervention with subsequent followup status only for those clients who initially quit. Studies using this paradigm have found significant but modest correlation with 3-month followup (McIntyre-Kingsolver, Lichtenstein, Mermelstein 1983; Coelho 1984). Self-efficacy also can be assessed during the maintenance phase, in order to predict longer term followup. Two studies have examined these relationships and both found significant prospective relationships (DiClemente 1981; Baer, Holt, Lichtenstein 1986). While intervention studies have usually found pretreatment efficacy unrelated to outcome, one study of unaided quitters found that baseline efficacy correlated with continuous abstinence at 1 year (Gritz, Carr, Marcus, in press). Another intervention study found that participants' attribution of stopping to their own skill and effort, gathered 3 months after stopping, was correlated with abstinence at 6-month followup (Fisher, Levenkron et al. 1982). National survey data reviewed by Shiffman (1986) suggest that lack of confidence in the ability to stop deters many smokers from attempting cessation.

Outcome Expectations

From a stage perspective, outcome expectations (perceived consequences of smoking or stopping) are more likely to be related to the decision to stop smoking or the initiation of quit attempts than to success in the stopping process. The effects of brief advice from a physician offer indirect support for the role of outcome expectations (Russell et al. 1979). Patients receiving brief advice to stop smoking were more likely to stop relative to control subjects. The physicians' advice probably enhanced the salience of the perceived positive consequences of stopping or the negative consequences of continuing to smoke and thus prompted the decision to attempt to stop. Negative consequences of smoking are potentiated by dramatic illness such as myocardial infarction, which is often the occasion for cessation efforts; however, relapse is often considerable (e.g., Baile et al. 1982), although less than with nondiseased smokers (Ockene et al. 1987). Cognitions concerning the health risks of smoking and the positive benefits of stopping remain very important from a public health perspective (see Chapter 4) and the health-belief model may be useful for guiding interventions aimed at smokers in the precontemplation or contemplation stages of change.

The role of disease in smoking cessation is substantial but not well understood. Certain environmental changes following a serious illness may aid cessation and/or the information and fear arousal provided by serious illness may motivate serious quit attempts, but continued maintenance is problematic (Ockene et al. 1985; Perkins 1988). Approximately one-quarter to one-half of survivors of myocardial infarctions are abstinent from smoking at extended followups (Ockene et al. 1985; Perkins 1988; Rigotti and Tesar 1985). While rates of cessation are impressive in some studies of cardiac and other patients, results of smoking cessation interventions produce inconsistent intervention effects (Perkins 1988; US DHHS 1986b). Research needs to evaluate the

impact of diseases and of dimensions of diseases including chronic and acute events, severity, and symptom mitigation following cessation, all of which vary across different diseases.

Information about negative effects on the fetus may trigger cessation among pregnant women, perhaps by potentiating a more general awareness of smoking's dangers. Pregnancy does prompt some cessation or reduction relative to the "natural" population; however, relapse after delivery is high (US DHHS 1980b). Prevalence of smoking among pregnant women and historical shifts are documented in the first part of this Chapter.

Personal Characteristics and Social Context

Personal Characteristics

Less educated smokers who do stop tend to have higher rates of relapse and shorter periods of abstinence than do more educated persons. Stopping smoking is more common among those smokers with greater personal skills or socioeconomic resources (US DHHS 1982). Prospective studies indicate that education level, income, and skills in self-management or personal coping are significantly related to success in self-initiated efforts to stop (Blair et al. 1980; Gritz, Carr, Marcus, in press; Perri, Richards, Schultheis 1977). In a multivariate logistic regression analysis of 1985 NHIS data, blacks were significantly less likely than whites to quit smoking, regardless of SES or demographic factors (Novotny et al. 1988). Currently there are several research projects funded by NCI aimed at better understanding SES and ethnic differences in smoking that may eventually provide information to explain these differences.

The sections on the initiation of smoking and regular smoking discussed the roles of several personality variables such as extraversion and neuroticism. While associations between extraversion and smoking have been replicated over the years (Eysenck 1980), it and other broad personality variables have not shown strong effects in smoking cessation (Lichtenstein 1982). Some evidence indicates that persons high in extraversion and low in neuroticism are more able to stop smoking (US DHEW 1979a). Internal-external locus of control has been hypothesized to be related to cessation (internals more successful) but the evidence is inconclusive (US DHEW 1979a). Research on personal characteristics is now focusing on more situation-specific or interactional variables such as self-efficacy, stress, and social support (Cohen et al. 1988; Condiotte and Lichtenstein 1981; Shiffman 1982).

Stress has been shown to affect initiation of smoking and smoking rate, as well as relapse following smoking cessation (US DHHS 1988). It appears to be a factor especially influencing women's cessation (Abrams et al. 1987; Sorensen and Pechacek 1987), as well as their initiation of smoking (Mitic, McGuire, Neumann 1985). High levels of anxiety (Schwartz and Dubitzky 1968) and self-reported tendencies to smoke to relieve negative affect (Pomerleau, Adkins, and Pertschuk 1978) have been associated with reduced success in stopping. The link of smoking to stress and research demonstrating the role of social support in buffering stress (Cohen and Syme 1985)

suggest that women's cessation efforts may benefit from interpersonal support more than those of men (Fisher, Bishop 1986; Gritz 1982).

Gender differences in cessation have been a major focus in recent years (US DHHS 1980b). Sex differences in onset and prevalence and historical shifts in these differences are well documented in the first section of this Chapter. These differences and shifts have prompted a search for physiological (e.g., Silverstein, Feld, Kozlowski 1980) and especially psychosocial variables (US DHHS 1980b) that might account for them. No compelling factors have yet emerged to account for the historical shifts although changes in social acceptability and the women's rights movement seem likely candidates (US DHHS 1980b). It has also been suggested, on the basis of survey data, that women have lower rates of quitting smoking than do men (Remington et al. 1985). This interpretation has been criticized for failing to adjust male quit rates to reflect the proportion of men who switch to other tobacco products (Jarvis 1984).

Women's concern about weight gain associated with smoking cessation has received much recent attention (US DHEW 1980b; US DHHS 1988). The likelihood of women gaining weight following smoking cessation and the role of weight gain in precipitating relapse deserve further investigation (US DHHS 1988) as does the hypothesis that women prefer and are more successful in cessation programs that provide social support (e.g., from a group or counselor) (Fisher and Bishop 1986; Gritz 1982). Studies of sex differences in cigarette cessation programs yield equivocal results, and the issue of gender differences in cessation remains unresolved (US DHHS 1988).

Social Context Influences

Although findings published as early as 1971 indicated the importance of peer smoking in adult smoking and cessation (Eisinger 1971; Graham and Gibson 1971), these factors did not receive the attention they were given in discussions of smoking among adolescents. This difference reflected, perhaps, popular notions that adolescents are especially influenced by social forces such as peer pressure but that adults are more tied to psychological and physiological needs (US DHHS 1988). The popularity of self-management procedures (Fisher 1986) was manifest in smoking cessation programs of the 1970s that stressed the individual's control over smoking by manipulating its triggers or antecedents. Unfortunately, research directed at such procedures failed to yield appreciable improvements in program impacts (Lichtenstein 1982). This led to a search for important variables that had not been well researched. The 1980 and 1982 Surgeon General's Reports (US DHHS 1980b, 1982) identified social support as possibly important in mediating cessation among adults. A number of recent papers have sought to explore empirically the effects of social support on smoking cessation (e.g., Copotelli and Orleans 1985; Fisher, Lowe et al. 1982; Mermelstein, Lichtenstein, McIntyre 1983; Morgan, Ashenberg, Fisher 1988).

As recently reviewed by Lichtenstein, Glasgow, and Abrams (1986), social support measures have been repeatedly correlated with abstinence, but the addition of social support components to standard behavioral cessation programs has not yielded incremental gains on outcome. For instance, an emphasis on group cohesion to enhance social support led to initial but not long-term advantages over a control group receiv-

ing standard intervention (Etringer, Gregory, Lando 1984). Similarly, efforts to mobilize spouse support have been disappointing (McIntyre-Kingsolver, Lichtenstein, Mermelstein 1986).

An understanding of the lack of a relationship between intervention strategies that promote interpersonal support and long-term smoking cessation may be advanced by considering the nature of support and its functions in different stages of smoking cessation (Cohen et al. 1988). Interpersonal emotional support seems especially related to maintained abstinence in the first several months after cessation (Coppotelli and Orleans 1985; Mermelstein, Lichtenstein, McIntyre 1983; Morgan, Ashenberg, Fisher 1988; Ockene et al. 1982a). On the other hand, long-term abstinence of a year or more may be more closely tied to the number of smoking friends and relatives in the social network (Eisinger 1971; Graham and Gibson 1971; Mermelstein et al. 1986; Cohen et al. 1988; Smith 1988).

The parallel between the importance of social network smoking status for long-term abstinence and for development of smoking in adolescence is noteworthy. Just as the adolescent progressing toward regular use will tend to have friends who also are smokers, so the long-term abstainer may benefit from friends who also are nonusers. At the stages of the transition to regular smoking and of long-term maintenance of cessation, the importance of peers' behavior, either smoking or nonsmoking, seems greatest. It may be more effective to intervene to change norms and smoking behavior of networks than to teach supportive strategies to a few significant others.

One way to have an effect on smoking by changing norms and the smoking of social networks is through the workplace, and worksite programs are attracting considerable attention (See Chapters 6 and 7). Worksites differ in smoking prevalence and cessation rates as well as in norms for supporting cessation attempts (Sorensen and Pechacek 1986; Sorensen, Pechacek, Pallonen 1986). Programs aimed at worksite norms and general support for nonsmoking have reported substantial quit rates, even among smokers who did not join cessation clinics. Employees' ratings of management support for such programs were associated with cessation attempts and with ratings of social support for nonsmoking (Fisher, Bishop et al. 1988b; Fisher, Bishop et al. 1988c).

Summary

Cross-sectional data reviewed earlier in this Chapter demonstrate that smokers with lower levels of education are less likely to stop. Stopping smoking seems more common among smokers who have greater personal and socioeconomic resources. Educational level, income, and skills in self-management or personal coping are related to success in self-initiated efforts to quit. Less educated smokers who stop tend to have higher rates of relapse and shorter periods of abstinence than more educated persons. Conditioned responses to smoking cues and alternative coping skills are important in maintenance and avoidance of relapse.

The relationship of cognitive and decisionmaking determinants to smoking cessation has received increasing attention over the past 25 years. Cognitions about outcome expectations—the pros and cons of smoking and quitting—relate primarily to decisions

to attempt cessation; efficacy cognitions about perceived ability to manage temptations or urges are related primarily to maintenance or relapse. Prospective studies indicate that the presence of acute disease, which is likely to affect cognitions about the pros and cons of smoking, is related to cessation. Consistent with an overall increasing appreciation of the importance of nicotine in all stages of smoking, more dependent smokers are less likely to succeed in quitting. Interpersonal support helps smokers in the early stages of quitting, but current evidence indicates that a low density of smokers in the social network is decisive for long-term abstinence.

Summary of Changes in Knowledge About Determinants of Smoking Behavior

There has been a dramatic increase in research on the determinants of smoking over the past 25 years. In 1964, there were few studies; by 1979 the number had expanded to a few hundred studies; now there are probably thousands. This increase in research reflects both specific Federal initiatives to support smoking research and larger trends toward recognizing the important relationship of behavioral factors to disease and the effect of preventive strategies in reducing morbidity and mortality.

Several historical trends are predominant in considering all three major stages together--development, regular smoking, and cessation. A strong consensus has evolved on the critical role of nicotine in smoking. The pharmacologic effects of nicotine and the role of conditioning are now understood as integrated processes that combine to produce the addictive nature of cigarette smoking. Cigarette smoking is now recognized to develop over a series of stages with multiple and different determinants at each stage (Figure 8; Table 35). The interaction of determinants (e.g., conditioning and the pharmacologic effects of nicotine with social influences) has become more clearly articulated. Recognition of these stages and their multiple interacting causes currently guides the development of intervention and educational programs.

Smoking onset is associated with social influences, educational and economic disadvantage, alcohol and other drug use, and antisocial behavior.

Our increased knowledge of pharmacologic and psychosocial determinants has facilitated the development of interventions-behavioral or combined behavioral and pharmacologic-to aid cessation of regular smoking. Continued increases in our understanding of the stages of cessation combined with better validated interventions of various levels of intensity or cost will help to offer smokers more choices to meet their needs. There continues to be a gap in our knowledge of how to target intervention programs for the educationally and economically disadvantaged.

As described in the next two chapters, the knowledge gained about the determinants of smoking has guided interventions and campaigns to reduce the prevalence of smoking in adults from 40 percent in 1965 to 29 percent in 1987. It has led to promising prevention and cessation programs, which use existing community channels-media, worksites, schools, physicians' offices, and hospitals-to deliver low-cost but effective interventions (Chapter 6).

CONCLUSIONS

Part I. Changes in Smoking Behavior

1. Prevalence of cigarette smoking has declined substantially among men, slightly among women, and hardly at all among those without a high school diploma. From 1965-87, the prevalence of smoking among men 20 years of age and older decreased from 50.2 to 31.7 percent. Among women, the prevalence of smoking decreased from 31.9 to 26.8 percent. Smoking prevalence among whites fell steadily. Among blacks, the prevalence of smoking changed very little between 1965 and 1974; subsequently, prevalence declined at a rate similar to that of whites during the same period. Smoking prevalence has consistently been higher among blue-collar workers than among white-collar workers.
2. Annual per capita (18 years of age and older) sales of manufactured cigarettes decreased from 4,345 cigarettes in 1963 to 3,196 in 1987, a 26-percent reduction. Total cigarette sales increased gradually to 640 billion cigarettes in 1981 and then fell to 574 billion in 1987.
3. In 1965, 29.6 percent of adults who had ever smoked cigarettes had quit. This proportion (quit ratio) increased to 44.8 percent in 1987. The rate of increase in the quit ratio from 1965-85 was similar for men and women. The rate of change in quitting activity in recent years is similar for whites and blacks. From 1965-85, the quit ratio increased more rapidly among college graduates than among adults without a high school diploma.
4. Of all adults who smoked at any time during the year 1985-86, 70 percent had made at least one serious attempt to quit during their lifetime and one-third stopped smoking for at least 1 day during that year.
5. The age of initiation of smoking has declined over time, particularly among females. Among smokers born since 1935, more than four-fifths started smoking before the age of 21.
6. Trends in prevalence of cigarette smoking among those aged 20 to 24 years are an indicator of trends in initiation. By this measure, initiation has declined between 1965 and 1987 from 47.8 to 29.5 percent. Initiation has fallen four times more rapidly among males than among females. The rate of decline has been similar among whites and blacks. Initiation has decreased three times more rapidly among those with 13 or more years of education than among those with less education.
7. The prevalence of daily cigarette smoking among high school seniors decreased from 29 percent in 1976 to 21 percent in 1980, after which prevalence leveled off at 18 to 21 percent. Prevalence among females has consistently exceeded that among males since 1977. Prevalence was lower for students with plans to pursue higher education than for those without such plans. The difference in prevalence by educational plans widened throughout this period; in 1987, smoking rates were 14 percent and 30 percent in these two groups, respectively.
8. The best sociodemographic predictor of smoking patterns appears to be level of educational attainment. Marked differences in smoking prevalence, quitting, and

initiation have occurred and have increased over time between more and less educated people.

9. The domestic market share of filtered cigarettes increased from 1 percent in 1952 to 94 percent in 1986. The market share of low-tar cigarettes (15 mg or less) increased from 2 percent in 1967 to 56 percent in 1981, after which this proportion fell slightly and then stabilized at 51 to 53 percent. The market share of longer cigarettes (94 to 121 mm) increased from 9 percent in 1967 to 40 percent in 1986.
10. Between 1964 and 1986, use of smokeless tobacco (snuff and chewing tobacco) declined among men and women 21 years of age and older. However, among males aged 17 to 19, snuff use increased fifteenfold and use of chewing tobacco increased more than fourfold from 1970-86.
11. Differences in prevalence of cigarette smoking and smokeless tobacco use between young males and young females suggest that the prevalence of any tobacco use is similar in these two groups.
12. From 1964-86, the prevalence of pipe and cigar smoking declined by 80 percent among men.

Part II. Changes in Knowledge About Determinants of Smoking Behavior

1. Smoking was viewed as a habit in 1964 and is now understood to be an addiction influenced by a wide range of interacting factors, including pharmacologic effects of nicotine; conditioning of those effects to numerous activities, emotions, and settings; socioeconomic factors; personal factors such as coping resources; and social influence factors.
2. Since 1964, there has been a gradual evolution of understanding of the progression of smoking behavior through the broad stages of development, regular use, and cessation. Each of these stages is differentially affected by multiple and interacting determinants.
3. Views of determinants of smoking are affected by the predominating theoretical and methodological perspectives. In smoking, the earlier focus on broad, dispositional variables (e.g., extraversion) has given way to an emphasis on situation-specific and interactional variables; a focus on a search for a single cause has given way to a focus on multiple and interacting causes.

Appendix

Questions Regarding Smoking Status and Quitting from the 1986 AUTS

Smoking status (current, former, never) is decided from responses to the following two questions:

“Have you ever smoked at least 100 cigarettes in your life?”

“Do you smoke cigarettes now?”

Current smokers were then asked:

“Have you ever made a serious attempt to stop smoking cigarettes entirely?”

“Thinking of your last serious attempt to quit, how long did you stay off cigarettes?”

“How long ago did that attempt to quit begin?”

Current smokers who reported that they had never made a serious attempt were asked:

“Have you ever thought about quitting?”

“Would you try to quit if there was an easy way to do so?”

Questions Regarding Smokeless Tobacco Use

1986 AUTS

Ever use:

“Have you ever used (snuff and chewing tobacco asked separately) on a fairly regular basis?”

Current use:

“Do you use (snuff, chewing tobacco) now?”

1964, 1966, 1970, and 1975 AUTS

Ever use:

“Have you ever used snuff at all regularly?”

“Have you ever chewed tobacco regularly?”

Current use:

“Do you now use (snuff, chewing tobacco)?”

1985 NIDA National Household Survey on Drug Abuse

Ever and current use:

“On the average, in the past 12 months, how often, if ever, have you used chewing tobacco or snuff or other smokeless tobacco?” Responses included “never,” “almost daily,” “less than daily,” and “not in past year.”

1985 CPS

Current other tobacco use:

“Does (name) presently use any other form of tobacco, such as snuff or chewing tobacco?”

Current smokeless tobacco use:

“What other form(s) of tobacco does (name) presently use?” The categories “snuff,” “chewing tobacco,” “cigars,” “pipe tobacco,” or “other” were coded in response to this followup question.

1986, 1987, and 1988 BRFSS

Ever use:

“Have you ever used or tried any smokeless tobacco products such as chewing tobacco or snuff?”

Current use:

“Do you currently use any smokeless tobacco products such as chewing tobacco or snuff?”

1987 NHIS

Ever Use:

“Have you ever used chewing tobacco, such as Redman, Levi Garrett, or Beechnut?” “Have you ever used snuff, such as Skoal, Skoal Bandits, or Copenhagen?” In addition, those who answered “yes” to the above questions were asked, “Have you used chewing tobacco at least 20 times?”

Current use:

“Do you use (chewing tobacco, snuff) now?”

1970 NHIS

Current use:

“Do you use any other form of tobacco?” Respondents could answer yes or no to “snuff,” “chewing tobacco,” or “other.”

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