

At the same time, Secretary of Health, Education, and Welfare John W. Gardner urged the Congress to require “tar” and nicotine levels on packages and advertisements, with provision for adding to the label any ingredients subsequently identified as hazardous (42).

The PHS then began transmitting this information to the public. The PHS policy formulated on the evidence available was that there is no safe cigarette; the single best way to avoid the health hazards of smoking is to quit smoking, but for those unable to quit, a lower “tar” and nicotine cigarette would probably pose lower risks.

In 1972, the PHS classified some of the known chemical constituents of cigarette smoke into different risk categories. The compounds classified as “most likely” contributors to health hazards—“tar,” nicotine, and carbon monoxide—were recommended as primary targets for reduction (34).

In 1974 and again in 1975, Secretary of Health, Education, and Welfare Caspar W. Weinberger formally requested legislation authorizing the regulation of cigarettes by formulation of maximum permissible levels of hazardous ingredients (38, 39).

During this time, a number of health professional societies, voluntary health agencies, and concerned citizens’ groups also conducted public education activities on the health hazards of cigarette smoking.

The cigarette industry’s activities during this period probably also influenced changes in cigarette choice. In 1952 only 1.4 percent of cigarettes sold in the United States were filter tipped; by 1956, 29.9 percent of all cigarettes were filtered (27). In 1979, filtered cigarettes represented 89.2 percent of all brands marketed (24), and were used by 91.7 percent of regular smokers, according to data from the 1979 Smoking Supplement of the National Health Interview Survey. Advertising probably contributed to this rapid growth of filter-tipped cigarettes. As early as 1954, one brand’s advertising slogan read, “. . . filter gives greater protection against nicotine and tars than any other cigarette on the market today. It is the greatest health protection in cigarette history” (27). Another brand advertised the “Miracle of the Modern Miracle Tip” (even while the “tar” yield of that product increased 40 percent and the nicotine increased 70 percent over the 2-year period after the filter had been introduced) (27).

During the last decade, when systematic data on “tar” and nicotine yields of marketed cigarettes have been available, lower “tar” brands have been marketed in increasing proportions. Federal Trade Commission data show that cigarettes yielding 15 mg or less of “tar” constituted 15 percent of all brands in 1968, 20.4 percent in 1972, 30 percent in 1976, and 58.5 percent in 1979 (1, 2, 3, 5). Over the same time period, the proportion of all marketed brands that yielded 10 mg or less of “tar” increased from 4.7 percent in 1968, 9.9 percent in 1972, 12.4 percent in 1976, to 33.0 percent in 1979.

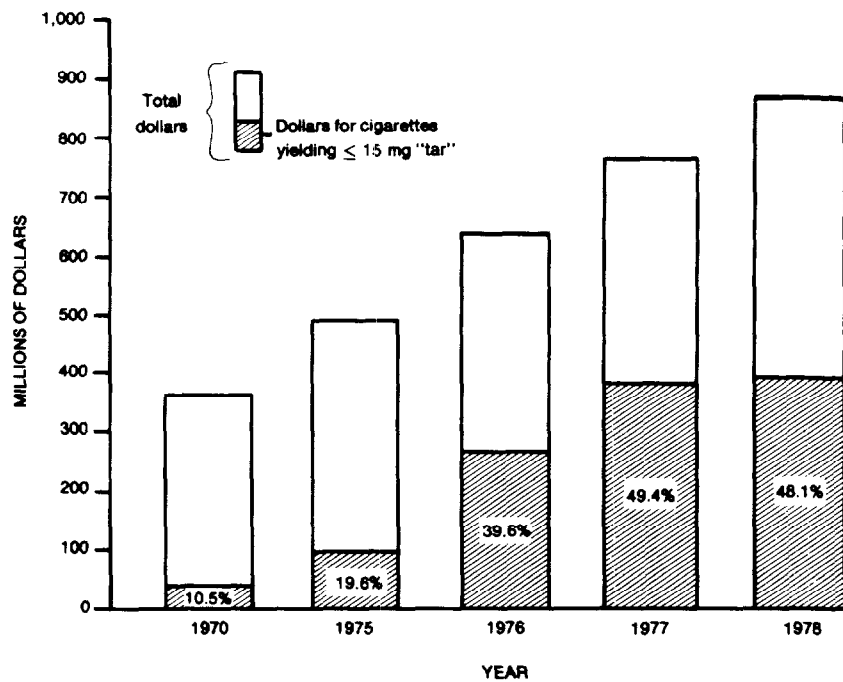


FIGURE 1.—Market share of dollars expended in the U.S. on advertising and promotion of cigarettes yielding ≤ 15 mg "tar" compared with total domestic cigarette advertising and promotional expenditures for years 1970, 1975, 1976, 1977, and 1978

NOTE: Percentages (shaded areas) refer to percent of each individual bar.
SOURCE: Derived from Federal Trade Commission (6).

Further, the marked increase in the last 5 years in the proportion of all cigarette sales accounted for by brands yielding ≤ 15 mg "tar" coincides with an increased percentage of total dollars spent for advertising and promotion of cigarettes yielding 15 mg or less of "tar" per cigarette. Figure 1 shows this increasing promotional effort. Since 1970, the absolute amount as well as the percent of all advertising dollars spent that went to advertising of "low tar" cigarettes has increased from approximately \$37,900,000, or 10.5 percent, in 1970 to \$421,300,000, or 48.1 percent, in 1978 (4). This increase occurred over the same period as the greatest increase in the lower "tar" brands' proportion of market sales.

Public Attitudes

Several surveys have examined the opinions of the general public about cigarette smoking.

Public surveys conducted by the National Clearinghouse on Smoking and Health examined the beliefs and attitudes of the U.S. public relative to cigarette smoking (28, 29, 36, 39, 41). These surveys indicated that the belief that cigarette smoking poses health hazards was increasing, not only among the general public but also among persons who continued to smoke. For example, in response to the statement "Smoking cigarettes is harmful to health," in 1964, 81.3 percent of the persons interviewed agreed and 13.1 disagreed, but in 1975, 84.9 percent agreed and 11.3 percent disagreed, with intermediate figures occurring in 1970 (29, 35, 39). Substantial differences were apparent when smoking history was considered. In 1964, former smokers believed smoking to be harmful in 90.5 percent of interviews, while only 69.5 percent of the current smokers believed smoking harmful; only 7.4 percent of former smokers did not agree that smoking is harmful, but 21.9 percent of smokers did not agree (29). This difference by smoking status in the percentage of interview subjects who believed smoking to be harmful persisted in 1975, but the difference narrowed (78 percent of current smokers agreed and 91.6 percent of former smokers agreed) (39). Very similar results were reported in a large survey in 1978, which found that 90 percent of all persons and 88 percent of smokers believed smoking to be harmful to health (?).

The percentage of smokers who agreed that "cigarette smoking frequently causes disease and death" increased from 52.2 percent in 1966 to 70.7 percent in 1975; the proportion of smokers who disagreed declined from 37.6 percent in 1966 to 22.3 percent in 1975. The percentage of the total population who had no opinion on this question and the preceding question declined from 9.1 percent to 5.3 percent and from 4.7 percent to 3.4 percent, respectively. This suggests that educational efforts may have reduced the size of the "undecided" population.

Other questions assessed the personal impact of beliefs about the health hazards of cigarette smoking. Although the percentage of smokers who reported being "slightly" concerned about the possible effects of smoking on their own health remained fairly constant from 1966 (18.1 percent) to 1975 (18.9 percent), the proportion of smokers who were "fairly" or "very" concerned increased from 29.1 percent in 1966 to 47.6 percent in 1975. The number of smokers "not concerned" declined from 52.5 percent in 1966 to 31.5 percent in 1975.

For the entire population, the proportion of interviewees who agreed that "smoking (is) enough of a hazard for something to be done about it" increased from 76.3 percent in 1966 to 84.0 percent in 1975.

Additionally, one question asked of current smokers in 1966, 1970, and 1975 provides information on smokers' perceptions of varying hazards by cigarette type (29, 36, 40). The number of smokers who felt that "all cigarettes (are) probably equally hazardous" declined from

57.8 percent in 1966 to 40.6 percent in 1975, while the number of smokers who believed that "some cigarettes (are) more hazardous than others" increased from 29.9 percent in 1966 to 49.1 percent in 1975. Among smokers who believed there was a difference among cigarette brands in health hazard, current smokers who believed their own cigarette brand was *less hazardous* than other kinds declined from 59.9 percent in 1966 to 49.7 percent in 1975, and smokers who believed their cigarette brand was *more hazardous* increased from 12.6 percent to 20.4 percent. Thus in the period from 1966 to 1975, there was an increasing proportion of smokers who believed different cigarettes posed varying health risks, but among these smokers the proportion who felt their cigarette was more dangerous to health than other cigarettes also increased. Unfortunately, identical large surveys to assess subsequent trends either in smokers' beliefs about differences in health risks or about the role of such beliefs in affecting cigarette product choice have not been published since 1975.

The Tobacco Institute, which represents the cigarette manufacturers, has also supported periodic surveys of attitudes. Their most recent survey is publicly available. Conducted in 1978 (18), this survey found that more than 90 percent of the U.S. population believed cigarette smoking is hazardous to the health of the smoker. Fully 61 percent believed that any amount of smoking is hazardous, up from 47 percent in 1970. This is in close agreement with surveys performed by the PHS in 1970. Further, in 1970 and 1978, 42 percent and 50 percent, respectively, of the population surveyed believed that smoking "makes a great deal of difference in longevity," a higher percentage than those believing the same thing about fatty diets (43 percent), alcohol consumption (39 percent), lack of exercise (34 percent), and overweight (24 percent).

The proportion of all persons who believe smokers "have" or "probably have" more of "certain illnesses" has increased from 56 percent in 1970 to 62 percent in 1978, when only 11 percent believed that smokers do not suffer more illness. Only 3 percent of people surveyed did not believe that cigarette smoking is a cause of disease, a figure that has not changed appreciably since 1970.

The 1978 Roper Survey found that the proportion of the population who believed others' smoking is hazardous to the nonsmoker's health had increased from 46 percent in 1974 to 58 percent in 1978. In 1978, the number who believed passive or involuntary smoking to be harmful was 69 percent among nonsmokers; while among smokers it was 40 percent. For the first time, the health effect of involuntary smoking was cited most frequently as a reason for legislation to ban cigarette smoking in public places.

The Cigarette Profile

The definition of cigarettes as "lower 'tar'" at ≤ 15 mg is arbitrary. Nonetheless, this breakpoint has gained general acceptance. The separation of ≤ 15 mg "tar" was meaningful when the vast majority of cigarettes were of higher "tar" yields; now, however, more than half of all the cigarettes sold in this country are at or below the level of 15 mg "tar" per cigarette. Many of the following measures use this breakpoint (≤ 15 mg). Special note should be taken, however, of the fact that both "tar" and nicotine yields vary continuously, and groupings by relative yield measurements do not automatically imply differences either in the type or in the magnitude of their biologic effects.

As discussed previously, the proportion of domestic commercially marketed cigarette brands that yield 15 mg or less of "tar" has increased over the last two decades to 58.5 percent in 1979 (1, 5). These figures, however, reflect industry marketing decisions and do not directly measure the smoking public's selection of a cigarette product. The market share of unit sales, however, reflects both the "tar" yield of each brand marketed and the smoking population's actual use of that product. Figure 2 shows the percentage of all U.S. cigarette sales (the "market share") represented by cigarettes containing 15 mg or less of "tar." Over the last decade the market share of sales accounted for by lower "tar" products has increased consistently since 1971. Cigarettes yielding < 15 mg "tar" accounted for only 2 percent of the cigarette market sales in 1967, but the comparable figure is projected to approach 50 percent in 1980 (24). This represents an almost 23-fold increase over 13 years. There has been a threefold increase over the last 5 years in the proportion of all cigarettes purchased and presumably consumed that are lower in "tar." Thus, cigarettes of 15 mg or less are not only available in the market, but they are also being chosen by the smoking population.

A different measure of cigarette choice is the sales-weighted average of "tar" or nicotine. The sales-weighted average is derived from the "tar" or nicotine yield of each cigarette available in the United States, weighted by the numbers of packages of each brand sold annually. The sales-weighted average values for "tar" and nicotine thus represent a hypothetical "average cigarette" smoked in the United States. Figure 3 shows the trend over time of the sales-weighted average cigarette's "tar" or nicotine content (43).

The yield of "tar" declined from 38 mg in 1954 to 19 mg in 1975, while that of nicotine declined from 2.3 to 1.3 mg per cigarette. The decline in both "tar" and nicotine approximated 50 percent over this 20-year period. Data provided from a single source of continuous measurement as shown in Figure 4 indicate that the decline in "tar" has continued in recent years, although at a slower rate than that observed from 1954 to 1965. It is projected that the sales-weighted

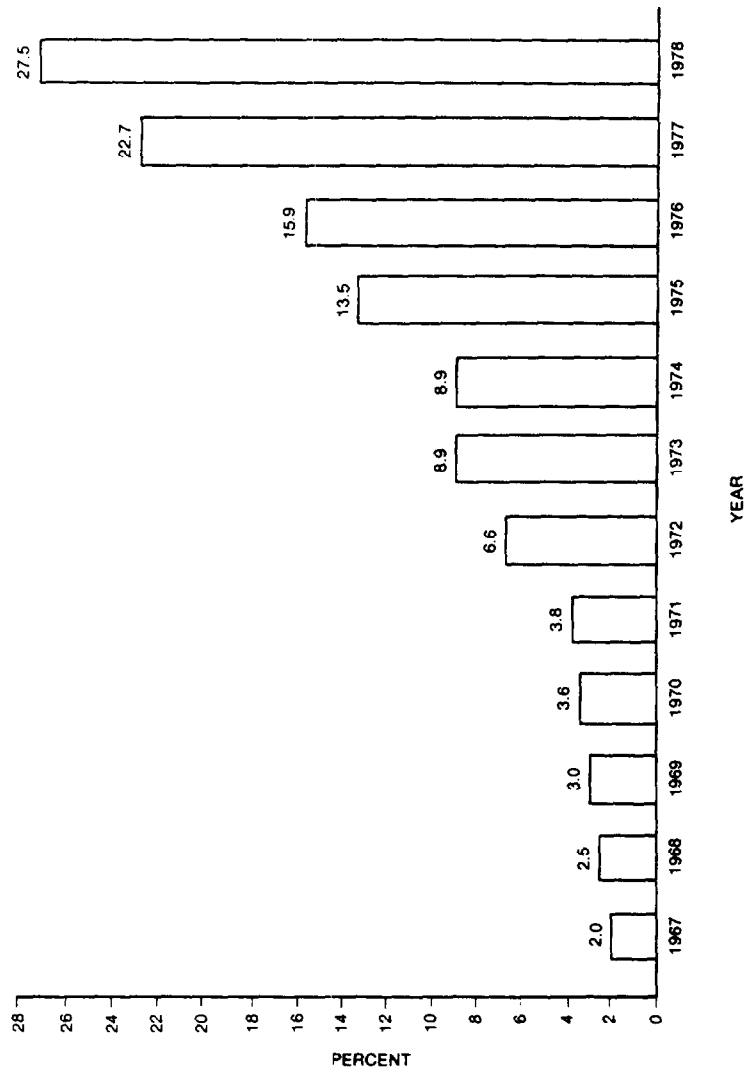


FIGURE 2.—Domestic market share of cigarettes yielding ≤ 15 mg "tar," 1967–1978

NOTE: 1979 data unavailable.

SOURCE: Derived from Federal Trade Commission (6).

average "tar" and nicotine in 1980 will be less than 14 mg and 1 mg, respectively.

Examination of the ratio of "tar" yield to nicotine yield per cigarette is interesting in light of the hypothesis that nicotine, perhaps in combination with organoleptic compounds, exhibits a threshold value for acceptability to the consumer. This threshold may have been

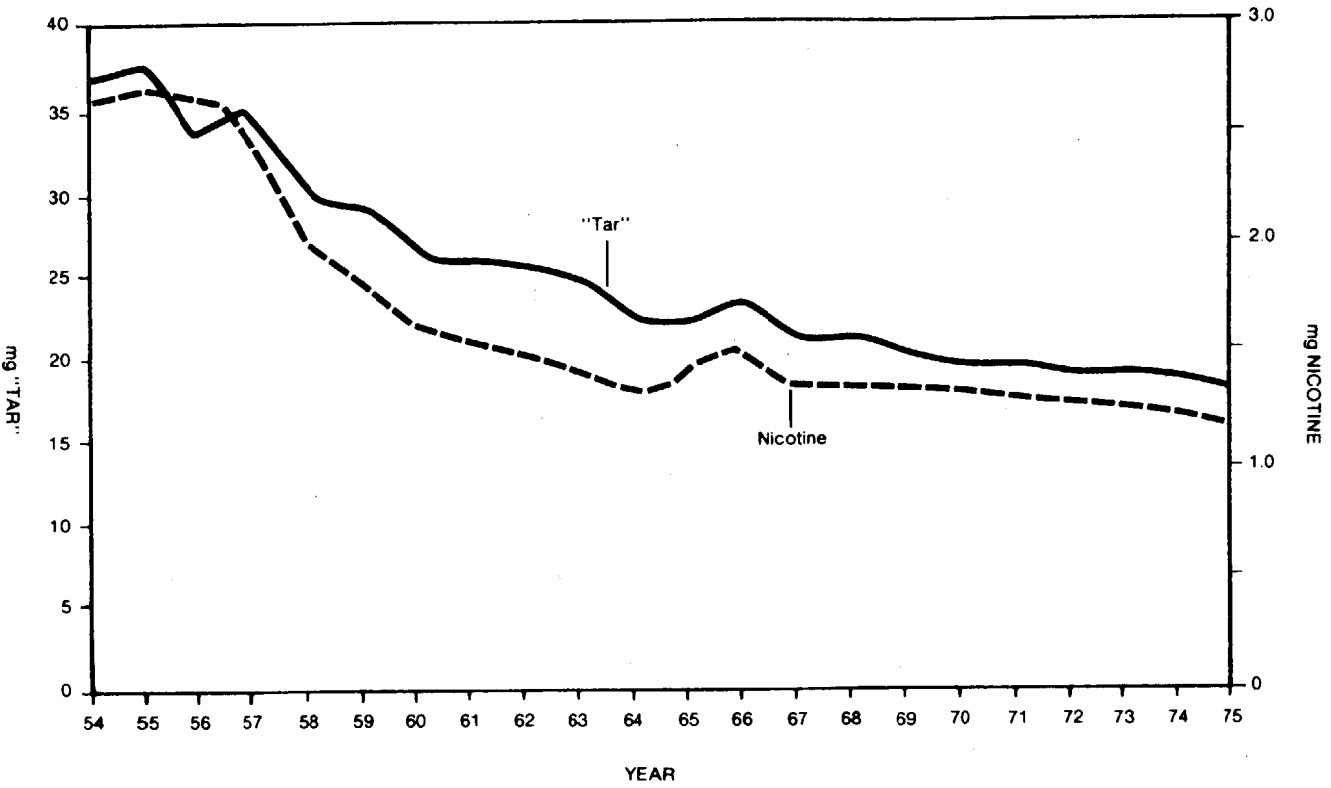


FIGURE 3.—Sales-weighted averages of "tar" and nicotine per cigarette consumed in the U.S., 1954-1975
 SOURCE: Wakeham (49).

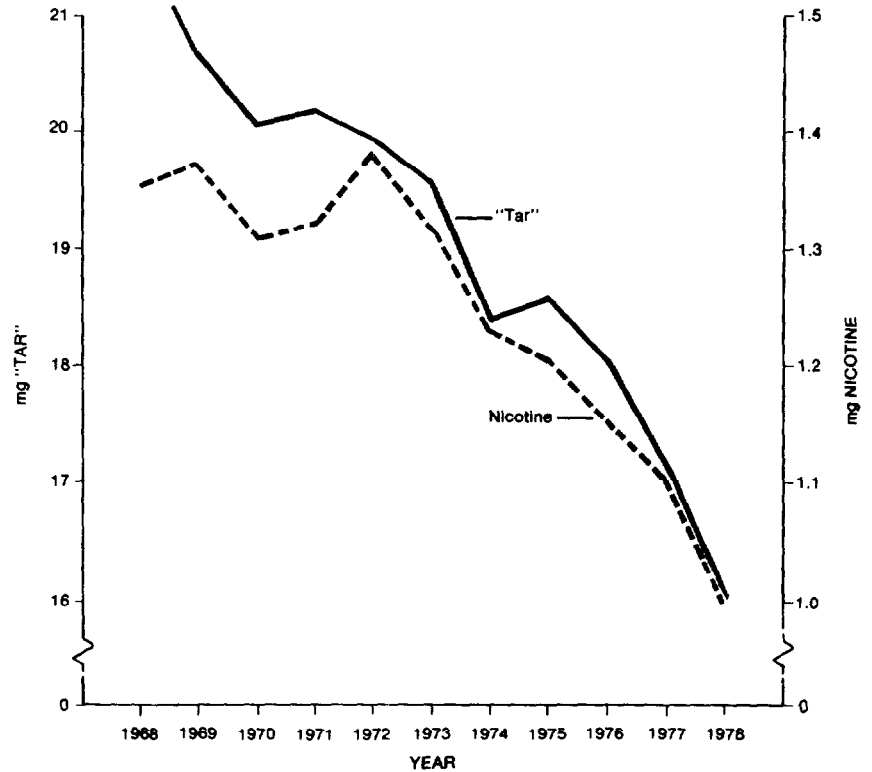


FIGURE 4.—Sales-weighted averages of “tar” and nicotine per cigarette consumed in the U.S., 1968–1978

SOURCE: Derived from Federal Trade Commission (6).

reached (at 1.4 mg nicotine) in certain countries (e.g., England) (19). In the United States, the sales-weighted average nicotine yield per cigarette has continued to decline below the level of 1.4 mg (Figures 3 and 4). Figure 5 presents the “tar” to nicotine ratio of the sales-weighted “average cigarette” annually from 1968 to 1978. The “tar” to nicotine ratio has ranged from 16 to 14.3, with a maximum variation of less than 10 percent of the ratio’s absolute value. There has been no systematic difference observed between the declines of “tar” and nicotine of the average cigarette product over the last decade.

The previous discussion has focused on “tar” yields and, to a lesser extent, on nicotine yields. The relationship between “tar” and nicotine is a direct one, as is shown in Figure 6 (5). The correlation coefficient for these two variables is 0.967, based on data from the Federal Trade Commission report (5). Similarly, the correlation coefficient reported by the Oak Ridge National Laboratory was 0.917 (12). The description

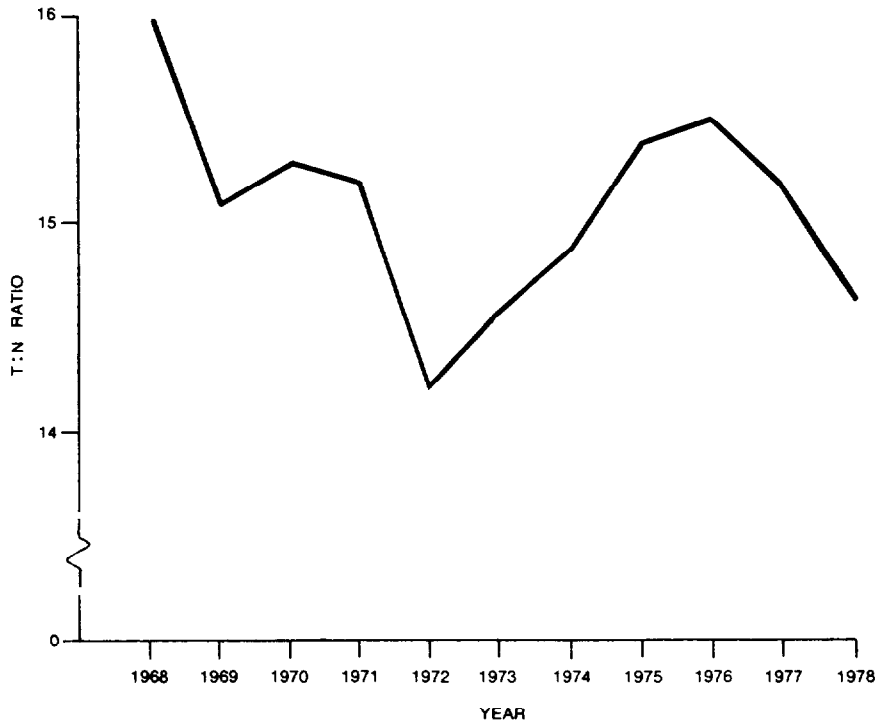


FIGURE 5.—Ratio of “tar” to nicotine based on sales-weighted averages of cigarettes consumed in the U.S., 1968–1978

SOURCE: Derived from Federal Trade Commission (6).

of cigarette products by “tar” yield can thus be assumed to approximate closely the pattern that would result from a similar analysis by nicotine yield. There appears to be a similar relationship between “tar” and carbon monoxide yields, as Figure 7 shows. There is, however, a systematic difference between the “tar” and carbon monoxide yields of filtered and nonfiltered cigarettes (12). Filtered cigarettes tend to have a higher carbon monoxide yield than do nonfiltered cigarettes of the same “tar” yield. Nonetheless, there appears to be a strong association between “tar” and carbon monoxide yield by cigarette variety, with a correlation coefficient for “tar” and carbon monoxide of 0.803.

Data from the Department of Agriculture describe tobacco weight per cigarette over time (24). Figure 8 shows tobacco weight per cigarette in relation to “tar” yield, with both values shown as a percent of its value in calendar year 1967. While “tar” content per cigarette declined by 32.2 percent and nicotine declined by 25.6 percent since 1968, the weight of tobacco per cigarette declined by 23.8 percent over the same period (24). This suggests that a significant portion of the

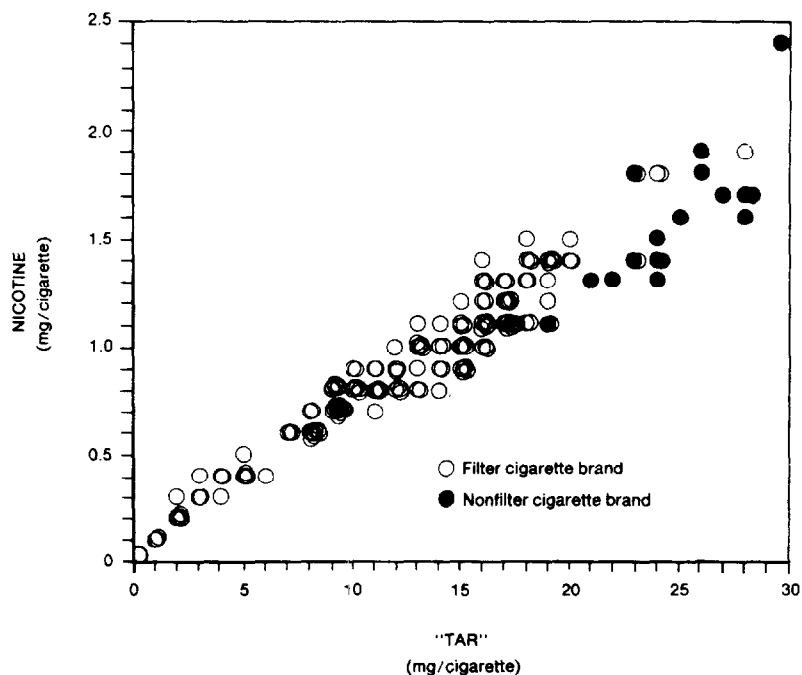


FIGURE 6.—Delivery of nicotine as a function of “tar” of commercial cigarettes, U.S.

SOURCE: Federal Trade Commission (5).

decline in the “tar” and nicotine yield in recent decades may have resulted directly from a decrease in the amount of organic material (tobacco) available to be burned in the cigarette.

Data available from Canada suggest that the observed decline in that country’s officially measured “tar” and nicotine yields per cigarette at least in part results from a decline in the total number of puffs taken per cigarette during machine measurements of smoke yield (13). Although detailed information on the number of puffs taken per cigarette is not available for U.S. cigarettes, the FTC reports on “tar” and nicotine yields of U.S. cigarette brands suggest a similar factor may be operating in the decline of “tar” and nicotine yield measurements. The FTC testing method specifies that cigarette “tar” and nicotine yields be determined by smoking the cigarette to a minimum butt length of 23 mm, or to the filter and overwrap length plus 3 mm if in excess of 23 mm, while holding constant the puff volume, duration, and interval. Since 1967, the filter and overwrap length of U.S. cigarettes appears to have increased. In 1967, the proportion of cigarette brands that were smoked down to a butt length

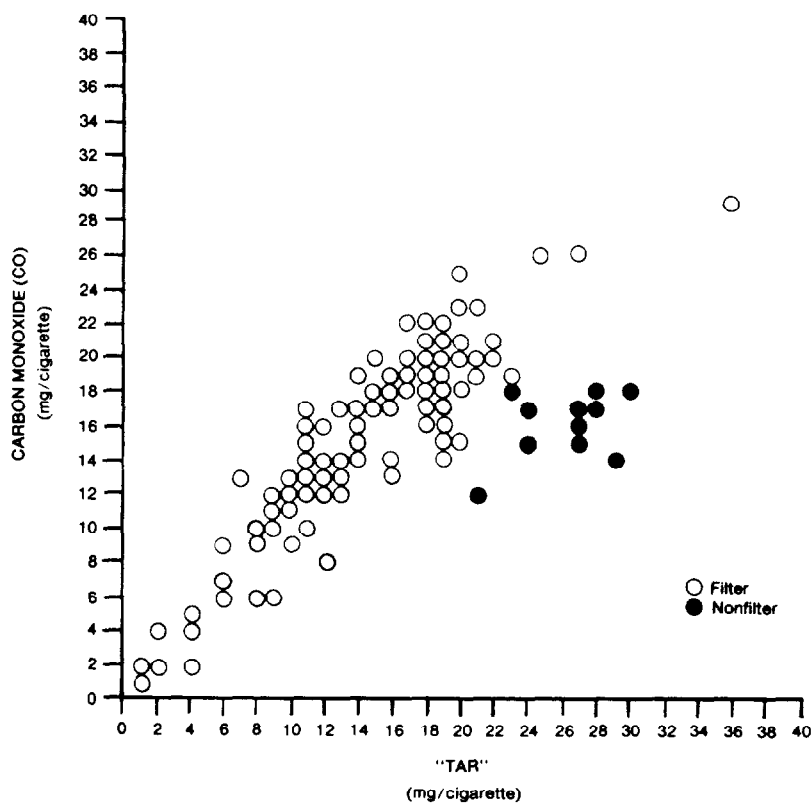


FIGURE 7.—Delivery of carbon monoxide as a function of "tar" of selected U.S. commercial cigarettes

SOURCE: Derived from Jenkins (18).

of 23 mm was 26 percent, but in 1979 the comparable figure was only 10 percent. Conversely, the number of all brands tested that were smoked to a butt length 30 mm or longer increased from 21 percent in 1967 to 77 percent in 1979. Thus, the butt and overwrap lengths of U.S. brands appear to have increased. The absolute contribution of this factor in the total decline in "tar" and nicotine yields over recent years, however, is undetermined.

Cigarette Choice and Smoking Behavior

Overview

Previous examinations of many parameters measuring the patterns of cigarette smoking in the United States have been published (25, 26). They documented the continuing decline over the last several decades

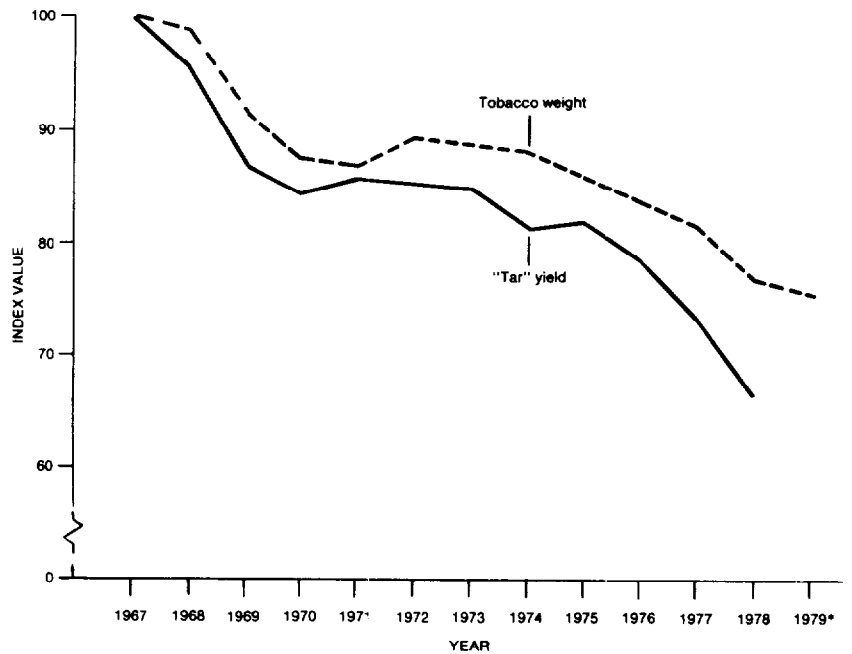


FIGURE 8.—Index of average "tar" and tobacco per cigarette, annually, 1967–1979

* Data estimated or unavailable.

NOTE: Base year 1967 = 100.

SOURCE: U.S. Department of Agriculture (24).

in the proportion of men who were regular cigarette smokers, from 52.6 percent in 1955 to 37.0 percent in 1978. These publications also reported a similar but smaller decline since 1965 in the proportion of women who were current regular smokers, varying between 32 and 33 percent from 1965 to 1976, but declining to less than 30 percent in 1978. These trends continued through 1979, with a total prevalence of smoking at 32.5 percent of all adults, or 36.1 percent for males and 29.4

percent for females, according to data from the 1979 Smoking Supplement of the National Health Interview Survey. Interpretation of these cross-sectional data is difficult since changes in prevalence figures represent the net effect of several variables, including the entry of new smokers, the removal of smokers who quit, the reentry of "relapsing" smokers, and the removal of smokers by death or emigration. The data show an increasing proportion of former smokers among the population, suggesting a significant role of cessation of smoking in the observed decline in the prevalence of adult smoking, particularly among males (25). The 1979 prevalence of regular smoking at 32.5 percent of all adults represents the lowest total figure in more than four decades.

Accompanying this decline in the prevalence of smoking among adults has been a decrease in the per capita consumption of cigarettes in recent years (Figure 9) and in the per capita consumption of pounds of tobacco in any form or as cigarettes (Figure 10). After peaking at 4,336 in 1963, the consumption of cigarettes per adult decreased (Figure 11) and is estimated to be 3,880 in 1980, its lowest point since 1950 (24). The decrease in per capita consumption of pounds of tobacco began in the 1940s and continues to the present. The relatively greater decrease in total pounds of tobacco consumed per capita in the form of cigarettes than in tobacco consumed per capita in any form since 1978 may result from an increasing use of tobacco in other forms, such as snuff or chewing tobacco, in addition to the previously mentioned decline in the estimated weight of tobacco per cigarette.

The preceding parameters are aggregate measurements. Other more detailed sources of evidence, however, suggest that the average number of cigarettes smoked daily by regular smokers may, in fact, be increasing. These data include evidence suggesting that the proportionate decrease in percentage of the adult population who smoke exceeds the reported decrease in per capita cigarette consumption for the total population (25). Further, when figures on total annual per capita cigarette consumption are divided by the estimated number of smokers in the United States as derived from reported prevalence figures, the estimated average daily intake for regular adult smokers was 11.5 cigarettes in 1935, 26.2 cigarettes in 1955, and 33.3 cigarettes in 1979 (26). These data should be interpreted in light of a strong tendency for smokers to round off their reported number of cigarettes smoked to one pack per day. Of the approximately 24,000 persons surveyed for the Smoking Supplement of the National Health Insurance Survey, fully 35.2 percent of all regular smokers reported smoking one pack, or exactly 20 cigarettes per day. Nonetheless, the proportion of all current regular smokers who consume 25 or more cigarettes per day has increased for both sexes (26). These findings could result from a higher rate of quitting by light smokers, from an actual increase in the number of cigarettes consumed by continuing

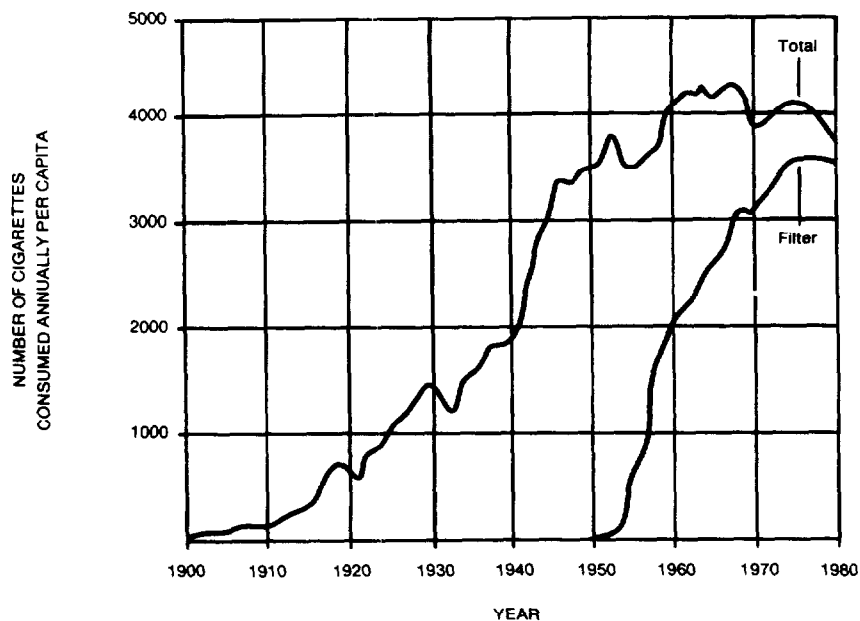


FIGURE 9.—Annual per capita consumption of total cigarettes and filter-tipped cigarettes in the U.S., for persons aged 18 and older, 1900–1979

SOURCE: U.S. Department of Health, Education, and Welfare (26).

smokers, from the entry of new smokers who consume more cigarettes per day, or from some combination of these factors. A number of sources of information exist on the issue of the role of nicotine as the major pharmacologic agent in maintenance of smoking, including prospective studies (8, 9, 10) and short-term experimental studies (20, 21). A more detailed discussion of the possible role of lower nicotine yields in increasing the daily number of cigarettes smoked can be found in the Behavioral Aspects section of this Report. To summarize, the available evidence is consistent with the conclusion that the average daily number of cigarettes smoked by current regular smokers has increased. Although a role for “tar” or nicotine yields in this change has been postulated, whether the role is primary and by what mode of action are not clearly understood.

Several surveys in the 1970s examined the percentages of recent smokers who recently attempted to quit and of those who succeeded. Data from the National Center for Health Statistics indicate that men and women were not only similar in the probability of attempting to quit but also indistinguishable in the probability of quitting successfully (26).

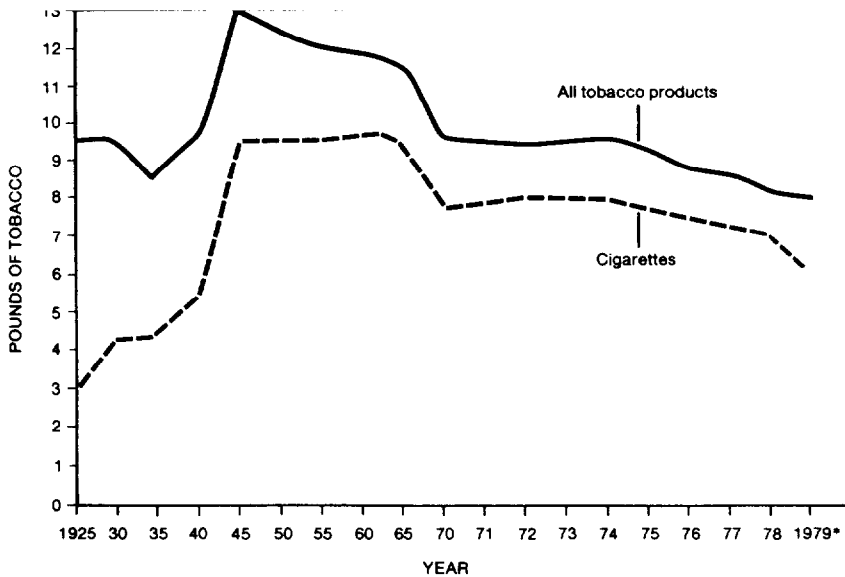


FIGURE 10.—Annual per capita consumption of tobacco products in the U.S. (including overseas forces) for persons aged 18 and older, 1925-1979

* 1979 data subject to revision.

SOURCE: U.S. Department of Agriculture (22, 23, 24).

Relationship of “Tar” and Nicotine Yields to Smoking Behavior

As indicated previously, this section focuses upon the currently available “tar” and nicotine data for adults. The discussion presents (1) a description by demographic characteristics of the current use of cigarettes of different yields, as well as changes over time where available; (2) data on the effect of varying “tar” or nicotine yields on consumption patterns; and (3) data defining the role of varying yields of “tar” and nicotine in cessation of smoking. The following data are from the National Center for Health Statistics’ Smoking Supplement to the Health Interview Survey and include discussion of the information on “tar” and nicotine levels of the cigarettes smoked by adolescents, as collected by the National Institute of Education (17).

As noted previously, the selection of categories of “tar” or nicotine yields is arbitrary; in fact, both are continuous variables. The categories of yield used in the following analysis do not imply that the cigarettes within those categories differ either qualitatively or quantitatively from the cigarettes in other categories. Rather, the groupings permit convenient presentation of data on a cigarette’s yield of “tar” and nicotine relative to other available cigarettes.

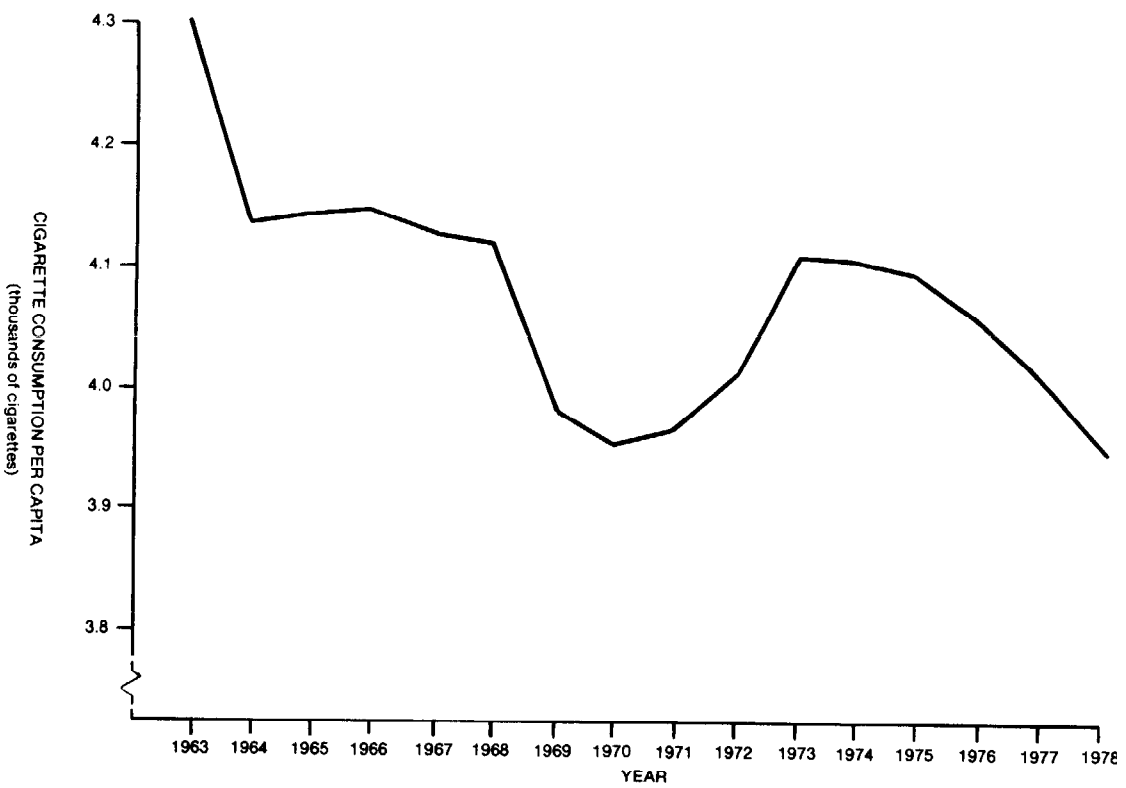


FIGURE 11.—Annual per capita consumption of cigarettes in the U.S. (including overseas forces) for persons aged 18 and older, 1963-1978

SOURCE: U.S. Department of Agriculture (24).

TABLE 1.—Estimated percentage distribution of current regular smokers by “tar” yield of primary brand of cigarette, by sex, race, age, and education, adults, U.S., 1979

	“Tar” yield of primary brand			
	<10 mg	10-14 mg	15-19 mg	>20 mg
Total	13.0	20.3	57.3	9.4
Sex				
Males	11.1	17.3	59.1	12.5
Females	15.0	23.6	55.4	6.0
Sex and race				
Males, white	12.2	18.0	57.4	12.5
Males, black	3.2	12.1	71.5	13.2
Females, white	16.0	24.5	53.6	5.9
Females, black	7.6	15.0	69.8	7.6
Age in years				
17-24	9.6	22.6	66.9	1.0
25-44	13.5	20.8	58.9	6.9
45-64	13.9	18.2	50.0	17.8
≥ 65	15.6	19.4	50.0	15.0
Years of education				
0-8	7.0	16.0	61.0	16.0
9-11	8.6	16.3	65.4	9.6
12	12.6	21.2	57.8	8.4
13-15	18.3	24.8	49.4	7.4
≥ 16	23.9	24.7	45.0	6.4

SOURCE: Based on data from the 1979 Smoking Supplement of the National Health Interview Survey.

The percentage distribution of current regular smokers by “tar” level of their primary brand of cigarettes is presented in Table 1. Although not shown, the same patterns are observed among five arbitrary categories of nicotine yield (based on data from the 1979 Smoking Supplement of the National Health Interview Survey).

As noted previously, both 1978 and 1979 data on brands were coded to 1978 FTC values for “tar” and nicotine yield. For this reason, and because the cigarette samples tested in 1978 were obtained in 1977, the data that follow probably report slightly higher values of “tar” and nicotine yields than were actually being used during these periods. A further discussion of the differences in “tar” and nicotine yields of cigarette varieties reported by the FTC in 1978 and 1979 appears in the addendum to this section. Overall, 33.3 percent of current smokers use lower “tar” cigarettes (yielding less than 15 mg of “tar”) and 66.7 percent use higher “tar” cigarettes. Females smoke lower “tar”

cigarettes in higher proportions than do males. This difference in choice of product by "tar" or nicotine level also persists when examined by race. Whites smoke lower "tar" products in greater proportions than do blacks, regardless of sex. For both sexes, white smokers choose lower "tar" products approximately twice as frequently as do black smokers of the same sex. While the percentage of all smokers using cigarettes yielding <10 mg of "tar" increases within age cohorts, there is no clear relationship of age cohort to those smoking cigarettes yielding 10 to 14 mg of "tar." Among smokers of the two highest "tar" categories, there is a clear difference by age; the proportion of smokers choosing cigarettes yielding 15 to 19 mg of "tar" decreases with age, but the percentage using the highest "tar" (≥ 20 mg) cigarettes increases with age. The trend to increasing use of highest yield products among older cohorts is clearer than the corresponding trend to higher proportions using the lowest "tar" yield products. The correlation of older ages and more frequent use of the highest "tar" products could result from a cohort effect among older smokers who continue to use the higher "tar" cigarettes that they used when they first began to smoke.

Educational level, as measured in years of education completed, is strongly associated with the percentage of smokers who use low "tar" products. In considering products of 15 to 19 mg "tar" yield, an inverse relationship with educational level in the proportion of smokers using that product is observed, and a similar pattern is observed for the extremely high "tar" products, yielding 20 mg or more of "tar" per cigarette. (This inverse relationship persists even when age is controlled, although the data are not shown in the table.) A similar though less clear trend is observed with an increasing proportion of smokers choosing lower "tar" products among higher income groups (data are not shown).

The lack of correlated health endpoint information or detailed data on knowledge and beliefs precludes interpretation of these data as cause or effect, but the data do provide a description of the observed differences in product choice by "tar" or nicotine yields.

The percentage of adults of both sexes who use lower "tar" products has increased over time. These increases are observed in both races for the time period shown. This is consistent with the previously cited market data on the sales of lower "tar" products. The finding that only 33.3 percent of adult smokers in 1979 used cigarettes yielding less than 15 mg "tar," although these products accounted for almost 40 percent of the market, does not establish a greater daily number of cigarettes smoked by users of the lower "tar" products, because gross sales figures include purchases by smokers not included in this analysis (e.g., institutionalized persons including the military forces, adolescent smokers, occasional smokers, and interviewees whose smoking status is unknown).

Comparison of changes in the "tar" level of chosen brand is possible for the years 1970 and 1979. The proportion of male smokers choosing cigarettes yielding less than 10 mg "tar" increased from 1.1 to 11.1 percent and females choosing these brands increased from 2.7 to 15 percent. The use of high "tar" (≥ 15 mg) declined from 1970 to 1979 from 89.4 to 71.6 percent for males and from 90.5 to 61.4 percent for females (based on data from the 1979 Smoking Supplement of the National Health Interview Survey and from U.S. Public Health Service (37)).

Analysis of cigarette choice by nicotine yield shows the same patterns by demographic variables, with the proportion of current regular smokers who use lower nicotine products increasing with increasing age and the proportion of smokers using products with higher nicotine yields also increasing with increasing age. Whites use lower nicotine products in greater proportions than do blacks.

A further measure of consumption suggests that the actual toxic exposure of smokers by age, race, and sex may, however, differ significantly from that implied by consideration only of cigarette "tar" or nicotine yield. Table 2 shows the estimated mean daily "tar" or nicotine dose derived from combining the reported yield per cigarette and the number of cigarettes smoked daily by each individual in that group. There is a consistent trend toward higher dose with increasing age of smokers for race and sex groups. Although these figures do not consider possible systematic differences in the style of smoking (e.g., butt length unsmoked, frequency and depth of inhalation, etc.), they do illustrate marked differences in an estimate of mean dose of "tar" or nicotine by age, sex, and race. It shows that if all smokers smoked in the same manner, blacks would nonetheless experience a lower daily dose of "tar" and nicotine than whites. Thus, although blacks smoke higher "tar" products in higher proportions, the lower numbers of cigarettes they smoke daily may result in a lower average daily dose of smoke constituents.

More recent data on cigarette brand choice reveal changes. Table 3 presents data on the percentage distribution of smokers by "tar" and nicotine yield of cigarettes in the period July through December 1978 versus 1979. These two surveys, each of which represents approximately 12,000 interviews, showed a shift in the percentage of persons using lower "tar" (< 15 mg) cigarettes from 28.8 percent in 1978 to 33.7 percent only a year later; a similar downward shift was observed at nicotine yields below the highest category. Such a shift might be caused by either an actual brand change or an involuntary downward "creep" due to reduction in the "tar" or nicotine yield of the product by the manufacturer. As noted previously, however, the cigarette brands reported were coded in both 1978 and 1979 by the 1978 FTC "tar" and nicotine yield values. Thus, the downward shift observed over this 1-

TABLE 2.—Mean daily dose* of “tar” or nicotine for current regular smokers by race, sex, and age, U.S., 1979**

		Mean daily dose (mg/day)	
		“Tar”	Nicotine
Males		406	26.3
White	All ages ≥ 17	417	26.9
	17-24	309	20.2
	25-44	416	27.1
	45-64	482	31.3
	65+	424	25.1
Black	All ages ≥ 17	308	21.1
	17-24	234	17.4
	25-44	294	20.7
	45-64	387	26.5
	65+	299	14.1
Females		316	21.0
White	All ages ≥ 17	324	21.4
	17-24	286	19.1
	25-44	326	22.0
	45-64	359	23.3
	65+	289	17.8
Black	All ages ≥ 17	244	16.9
	17-24	204	14.6
	25-44	243	17.0
	45-64	262	17.5
	65+	392	28.0

*Number of cigarettes consumed multiplied by the level of “tar” or nicotine.

**Last two calendar quarters only.

SOURCE: Based on data from the 1979 Smoking Supplement of the National Health Interview Survey.

year interval in cigarette “tar” and nicotine yield represents an actual change in the brand of cigarettes used by smokers.

Similar patterns have been observed in smoking among adolescents. In a 1979 national telephone interview survey of 2,639 adolescents, the percentage of all adolescent smokers who selected brands of lower “tar” (≤ 15 mg) had increased from 6.7 percent observed in 1974 for both sexes (Table 4) to 33.5 percent in 1979. Direct comparison of the percentage distribution of “tar” yield among adolescents with that observed among adults is complicated by different groupings of “tar” level and by different definitions of “regular” smokers in the two surveys (after having smoked 100 cigarettes, “regular” smokers were defined for adolescents as “smoking regularly each week”; for adults, as any positive response to “when did you start smoking regularly?”). Nonetheless, a similar trend toward increasing use of lower “tar” products is observed among adolescents and adults.

Table 5 presents data on brand choice by “tar” level among adolescents of different ages from the largest recent smoking survey of adolescents. The small numbers of smokers, and the relatively large numbers of individuals who are unclassifiable, make interpretation of

TABLE 3.—Estimated percentage distribution of current regular smokers by “tar” and nicotine yield of primary cigarette used, U.S., 1978* and 1979*

“Tar” yield	Percentage in 1978	Percentage in 1979
≤5 mg	4.2	4.0
5-9 mg	7.5	9.0
10-14 mg	17.1	20.7
15-19 mg	61.4	56.8
≥20 mg	9.8	9.6

Nicotine yield	Percentage in 1978	Percentage in 1979
<0.5 mg	4.3	4.2
0.5-0.9 mg	26.7	31.7
1.0-1.2 mg	41.1	37.7
1.3-1.6 mg	26.7	25.3
≥1.7 mg	1.2	1.2

*Last 2 calendar quarters only.

SOURCE: Based on data from the 1979 Smoking Supplement of the National Health Interview Survey.

TABLE 4.—Estimated percentage distribution of regular smokers by “tar” yield, adolescents aged 12-18, U.S., 1974 and 1979

“Tar” yield	Percentage boys		Percentage girls		Percentage both sexes	
	1974	1979	1974	1979	1974	1979
≤10 mg	0.5	2.5	0.5	12.3	0.5	7.8
11-14 mg	5.6	29.5	6.8	22.6	6.2	25.7
15-19 mg	73.7	60.8	74.4	59.5	74.0	60.1
≥20 mg	20.3	7.4	18.2	5.5	19.3	6.3

SOURCE: National Institute of Education (17).

product choice among adolescents by age group difficult. Thus, a clear definition of the relationship of the adolescent smoker’s age to choice of cigarette smoked is not possible from this series.

In Table 6, the mean age of onset of smoking cigarettes for all current regular smokers is 18.2 years. Although most of the data in the National Health Interview Survey Smoking Supplement involves recall, the mean age at onset is perhaps the most subject to bias, whether in remembrance or in reporting preference. Nonetheless, the reported age at onset of smoking is higher among older age groups. This might reflect (1) a real change in recent years in the age at which younger cohorts start to smoke, (2) the addition of a few late-starting smokers during the extra years “at risk,” causing a higher reported age at onset among older cohorts, or (3) an effect of different mortality rates for early versus late beginning smokers. The demonstration that the average age at onset of smoking among females has declined from 35 years among women born prior to 1900 to 16 years among women

TABLE 5.—Percent distribution of adolescent regular smokers by “tar” yield of primary brand, by sex and age, U.S., 1979

Boys age group	<u>“Tar” yield of primary brand</u>							
	≤15 mg		>15 mg		Unspecified		Don't know	
	%	n	%	n	%	n	%	n
12-14	11.1	2	55.6	10	27.8	5	5.6	1
15-16	29.4	15	62.7	32	7.8	4		
17-18	26.4	19	58.3	42	15.3	11		
19	23.6	13	63.6	35	12.7	7		

Girls age group	<u>Nicotine yield of primary brand</u>							
	≤15 mg		>15 mg		Unspecified		Don't know	
	%	n	%	n	%	n	%	n
12-14	25.0	6	70.8	17	4.2	1		
15-16	23.9	11	66.5	26	13.0	6	6.5	3
17-18	34.7	34	62.0	51	12.2	12	1.0	1
19	30.5	18	60.8	30	18.6	11		

SOURCE: National Institute of Education (17).

born between 1951 and 1960 (26) explains a portion of the observed differences in age at onset by cohort. Older cohorts may not fit the assumption that the survivors within that cohort are representative of all individuals within the original cohort. The amount and direction of the effects of (1), (2), and (3) remain to be defined. However, there is a general trend that, for each age cohort, the higher the “tar” level of the cigarette currently smoked, the younger the reported age of onset of smoking. The same observation is also found in the relationship between nicotine yield and age of onset, except that an older age of onset is indicated for those smoking the highest nicotine yield (>1.7 mg) cigarettes, which value is based on a small sample size.

Consumption Patterns

In attempting to define the role of “tar” or nicotine yield on the daily number of cigarettes smoked, adult regular smokers were divided into three levels of daily consumption by approximate quintiles of “tar” and nicotine yield of primary brand (Table 7). This Table shows that the percentage distribution of smokers by number of cigarettes per day does not exhibit an association with “tar” or nicotine level of cigarette used. This Table provides evidence that there is not a significantly greater proportion of “heavy” smokers among smokers of the lowest “tar” and nicotine cigarettes than there is among smokers of the highest “tar” and nicotine cigarettes. It does not, however, disprove the theory that individual smokers may increase their daily number of cigarettes smoked when they switch to a cigarette with lower “tar” or nicotine yield. That is, the absolute number of cigarettes

TABLE 6.—Mean age at onset of regular smoking by “tar” or nicotine yield of primary brand, by age at interview, current regular smokers, U.S., 1979

“Tar” yield	Age at interview						
	Total	17-24	25-34	35-44	45-54	55-64	65+
<5 mg	19.6	16.6	18.3	19.5	20.3	19.2	23.8
5-9 mg	18.8	16.3	17.8	18.8	19.6	20.7	24.1
10-14 mg	18.5	16.2	18.1	18.7	19.3	20.6	22.4
15-19 mg	18.0	15.6	17.3	18.3	19.0	19.8	23.9
≥20 mg	17.0	15.7	17.1	17.0	17.1	18.1	21.3
Total	18.2	15.8	17.5	18.4	18.8	19.7	23.2
Nicotine yield							
<0.5 mg	19.7	16.5	18.3	19.8	20.5	19.2	24.1
0.5-0.9 mg	18.7	16.3	18.1	18.9	19.5	20.7	23.3
1.0-1.2 mg	18.0	15.7	17.2	18.2	19.1	19.7	23.7
1.3-1.6 mg	17.7	15.2	17.0	17.8	17.6	18.7	22.6
≥1.7 mg	19.3	18.0	17.5	17.3	19.4	21.6	20.3
Total	18.2	15.8	17.5	18.4	18.8	19.7	23.2

SOURCE: Based on data from the 1979 Smoking Supplement of the National Health Interview Survey.

smoked by individuals at low “tar” and nicotine yields may, in fact, be higher than the number of cigarettes the *same individuals* smoked at high yield levels, even though there is no cross-sectional difference.

The relationship of “tar” or nicotine yield to the number of cigarettes smoked daily can also be examined by the average number of cigarettes smoked in various age groups, as presented in Table 8. After grouping smokers by age at interview, it is still observed that neither the level of “tar” nor that of nicotine demonstrates a definite association with the mean number of cigarettes smoked daily.

Cessation

The role played by cigarettes of varying “tar” and nicotine yields in cessation has been widely discussed (25, 26). Present survey data have not sufficed to define the role for varying “tar” and nicotine yields in cessation, largely because of the lack of longitudinal surveys of cigarette consumption prior to attempting to quit or after an unsuccessful attempt. A longitudinal study of smoking patterns by both cigarette product choice and number smoked daily to determine their relationship to cessation is being conducted by the NCHS for the Office on Smoking and Health during 1980 and 1981.

Table 9 examines by cigarette “tar” or nicotine yield the percent of current smokers who report ever having seriously tried to quit smoking. Overall, there is a clear inverse relationship between the “tar” or nicotine yield of the cigarette and the percent of smokers who have ever tried to quit. The group of lowest yield smokers shows a

TABLE 7.—Estimated percentage distribution of current regular smokers by number of cigarettes smoked daily by approximate quintiles of “tar” or nicotine yield, adults, U.S., 1979

	<u>“Tar” yield per cigarette (quintiles)</u>				
	<u>≤10</u> mg	<u>11-15</u> mg	<u>16-17</u> mg	<u>17-18</u> mg	<u>≥19</u> mg
Percent of total population	19.1	18.1	23.5	19.4	19.8
Daily number of cigarettes					
<15	29.9	27.5	31.2	27.6	25.9
15-24	42.7	45.5	42.4	43.3	43.9
≥25	27.5	26.9	26.3	29.2	30.2
Totals	100.1	99.9	99.9	100.1	100.0

	<u>Nicotine yield per cigarette (quintiles)</u>				
	<u>≤0.7</u> mg	<u>0.8-1.01</u> mg	<u>1.02-1.09</u> mg	<u>1.10-1.31</u> mg	<u>≥1.32</u> mg
Percent of total population	20.3	20.3	19.7	21.3	18.4
Daily number of cigarettes					
<15	29.2	29.0	28.2	27.5	31.0
15-24	42.3	46.5	41.4	43.3	43.1
≥25	28.5	24.5	30.4	29.2	25.9
Totals	100.0	100.0	100.0	100.0	100.0

SOURCE: Based on data from the 1979 Smoking Supplement of the National Health Interview Survey.

higher proportion of persons who have ever tried than those groups smoking higher yield products. This relationship was found for both “tar” and nicotine yields for all age groups except those 65 or more years of age, where the sample size was considerably smaller and the pattern was less clear.

The finding that greater proportions of current smokers of lower “tar” or nicotine products report ever attempting to quit than do smokers of higher “tar” products could result from (1) a higher rate of attempting to quit (but with a similar failure rate) for more health-conscious individuals who may also therefore choose lower yield cigarettes; (2) a difference in the addictive qualities of lower “tar” or nicotine products, causing a higher probability of relapsing after attempting to quit; or (3) the choice of a lower “tar” and nicotine cigarette product after failing to stop smoking. Selection between these alternatives would require comprehensive data on brand choice both prior to and following an attempt to quit smoking, as well as health status measurements that might affect brand switching or quit attempts. Such information is not available from this data set.

TABLE 8.—Mean number of cigarettes smoked daily by “tar” or nicotine yield, by age groups, current regular smokers, adults, U.S., 1979

Tar yield	Age at interview						
	Total	17-24	25-34	35-44	45-54	55-64	65+
<5 mg	21.5	16.0	19.5	23.3	26.3	21.8	18.9
5-9 mg	20.7	17.0	20.7	21.9	23.3	22.0	18.9
10-14 mg	20.2	16.2	20.2	23.1	23.7	19.5	16.4
15-19 mg	20.6	17.5	21.0	22.7	23.3	22.1	16.4
≥20 mg	22.5	15.2	23.0	24.9	23.9	21.6	16.9
Total	20.7	17.1	20.8	22.9	23.4	21.5	17.2

Nicotine yield	Age at interview						
	Total	17-24	25-34	35-44	45-54	55-64	65+
<0.5 mg	21.4	16.9	19.8	22.9	25.6	21.5	18.7
0.5-0.9 mg	20.2	16.2	20.3	22.4	23.7	20.5	18.4
1.0-1.2 mg	21.0	17.7	21.9	23.1	23.5	22.0	15.9
1.3-1.6 mg	21.2	17.6	20.1	23.4	23.7	22.3	17.3
≥1.7 mg	18.5	5.5	18.3	21.4	18.8	18.3	17.0
Total	20.7	17.1	20.8	22.9	23.4	21.5	17.2

SOURCE: Based on data from the 1979 Smoking Supplement of the National Health Interview Survey.

TABLE 9.—Estimated percent of current regular smokers who have tried seriously at least once to quit, by “tar” or nicotine level and age, U.S., 1979

Age group	“Tar” level of primary variety				
	<5 mg	5-9 mg	10-14 mg	15-19 mg	≥20 mg
17-24	62.9	57.1	57.6	52.3	43.3
25-44	72.9	68.8	63.5	59.8	50.0
45-64	71.5	64.0	59.1	58.5	51.0
≥65	50.8	60.0	61.6	58.4	49.7
All ages	69.8	65.3	61.8	58.8	51.5

Age group	Nicotine level of primary variety				
	<0.5 mg	0.5-0.9 mg	1.0-1.2 mg	1.3-1.6 mg	≥1.7 mg
17-24	60.7	58.0	53.6	47.1	50.4
25-44	73.3	65.1	61.2	55.1	49.2
45-64	70.7	60.6	58.4	55.0	48.3
≥65	53.3	60.8	57.5	54.3	58.6
All ages	68.8	62.1	58.4	53.8	50.0

SOURCE: Based on data from the 1979 Smoking Supplement of the National Health Interview Survey.

Table 10 shows a comparison of the frequency distributions of recent smokers by “tar” or nicotine level of the primary cigarette brand smoked by those who either did not try to quit, those who tried but failed to quit, and those who succeeded in quitting smoking within the