

Health Risks Associated With Cigar Smoking

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CIGAR SMOKING HAS INCREASED rapidly in recent years, coincident with the aggressive glamorization and promotion of cigars.^{1(pp195-219)} The American Cancer Society convened a conference June 15 and 16, 1998, in Washington, DC, to review current knowledge of the health risks of cigar smoking. The 120 invited attendees represented governmental and private agencies, academia, health educators, and tobacco control experts. Tobacco control experts with a specific interest in cigar smoking were invited to present papers. Many of these speakers had review articles published in the recent National Cancer Institute monograph on cigar smoking¹ and were asked to provide an update on their research efforts. In addition, a series of panels discussed the implications of the data presented at the conference, and a final panel of all conference attendees provided a forum for summary discussion. This article summarizes the data pre-

This article summarizes principal findings from a conference convened by the American Cancer Society in June 1998 to examine the health risks of cigar smoking. State-of-the-science reports were presented and 120 attendees (representing government and private agencies, academia, health educators, and tobacco control experts) participated in panels and summary development discussions. The following conclusions were reached by consensus: (1) rates of cigar smoking are rising among both adults and adolescents; (2) smoking cigars instead of cigarettes does not reduce the risk of nicotine addiction; (3) as the number of cigars smoked and the amount of smoke inhaled increases, the risk of death related to cigar smoking approaches that of cigarette smoking; (4) cigar smoke contains higher concentrations of toxic and carcinogenic compounds than cigarettes and is a major source of fine-particle and carbon monoxide indoor air pollution; and (5) cigar smoking is known to cause cancers of the lung and upper aerodigestive tract.

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sented at the conference and the formal discussions at the concluding session.

How Do Cigars Differ From Cigarettes?

Cigars are defined by the US Department of the Treasury as “any roll of tobacco wrapped in leaf tobacco or in any substance containing tobacco”; cigarettes are defined as a “roll of tobacco wrapped in paper or a substance not containing tobacco.”² There is no universal agreement on how to classify the many types of cigars available today (TABLE 1).

A fundamental difference between cigar and cigarette tobacco is in the processing. Cigars consist of filler (the inner part of the cigar), a binder, and a wrapper, all of which are made with air-cured and fermented tobaccos. US cigarettes contain a blend of heat-cured and air-cured tobaccos as major components and a small percentage of sun-cured (oriental) tobaccos; they do not contain fermented tobacco.

Air-curing tobacco involves hanging the whole tobacco plant or individually primed leaves (if intended for cigar use)

in barns or sheds for 30 to 40 days. In heat-curing, leaves of tobacco are hung on tiers in barns where the air is gradually warmed to a temperature of 70°C to 75°C over a period of 5 to 7 days. After curing, the leaves are typically aged for 2 or more years. Fermentation entails packing the tobacco leaves with placement in fermentation rooms for 3 to 5 weeks; they are subsequently removed, repacked, and returned to the fermentation rooms several times to achieve the desired flavor and aroma.

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Table 1. Cigar Types and Characteristics*

Classification System	Cigar			
	Weight, g	Length, mm	Diameter, mm	Description
US Department of the Treasury ^{2†}	Small	≤1.36	...	...
	Large	>1.36	...	...
US Federal Trade Commission ^{2†}	Little	<1.36	...	...
	Medium	1.36-4.54	...	...
	Large	>4.54	...	...
Hoffman and Hoffman, ^{1(pp65-104)} 1998	Little	0.9-1.3	70-100	...
	Small	1.3-2.5	70-120	...
	Regular	5-17	110-150	≤17
	Premium	≤22	127-214	12-23

*Ellipses indicate none specified.

†Converted from the US Customary System of measurement to the International System for comparability.

Cigar tobacco compared with US cigarette tobacco is rich in nitrate (1.4%-2.1% vs 0.1%-1.7%). During fermentation, which contributes greatly to the flavor and aroma of cigar tobacco, nitrate is partially reduced to the strong N-nitrosating nitrite, which reacts with amines to form nitrosamines. Cigar tobacco, compared with cigarette tobacco, is rich in the highly carcinogenic N'-nitrosornicotine (NNN) (3.0-4.5 µg/g vs 1.8-3.0 µg/g) and in 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK) (1.2-4.5 µg/g vs 0.1-1.0 µg/g); these tobacco-specific carcinogens are formed from nornicotine and nicotine. During fermentation, cigar tobacco is greatly reduced in protein, reducing sugars (0.9%-2.7%), phytosterols (0.14%-0.16%), and polyphenols (<0.1%), but in cigarette tobacco, sugar levels range from 5.5% to 20%, phytosterol levels range from 0.3% to 4.5%, and polyphenol levels range from 3.0% to 5.0%. Consequently, cigar smoke is rich in nitrogen oxides (150-300 µg/g of tobacco burned vs 90-150 µg/g from cigarettes), ammonia, and nitrosamines.

Furthermore, cigar smoke tends to have a higher pH than cigarette smoke, which increases the amount of free nicotine in the particulate and vapor phases of the smoke.¹

Trends in Cigar Smoking

Between the years 1993 and 1997, the consumption of all types of cigars in the United States increased by 46.4%, reversing a steady decline (66%) in cigar consumption from 1964 to 1993.^{1(pp21-53)} Between 1993 and 1997, consumption of large cigars and cigarillos increased 69.4%.⁴

Premium cigars accounted for only a small part of this increased consumption. The vast majority of cigar smokers smoke other less expensive large cigars; small cigars, known as cigarillos; and little cigars, which resemble cigarettes and are packaged similarly but have a wrapper that contains tobacco (Table 1).¹⁽⁵⁵⁻¹⁰⁴⁾

Data on cigar sales are readily available from the US Department of Agriculture, but prevalence data on current cigar smoking are sparse. Since cigar-smoking rates had remained low

for many years, questions on cigar use were omitted from many national health surveys. Surveys among California adults between 1990 and 1996 showed that the increases in cigar smoking occurred primarily among younger more educated adults.⁵ Some data indicate that adult men are more likely to smoke cigars than adult women and that cigar smoking is increasing among adolescents in both sexes, surpassing the use of smokeless tobacco.⁶ Data from the 1997 Youth Risk Behavior Survey⁷ indicated that 31% of male adolescents had smoked at least 1 cigar in the past month and that cigar smoking prevalence among adolescent girls was nearly 11%. Data from the 1998 National Household Survey on Drug Abuse indicate that the rate of current cigar use among those aged 12 years or older increased from 5.9% in 1997 to 6.9% in 1998, a statistically significant increase, and that an estimated 5.6% of youths aged 12 to 17 years were current cigar users in 1998. Statistically significant increases in past-month-cigar use were also reported for (1) white, non-Hispanic males, (2) those living in the Northeast, (3) those with some college education, and (4) the unemployed.⁸

An additional concern relates to initial evidence suggesting that some adolescent cigar smokers may engage in a practice known as *blunting*, whereby the cigar filler tobacco is removed and replaced with marijuana and possibly other illicit drugs.⁹

Marketing and Promotion of Cigars

Beginning in the mid 1980s, the cigar industry intensified its public relations efforts in the United States through strategies such as cigar dinners, product placement in movies, feature stories, sporting events, and the development of cigar-friendly lifestyle magazines (such as *Cigar Aficianado*). Electronic and print media report America's "rediscovery" of the premium cigar smoked by the affluent and successful members of society.^{1(pp195-219),10,11} The sale of cigars has expanded from tobacco stores,

upscale restaurants, and luxury hotels to availability at gas stations, grocery stores, liquor stores, variety stores, and menswear sections in department stores. These promotional efforts resemble those undertaken in the early stages of the smokeless tobacco campaign, which ultimately became a major health problem.^{12,13} Advertising and promotional activities for cigars, similar to those for cigarettes, routinely include sexual imagery, affluence, and celebrity endorsement (explicitly and implicitly). Unlike cigarette marketing promotions, those for cigars are not required to mention the potential health risks associated with tobacco use, which gives the impression that cigars are a “safe” product.

The Public Perceptions of Cigars

National data indicate that 46.6% of cigar smokers surveyed believe that cigar smoking is a high-risk behavior for developing cancer.¹⁴ However, they evidence an “optimistic bias” in their estimate of their own risk of developing cancer in the next 20 years: only 8.7% consider themselves to be at high risk.¹⁴⁻¹⁶ Compared with nonsmokers, cigar smokers also underestimate the cancer risk of exposure to environmental cigar smoke.¹⁴

The glamorized image of cigar smokers presented in the media appears to be accepted both by those who smoke cigars and those who do not. A large fraction of both groups (about 40%) perceive cigar smokers as relatively well-to-do, well-educated, older managers or executives. Cigar smokers are more likely to associate athleticism with cigar smoking than are nonsmokers, which may be due in part to media imagery of sports figures smoking cigars at a victory celebration.¹⁴

Pharmacology and Abuse Potential of Cigars

Whether cigars deliver nicotine at a level capable of producing dependence is a function of the degree of cigar smoke inhalation, the rate of nicotine absorption, the development of tolerance to

nicotine, the age of initiation, and the duration of exposure. The amount of nicotine in a cigar is approximately proportional to the amount of tobacco it contains; this may range from less than 1 g to more than 20 g of tobacco, depending on the cigar size and the amount of tobacco incorporated in its components.¹⁷ Thus, the nicotine in the smoke of a single cigar can vary from an amount approximate to that in the smoke of a single cigarette to the amount generated by smoking a pack or more of cigarettes. Cigars are capable of providing high levels of nicotine at a sufficiently rapid rate to produce clear physiological and psychological effects that lead to dependence, even if the smoke is not inhaled.

The manner in which tobacco products are smoked and their ability to deliver nicotine is influenced by the pH of the smoke. Accurate measurement of smoke pH has eluded scientists, and measurements obtained vary depending on the method used. However, if the concept of smoke pH is defined as the pH of the smoke and aerosol particles, it is generally correct to assume that cigar smoke aerosol particles are less acidic relative to cigarette smoke aerosol particles. Furthermore, the alkalinity of cigar smoke aerosol particles relative to cigarette smoke aerosol particles tends to deter inhalation, although cigar smoke is often partially inhaled, especially by current and former cigarette smokers.^{1(pp181-193),7,18} Studies indicate that two thirds of those who smoke both cigars and cigarettes (>40% of cigar smokers) inhale cigar smoke, compared with less than 15% of cigar smokers who never smoked cigarettes.^{1(pp181-193),19}

Definitive studies of nicotine tolerance and withdrawal have not been conducted on cigar smokers. Some research suggests that cigars produce fewer abstinence-induced withdrawal symptoms than cigarettes, but their nicotine delivery characteristics and the daily patterns of cigar smoking by many persons suggest a distinct potential to produce dependence.^{1(pp181-193)} The number of cigar smokers in the popu-

lation who smoke infrequently, who consume few cigars per day, and who inhale minimally suggests that cigar use beginning in adulthood may be less likely to induce dependence than that resulting from cigarette smoking.

Chemistry and Toxicology

Most of what is known about the nature and chemistry of tobacco and tobacco smoke is derived from studies on cigarettes, with little work specifically focused on cigar smoke. Tobacco and tobacco smoke contain about 6700 compounds, of which about 4000 have been identified in tobacco smoke.²⁰ At least 63 of these compounds are known to be carcinogenic, including 11 known human carcinogens.²¹ The chemistry of cigar smoke is believed to be qualitatively similar to that of cigarettes, except for differences caused by the aging and fermentation of cigar tobacco and by the use of additives (primarily in cigarettes). Quantitative differences are primarily due to differences in the smoke pH and lower oxygen concentrations (resulting from the poor porosity of the tobacco wrappers compared with the paper wrappers of cigarettes).

A class of highly carcinogenic compounds known as tobacco-specific, N-nitrosamines (TSNA) is present in cigar smoke at significantly higher levels than in cigarette smoke.^{1(pp55-104)} Examination on a “per gram of tobacco smoked” basis reveals that tar, defined as the total particulate matter collected by a Cambridge filter after subtracting moisture and nicotine; carbon monoxide; and ammonia are produced in greater quantities by cigars than cigarettes. When equal doses are applied, the tar produced by cigars exerts greater tumorigenic activity in mice compared with the tar from cigarettes, because cigar tar contains higher concentrations of carcinogenic polycyclic aromatic hydrocarbons.^{1(pp55-104)22-24}

Environmental Tobacco Smoke

Sidestream smoke (the aerosol emitted from the burning cone of a cigar, cigarette, or pipe during the interval be-

tween puffs and the portion of the inhaled smoke that is not retained and is exhaled²⁵) contributes significant pollutants to the environment in the form of carbon monoxide, nitrogen oxides, respirable suspended particulate matter, nicotine, polycyclic aromatic hydrocarbons, and other compounds, and sidestream smoke from cigars does so to a greater degree than the sidestream smoke of cigarettes, when equal amounts of tobacco are burned.^{1(pp55-104,161-179)} Compared with a single cigarette (0.55 g) smoked to 70% of its mass, a large cigar smoked 70% emits about 20 times the carbon monoxide, 5 times the respirable particles, and twice the amount of polycyclic aromatic hydrocarbon.^{1(pp161-179)}

One study of environmental pollutants from tobacco smoke found the levels of carbon monoxide at cigar banquets and in some cigar smokers' homes equal to carbon monoxide concentrations on crowded California freeways. The indoor carbon monoxide level measured at a cigar banquet averaged 10 ppm over the 3-hour-20-minute event, and peak levels were comparable to that in a busy parking garage. By comparison, the ambient outdoor carbon monoxide level at rush hour was 1 to 2 ppm.^{1(pp161-179),26} The Environmental Protection Agency's standard for carbon monoxide places the maximum permissible level at an average of 9 ppm over an 8-hour period.²⁷

Mathematical models designed for the analysis and interpretation of indoor air pollution measurements suggest that typical levels of respirable tar particles from cigar smoking in homes, offices, and restaurants may exceed the National Ambient Air Quality Standard for outdoor fine-particle air pollution ($65 \mu\text{g}/\text{m}^3$ on a 24-hour average).^{1(161-179),27} Thus, it is clear that cigar smoke can be a major source of indoor air pollution.

Cigar Smoking and Cancer Risk

Since the 1950s, epidemiologic studies of cigar smokers have found increased risk of oral, esophageal, laryngeal, and lung cancer.^{1(105-158),25,28-31} The

risks of cancers of the oral cavity and esophagus are similar among cigarette and cigar smokers, probably due to the similar doses of tobacco smoke delivered directly to these areas by cigars and cigarettes.^{1(pp105-158)} Lung cancer risk is less strongly associated with cigar smoking than with cigarette smoking, but risk increases with the number of cigars smoked per day and depth of inhalation. Men who smoke 3 or more cigars per day and report moderate inhalation experience lung cancer death at about two thirds the rate of men who smoke 1 pack of cigarettes a day.^{1(pp105-158)} A recent case-control study from Europe (where inhalation patterns and tobacco composition in cigars may differ from those in the United States) found a relative risk (RR) of 9.0 (95% confidence interval [CI], 5.8-14.1) for lung cancer among European cigar and cigarillo smokers,³² substantially higher than the lung cancer risk in older studies of US cigar smokers.¹

Additional estimates of the risk of cancer in cigar smokers come from an analysis of data from the Cancer Prevention Study 1 (CPS-1) of the American Cancer Society, a cohort study conducted between 1959 and 1972.^{1(pp105-158)} Of the 442455 white male subjects in CPS-I, 15191 were primary cigar smokers and had never smoked cigarettes, 7404 were secondary cigar smokers and had previously smoked cigarettes, 10300 were mixed smokers and currently smoking both cigars and cigarettes; and 175000 were cigarette-only smokers. The cancer risks for these groups were compared with rates for 92300 men who never smoked based on mortality information. The analysis included consideration of a dose-response effect for all groups related to numbers of cigars smoked per day and degree of self-reported smoke inhalation.

This study provides strong support for an increased risk in cigar smokers for cancers of the lung, esophagus, larynx, oral cavity, and, probably, pancreas. The increase in risk appears to be roughly proportional to the degree of exposure to the cigar smoke. For example, the death rate from cancers of the oral cav-

ity among male cigar smokers, compared with lifelong nonsmokers, is nearly 8 times higher (RR, 7.92; 95% CI, 5.12-11.69); similarly, the death rate from cancer of the larynx is about 10-fold higher (RR, 10.02; 95% CI, 4.0-20.6). For both of these cancers, a dose-response effect is evident and is related to the frequency of cigars smoked.^{1(pp105-158)} The death rate from esophageal cancer is 3 to 4 times higher in male cigar smokers than in lifelong male nonsmokers (RR, 3.60; 95% CI, 2.2-5.6). The increase in cancer risk associated with cigar smoking is thus greater in the oropharynx and larynx than in the more distant esophagus. The mucosa of the esophagus is exposed only to tobacco carcinogens that have been dissolved in saliva and swallowed but not to the smoke itself. Similarly, lung cancer risk is higher among cigar smokers who report inhaling the smoke than in those who report not inhaling, and higher among cigar smokers who previously smoked cigarettes than among those who only smoked cigars.^{1(pp105-158)}

Other Health Effects of Cigar Smoking

Several older studies suggested that cigar smoking increases the risk for coronary heart disease (CHD), chronic obstructive pulmonary disease, and aortic aneurysm, particularly among heavy cigar smokers (≥ 3 cigars a day) and those who inhale smoke deeply,³¹ but there was no clear consensus that cigar smoking causes CHD. The 1983 Surgeon General's Report, which mainly emphasized the hazards of cigarette smoking, concluded that those who smoke only cigars did not appear to experience substantially greater risks than nonsmokers.³³ The report notes that the category of nonsmokers also includes passive smokers so that the control group contains persons exposed to environmental tobacco smoke. However, an analysis of CPS-1 data concluded that "cigar smokers who smoke several cigars per day or who inhale [the smoke] are at increased risk for CHD."^{1(pp105-158)}

A second large cohort study, the Cancer Prevention Study II (CPS-II), was

Table 2. Implication for Patient Counseling

- Ask patients if they smoke cigars and advise them of the associated health risks.
- Advise patients that smoking cigars is not a safe alternative to cigarette smoking.
- Inform patients that cigar smoke contains a number of carcinogenic and noxious substances and poses risks to the smoker and persons environmentally exposed.
- Caution adolescents of the double dangers of *blunting*, removing the cigar filler tobacco and replacing it with marijuana or other drugs, exposing them to the drug as well as nicotine and carcinogens in the wrapper.

initiated by the American Cancer Society in 1982. A recent analysis of these data examined death rates due to CHD in relation to cigar smoking.³⁴ After excluding men who had ever smoked pipes or cigarettes regularly, approximately 7000 current cigar smokers, 7000 former cigar smokers, and 113000 men who had never regularly smoked tobacco remained in the analysis. As with cigarette smoking, the association between cigar smoking and death due to CHD was strongest among younger men and current rather than former smokers. There was no apparent increase in risk for cigar smokers aged 75 years or older or among former cigar smokers. Among men younger than 75 years, current cigar smokers experienced a death rate from CHD about one third higher than those who never smoked. This relationship held over the range of cigars smoked per day and was not limited to men who reported inhaling cigar smoke (although unintentional inhalation obviously occurs).

Policy Issues

Fewer federal and state regulations pertain to cigars than to cigarettes or smokeless tobacco.³⁵ Cigars are not included in many of the federal and state policies involving health warnings on tobacco, prohibition of sales to minors, and taxation. However, a recent Federal Trade Commission report to Congress recommended health warnings on all labeling and advertising for cigar products; prohibition on electronic advertising such as radio and television for all tobacco products, including all sizes and types of cigars; and consistency in regu-

lating youth access to tobacco products, including cigars.³

Evidence of the health hazards and an alarming increase in rates of cigar smoking underscore the pressing need for cigars to be included in a coherent national policy on tobacco use and dependence. The research on the heavy impact of secondhand cigar smoke on indoor air pollution is particularly relevant for restricting smoking in restaurants and other public places. Although smoking is usually considered an adult problem, tobacco use by children and adolescents is of a particular concern. In addition to research showing high levels of adolescent cigar use, evidence is emerging that young persons use cigars to mask illicit substance abuse.⁹ The serious health risks associated with tobacco use, including cigars, highlights the need for a broad and inclusive national policy that addresses the constellation of tobacco products and their use by all age groups.

Conclusions

The available scientific knowledge on the health risks of cigar smoking is more than sufficient to conclude that cigar smoking is a cause of cancer and a serious risk to the public health. The increase in cigar smoking has particular implications for both research and policy development. First, rates of cigar smoking are increasing, and not just among adults. Both male and female adolescents are using cigars, and their rates of use have met or exceeded those of adults before 1993. Second, similar to other tobacco products, cigars contain nicotine, which is highly addictive; smoking cigars instead of cigarettes does not reduce the risk of becoming addicted to nicotine. Third, as the number of cigars smoked and the amount of smoke inhaled increases, the risks of death related to cigar smoking approach those of cigarette smokers. Switching to cigars from cigarettes does not necessarily reduce the risk of death from a tobacco-caused illness. Fourth, cigar smoking does not just affect cigar smokers: environmental cigar smoke contains high concentrations of

toxic and carcinogenic compounds and can be a major contributor to indoor air pollution, in amounts greater than that produced from cigarettes. Most importantly, cigar smoking is known to cause cancer of the lung and upper aerodigestive tract.

The weight of the evidence indicates that smoking cigars is not a safe alternative to cigarette smoking. The recent increase in rates of cigar smoking and its risks to health underscore the pressing need for a comprehensive national tobacco policy and for active patient educational efforts (TABLE 2). Laws and regulations limiting the marketing of cigarettes and access to cigarettes by minors should be applied to all tobacco products.

A number of avenues for research to define further the health risks exists. Such research could include efforts to understand better the nature of tobacco addiction associated with cigar smoking; the identification of biomarkers of the uptake of carcinogens, carbon monoxide, and nicotine in active cigar smokers; and the relationship of atmospheric nicotine to body fluid cotinine in nonsmokers exposed to environmental cigar smoke. Research is necessary to establish clearly the risks of cigar smoking associated with CHD, cancers, and pulmonary disease. Future studies should focus on morbidity in susceptible groups, including younger cigar smokers; give attention to the type, size, and pattern of use of cigars; examine intermediate markers of morbidity and mortality; and address the temporal relationships between cigar smoking and the development of disease.

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What smells so? Has somebody been burning a Rag,
or is there a Dead Mule in the Back yard? No, the Man
is Smoking a Five-Cent Cigar.
—Eugene Field (1850-1895)