Smoking: epidemiology, cessation, and prevention. Task Force on Research and Education for the Prevention and Control of Respiratory Diseases

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Smoking: Epidemiology, Cessation, and Prevention

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EXECUTIVE SUMMARY

Summary of Overall Review of Existing Data

Epidemiology: (a) SMOKING INITIATION. Epidemiologic data provide mixed evidence for trends in smoking cessation. Smoking initiation appears to be decreasing in the age group 20 to 24 among better educated men. In the teen years, overall initiation appears to be declining but only marginally among those with low educational aspirations. Moreover, 75% of teenagers have used cigarette tobacco at some time and may be at risk for future use of tobacco, although no conclusive data are available on this latter issue. Among adolescents and young adults, female subjects have a greater prevelance of smoking than do male subjects.

(b) SMOKING CESSATION. Epidemiologic data have evaluated a relatively narrow range of factors that may influence overall smoking cessation. Although racial and gender differences in patterns of cessation are apparent, level of education and related socioeconomic factors (eg, type of job, employment status) have emerged as major obstacles to further reduction of smoking in the general US population. Among the least educated, little progress has been made in the last 20 years.

(c) BENEFITS OF SMOKING CESSATION. 1. Chronic Obstructive Pulmonary Disease—The preponderance of evidence indicates that smoking cessation results in an attenuation of the excessive rates of lung function loss (measured as FEV₁) associated with active smoking. Although it is likely that some actual recovery of function may occur, such recovery is small relative to the cumulative adverse effects of long-term cigarette smoking. Only in smokers who are relatively young (eg, <35 years) and who have not had a large (undefined as yet) cumulative burden of smoking can it be expected that "normal" function could return with complete cessation.

Despite the above data, a number of important questions remain: (1) What is the benefit of smoking cessation for asymptomatic persons who already have evidence of COPD (usually FEV₁/FVC <70%), and what are the characteristics of those not likely to benefit (in terms of progression to symptomatic COPD)? (2) Are there sex differences in the benefits of cessation after adjustment for age and cumulative smoking experience? (3) What is the effect of intermittent (unstable) cessation on decline in lung function? (4) Are there adjunctive therapies (for COPD) that should accompany cessation to improve its beneficial effects on deterioration of lung function?

Although data are available about the COPD mortality-sparing effects of smoking abstinence, less is known about the benefits of cessation in this regard. However, since cigarette smoking is the major cause of low FEV₁, it can be assumed that the earlier cessation occurs, the greater the COPD mortality-sparing effect.

2. Cardiovascular Disease—The preponderance of evidence supports the claim that smoking cessation is a worthwhile secondary and tertiary intervention for all groups of persons with coronary heart disease, especially if the endpoint is survival. Benefits of cessation generally have been realized within 2 to 5 years after cessation. A similar conclusion can be reached for cerebrovascular disease. The data for atherosclerotic peripheral vascular disease indicate that smoking is a major risk for such disease, but the benefits of cessation have not been studied well.

3. General Comment—A major problem for all studies of smoking cessation has been the classification of subjects as "former" smokers or "quitters." The process of smoking cessation is not dichotomous, as has been recognized by classification schemes such as that of the Adult Use of Tobacco Surveys. In MRFIT, only one half of the 12.7% of "usual care" subjects who quit during year 1 remained persistent quitters throughout the trial; the results were worse for the heaviest smokers. It is quite likely that in many studies, misclassification of subjects with regard to cessation status is occurring. This possibility makes the available data all the more compelling, since this misclassification is likely to be in the direction of underreporting smoking with a consequent bias toward relative risks of 1 and risk differences of 0. While efforts to provide more accurate descriptions of the actual smoking history and status of subjects is necessary on scientific grounds, such a requirement should not deter efforts to act on the basis of extant data.

Physician's Role in Smoking Cessation: (a) Physician-Delivered Smoking Intervention. Data indicate that physician-delivered smoking intervention can be effective in many different types of patient groups. However, the data also suggest that a maintained intervention effect cannot be expected from minimal levels of physician intervention. The data indicate that at least 4 steps need to occur before a significant physician-initiated smoking cessation effect can occur: (1) change in physician skills; (2) change in physician behavior; (3) the advocated physician behavior has to be able to stimulate patient smoking cessation attempts; and (4) the patient cessation attempt has to be strong enough to translate into long-term abstinence from smoking. Since physician follow-up is time consuming and may require more behavioral expertise than physicians typically can be expected to have, extended follow-up might be more efficiently and effectively provided by trained smoking intervention counselors via contacts such as telephone calls. The latter needs to receive more attention before it can be used.

(b) Nicotine Replacement Therapy. Nicotine gum is an effective aid to smoking cessation when combined with clinical behavioral intervention. In addition, when prescribed to smokers during a brief physician-delivered intervention, there is also evidence that it is effective. However, there are some studies which do not support this outcome.
long-term. Further studies are needed to assess the long-term impact of clonidine, as well as the mechanism(s) by which it reduces symptoms of withdrawal.

(c) Maintenance/Relapse Prevention Intervention. Insufficient data are available to assess the effect of maintenance or relapse prevention interventions implemented by physicians on smoking cessation rates.

(d) Pregnant Smokers. Some evidence indicates that physicians can have an impact with this group. However, more research is needed which targets this population.

(e) General Comment. The use of a multifaceted, long-term approach to physician-delivered smoking intervention resembles the present-day approach to hypertension, which has become relatively well-controlled in the last 2 decades. This control is in part a result of effective screening approaches and well-developed treatment and follow-up protocols. Similar control over smoking is likely to occur as health care providers utilize effective screening and consistent intervention and follow-up.

Barriers exist that limit the effectiveness of physicians in smoking cessation efforts. Medical schools and residency training programs do little to teach and promote the counseling skills necessary for physicians to feel confident in their ability to intervene effectively with smoking patients. Financial reimbursement, organizational priorities which do not provide time and space for prevention, educators' attitudes toward teaching preventive rather than the more traditionally taught curative medicine, and lack of available information about the effectiveness of various approaches to smoking intervention also are barriers.

Pediatric Cigarette Smoking: (a) Smoking Initiation. A number of important domains of variables (e.g., social bonding, social learning, "intrapsychic," cognitive, pharmacologic and conditioning) may have different effects at different stages of the onset process, and the biologic, psychological and social determinants may interact in complex ways. However, it is clear that successful prevention of cigarette smoking and early cessation programs will need to include consideration of all of these determinants and their interactions as we understand them. Any program that emphasizes only one or a few of the determinants or stages of onset is doomed to mediocrity at best, probably failure, and possibly worsening the situation.

(b) Prevention. Barriers to prevention are multiple (e.g., complexity of the acquisition process, pressure on youth to smoke). Information-based approaches to prevention have failed probably due to their lack of consideration of the broad set of psychologic and pharmacologic determinants of smoking. Curricula based upon psychosocial approaches have had some success in delaying the onset of smoking. However, it is unclear what components of the content or strategies of the programs are responsible for the beneficial effects. Evidence suggests that social skills approaches to prevention might be more effective when combined with community intervention, and smoking prevention programs need to start in elementary school or before and follow a "developmentally sensitive" path through high school and beyond. Pharmacologic processes also must be considered. Social and school policies can and should play a role in prevention programs.

(c) Role of the Pediatrician. Pediatricians, as well as the general medical and public health sectors, can and should play a more positive and visible role in smoking prevention. Physicians should monitor family and child cigarette smoking and other substance use and their precursors (see predictors above). They should work with complete families to remove the youth's exposure to smoking—by having parents quit and by providing patients with age-appropriate prevention materials.

(d) Early Cessation. Smoking cessation for youth is no easier than it is for adults and may even be more difficult, since youth are less motivated by the possible consequences to their long-term health. Youth make frequent and unsuccessful attempts to quit smoking, and they report many of the same reasons for difficulty in quitting as adults. Youth who desire to quit have great difficulty in finding programs tailored for them. Effective cessation programs for youth will need to educate them about the importance and power of addiction, and teach them how to handle social and stressful situations, as well as address all those issues of importance to adults.

Recommendations

Epidemiology: Given that the data supporting the health benefits of smoking cessation are so compelling, future epidemiologic studies should not be conducted just to document benefit. If nonintervention studies are to be carried out, they should focus on identification of the following factors that relate to health benefits: (a) maximum time-duration of exposure compatible with primary prevention of clinical disease (atherosclerotic disease) or reversal of functional abnormality (lung function); (b) the effect of age of smoking initiation on No. 1; (c) effect of gender on No. 1 and 2; (d) the independent and combined effects of race and socioeconomic status on No. 1, 2, and 3; (e) the effects of repeated cycles of cessation and recidivism on the smoking exposure-health-response relationship and how the factors in No. 1 to 4 influence the relationship; and (f) the effect of prolonged exposure to nicotine gum on cardiovascular disease outcomes.

More data are required on the epidemiology of and health effects (lung function, blood pressure, endocrine function, etc) of early teenage smoking both during the time of smoking and potential lasting effects after cessation. This issue is a special case of the relationships in No. 1a to 1d above, but it deserves special attention, since smoking may have particularly deleterious long-term effects (even after adjustment for total exposure) when exposure begins during periods of rapid growth and development. Identification of the "health-at-risk" teenager will be central for targeted interventions to prevent initiation of smoking or achieve rapid cessation during the teen years.

Data derived from public health surveillance studies have been extremely useful to date, but they could be made more useful by refinements in their descriptions of smoking activity. Data to provide classifications like that employed in AUTS should become the norm, if intervention studies are to be developed to reduce smoking in "hard-core groups," especially early in life.

Physician's Role in Smoking Cessation: (1) Determine the optimal combination of training and prompting to enhance
physicians' effectiveness with smokers.

(2) Develop methods to teach counseling techniques in a variety of settings and to physicians at different levels of professional development.

(3) Develop brief counseling techniques to be used by physicians to intervene effectively with behavioral risk factors other than smoking, for example as has been called for recently in relation to physical exercise and cholesterol lowering.

(4) Develop methods that physicians and other health care providers can use to help patients maintain smoking cessation, given the minimal intervention that actually occurs at each patient-physician encounter.

(5) Develop methods which physicians and other health care providers can use to help harder-to-reach less-educated populations to stop smoking.

(6) Develop smoking interventions which target pregnant women in health care settings to enhance their maintenance of cessation rates. This would require research designs that allow for postdelivery long-term follow-up of pregnant smokers. Studies are needed to develop smoking interventions in health care practices which are directed at pregnant women in lower educational group.

(7) Develop studies to determine how to tailor smoking interventions for minority populations in health care settings.

(8) Develop methods to teach physicians about the cultural perspective of the minority populations that they serve that can be used to maximize the effectiveness of smoking interventions.

Pediatric Cigarette Smoking: Prevention. There are many unanswered questions regarding the prevention of cigarette smoking by youth. Many of these concern refinements of the school-based curricula, such as: (1) the long-term effectiveness of even the most effective current prevention strategies; (2) The importance of (a) multiyear interventions; (b) addressing the multiple determinants of smoking behavior in prevention interventions; (c) teacher training for effective prevention; (d) using other program delivery personnel; and (e) development of a system of dissemination for effective programs. (3) The role of pediatricians and other health professionals in smoking prevention.

Early Cessation. Only limited research has been conducted on early cessation with youth. This area deserves much greater support, because early cessation is the next level to strive for prevention of respiratory diseases for those individuals for whom complete prevention of smoking fails. There is a special need to find approaches useful for early school leavers.

General Introduction

This report deals with the current knowledge base and research needs for smoking prevention and cessation. The report is divided into 3 major sections: (1) the epidemiology of smoking cessation—patterns and benefits; (2) physicians' role in smoking cessation for the prevention and control of respiratory diseases; and (3) pediatric cigarette smoking prevention and control. Each section is self-contained in that it reviews the problem for the particular section and presents recommendations for future research at the conclusion of the section.

Epidemiology of Cigarette Smoking

Introduction

This section of the task force report summarizes the large body of data on the epidemiology of cigarette smoking in the United States. The most comprehensive review to date is provided by the 1989 Report of the Surgeon General which should serve as a data resource guide for a more comprehensive presentation of the data and their interpretation. The present focus is on those aspects of the epidemiology of smoking that bear directly on the development and implementation of programs of education about prevention of cigarette smoking. Consideration of health benefits that can be expected from primary prevention or cessation are restricted to nonmalignant pulmonary disease and cardiovascular diseases.

Temporal Patterns in Smoking Initiation

Central to the planning of programs is an understanding of recent patterns of smoking initiation and projection of future trends. Moreover, age at initiation of smoking, due to its direct association with likelihood of continued smoking and smoking of long duration,* has been shown to be related to the risk of many of the adverse health consequences of smoking.8

Three types of data have been used to estimate patterns of initiation: (1) direct estimates of age of smoking initiation; (2) trends in smoking prevalence in persons age 20 to 24; and (3) smoking prevalence among adolescents. While the exact quantitative estimates of burden have differed between these 3 sources, the overall trends and covariates have been virtually identical.

Direct Estimates of Age of Initiation: Surveys conducted among high school seniors, among students in the 8th to 10th grades, and among persons 20 to 24 years old all indicate that smoking initiation is largely complete by age 21 (80% to 90%). A preliminary analysis of data from the National Adolescent Student Health Survey (NASHS)* found that 51% of 8th graders and 63% of 10th graders at least had tried smoking, 31% by the 6th grade. Sixteen percent of 8th graders and 26% of 10th graders were identified as current smokers (smoked at least 1 cigarette in the month preceding interview). Six percent of 10th graders were smoking >1 pack of cigarettes per week. Data from successive rounds of the National Health Interview Survey (NHIS)* over the years 1978 to 1987 have shown that, in 5-year birth cohorts from 1910 to 1954, there has been an increasing trend toward smoking initiation prior to age 18 years. Smokers born between 1950 and 1954 were 36% more likely to start before age 18 compared to smokers born between 1910 and 1914 (52% vs 38.3%). The trend was more striking for females and persists even with restriction of the analysis to birth cohorts after 1930 (to minimize possible bias due to differential mortality among smokers with differing ages of initiation).*

Studies of high school seniors have shown that gender, race, and educational aspirations have differing effects on age at which the first cigarette is smoked. Gender and educational aspirations appear to influence the process in a minor way. White subjects, on the other hand, appear to start somewhat earlier than black subjects in grades 6 to
Unfortunately, these studies cannot provide data in relation to long-term, stable smokers.

Prevalence of Smoking in Persons 20 to 24 Years Old: Analysis of trends in smoking prevalence between ages 20 and 24 years has proven to be a rich source of data to map trends in smoking initiation. The assumptions which underlie the use of prevalence data in this age-range to estimate trends are reasonable, and the limitations of the data are minor (eg, some instability in the estimates of fraction of individuals who will have stable smoking habits). The Office of Smoking and Health (CDC) has published an extensive analysis of NHIS data from 1974 to 1985* that provides useful insights into trends of smoking initiation. Male prevalence declined from 44.8% to 33.4% over the period, while female prevalence remained virtually unchanged. Among males, rates for black subjects declined faster than white subjects. No racial effects were seen for female subjects. Most striking was the effect of education. Female subjects with high school education or less increased their smoking prevalence by 10%; female subjects with high school education demonstrated a small decline. For male subjects, prevalence decreased at all educational levels. The effect was most marked (57.1% decrease) for those who obtained at least some college education, but the data suggested that this rapid fall may be leveling off. The effect of education was not stratified by race, and if the current trend continues, the data estimate that in the year 2,000, smoking prevalence will be about 30% for persons with a high school education or less and 16% for those with at least some college education.

Prevalence Among Adolescents: Ongoing surveys have provided estimates of smoking prevalence in adolescents. Due to substantial differences in definitions used for smoking categories, direct quantitative comparisons with NHIS data are not possible, but the comparison of trends is informative. Moreover, direct quantitative comparisons between repetitions of these surveys also are hindered by differing methodologies (telephone vs direct interview). Again, trend comparisons are useful. From 1968 to 1987, smoking prevalence (any use other than experimentation) increased. The increased overall prevalence was most noticeable in female subjects and those without plans for higher education.

In contrast to overall prevalence, the prevalence of daily smokers has decreased over the past 20 years. The decline has been more pronounced in black (27.6%) than in white (6.7%) subjects. The "Monitoring the Future" annual survey of high school youth (University of Michigan Institute for Social Research), indicates that, in 1988, 19% of high school seniors smoked daily and almost 30% at least monthly. The daily smoking level decreased from 29% in 1977 to 20% in 1981, where it has remained. The survey found that female subjects have been more likely than male subjects to smoke daily but have been less likely to smoke more than 10 cigarettes per day.

While annual high school survey data are reliable, they probably underestimate the true prevalence of smoking by adolescents; because these samples do not include the 25% to 30% of youth who do not complete high school. Recent data indicate that prevalence among high school dropouts is approximately 3½ times higher than for high school seniors.  

Summary of Initiation Data: One trend appears to be clear: those who expose themselves to cigarettes appear to be doing so at younger ages such that by the conclusion of the teen years, the majority of experimentation has occurred. Summarization of the data on the act of initiation provides a mixed result. The age 20 to 24 prevalence data from NHIS indicate that, especially among the well-educated men, smoking initiation is decreasing. The data on overall smoking exposure in the teen years is less optimistic. While the prevalence of daily smoking is declining, this decline is marginal among those with low educational aspirations. Moreover, 75% of this group has used cigarette tobacco and provides a large pool of individuals who may be at risk for the adoption of stable smoking at some future date. Virtually no data are available on this point, and current analyses acknowledge that predictions do not account for possible changes in demography. If the NHIS data are valid estimates of the fraction of the population who are becoming regular smokers, then smoking is, and increasingly, will continue to be an affliction of the socially disadvantaged.

Temporal Patterns in Smoking Cessation

The most comprehensive epidemiologic assessment of overall smoking cessation patterns in the United States is a recently published analysis of NHIS data from 1974 to 1985. Cessation was expressed as the quit ratio (former smokers/ever smokers) which does not account for duration or stability of cessation; only gender, race, and education were investigated as predictors. Nonetheless, some important observations relative to future programs of cessation emerge.

While all combinations of gender and race showed linearly increasing quit ratios, black male subjects made the largest gains (−1% per year) and black women the least (0.46% per year, not statistically significant). White women increased their quit ratios faster than white men (0.90% per year vs 0.67% per year). When viewed in terms of absolute quit ratios and prevalence, black men had lower quit ratios and a greater prevalence than white men, and black women were relatively similar to white women for both measures. Although not subjected to adjustment by sex or race, level of education also had a marked effect on quit ratios. Those with a high school education or less had the lowest quit ratios and the smallest increments over the study years (virtually no change in prevalence for those with less than a high school diploma). Among those with greater than a high school education, college graduates maintained the highest ratios and showed the greatest gains (−1% per year). An analysis of the 1985 NHIS data demonstrated that, after adjustment for employment status, race, gender, marital status, and income level, the odds ratio for former smoking decreased with decreasing level of educational achievement. Among all of the factors considered, educational level had the largest effect on the adjusted relative odds for former smoking. Similar inferences were obtained for an analysis of "ever" vs "never" smoking. The analysis also confirmed that black subjects were less likely to "quit" than white subjects, and men were more likely to quit than women (in contrast to the unadjusted results). Employment status (unemployed), marital status (unmarried), and low income were all independent adverse factors for the quit ratio. Significant interactions were observed.
In 1986, the Adult Use of Tobacco Survey (AUTS) employed a smoking continuum index\(^2\) that classified duration of cessation among former smokers and attempts at cessation in current smokers. The effects of education were consistent with the NHIS data cited above. The proportion of ever smokers who had not tried to quit was 49.5% greater in the least educated group relative to those employed.\(^{10,27} \text{a} \) a similar, but less consistent, trend was observed for women. Parallel trends were observed for blue vs white collar workers, but no adjustments were made for other important confounding factors.\(^{10,27} \text{a} \) Moreover, it has been demonstrated that men in the jobs (largely blue collar) that are associated with potentially hazardous environmental exposures (eg, asbestos) are likely to smoke and to be heavier smokers relative to those not so employed.

Inadequate data are available on smoking trends in nonwhite, non-African-black populations (eg, Hispanics) to permit any useful inferences at the time of this writing. Despite the large body of data that relates to the adverse health effects of smoking during pregnancy on the health of the fetus, relatively poor data are available to evaluate trends in smoking during pregnancy. Data summarized by the Surgeon General\(^9\) (in view of the epidemic of teenage pregnancy, particularly among the poor, and the smoking data for teenage women) would suggest that a significant problem still exists.

Overall rates of smoking among military personnel remained well above the national average for the first half of the 1980s, although they have been steadily declining. One study\(^15,16 \) indicated that the average rate could be accounted for by increased smoking that occurred after entry into the service. The effect of efforts to reduce smoking among military personnel awaits analysis.

**Summary of Cessation Data:** Epidemiologic data have evaluated a relatively narrow range of factors that may influence overall smoking cessation. Although racial and gender differences in patterns of cessation are apparent, level of education and related socioeconomic factors such as type of job and employment status have emerged as major obstacles to further reduction of smoking in the general US population. In fact, among the least educated (and most socially disadvantaged), little progress has been made\(^15,16 \) over the past 20 years.

**Health Benefits of Smoking Cessation**

**Chronic Obstructive Pulmonary Disease:** Cigarette smoking is the major risk factor for the development, clinical course, and natural history of chronic obstructive lung disease (including airways reactive disease in certain adults).\(^17 \) As such, all elements of the COPD complex (mucus hypersecretion, acute respiratory illness morbidity, impaired lung function, altered airways reactivity, mortality) can be expected to benefit from smoking cessation. However, since the most profound public health consequences of smoking and COPD are expressed through effects on lung function and subsequent mortality, the emphasis will be on these factors. A less detailed commentary is provided for mucus hypersecretion (since its public health effect is most evident in those with more severe disease) and for airways reactivity (since its relationship to COPD pathophysiology and natural history still is unclear).\(^18 \)  

**Benefits of Smoking Cessation on Decline in Lung Function.** Most of the data that relate to this issue have been derived from population-based epidemiologic studies in which the motivations for smoking cessation either are unknown or related to the extent of underlying COPD or other diseases. Thus, differences between studies, in part, may be due to differences in the characteristics of subjects who quit smoking (not fully captured by age). In addition, factors such as type of cigarettes smoked, inhalation patterns, etc, also are unknown. The relatively small number of longitudinal studies are limited by the following: (1) the generally short periods of follow-up (relative to the natural history of lung function decline); (2) the variability in the starting points of the studies in relation to the onset of smoking; and (3) analyses that simplify the complex patterns of cessation-relapse that characterize efforts at smoking cessation.\(^10,25,26 \)

Measurements derived from forced vital capacity (FVC) maneuvers, especially FE\(_{\text{V}1}\), and FVC, have been the most extensively studied measures.\(^17 \) Tests of small airways function (eg, closing capacity, slope of phase 3 of the N\(_{2}\) washout curve), which are considered more "sensitive" tests of the effects of cigarette smoke on the lung,\(^18 \) have been evaluated to a lesser extent, except for studies of the short-term effects of smoking cessation.\(^19 \) Since the level of FE\(_{\text{V}1}\) consistently has been found to be an important predictor of COPD\(^10 \) and all-cause mortality, emphasis is placed on FVC-derived measurements. (Although at least one study has suggested that slope of phase 3 of the N\(_{2}\) washout curve may predict mortality better than FE\(_{\text{V}1}\),\(^19 \))

Most cross-sectional epidemiologic studies have shown that former smokers have higher levels of FE\(_{\text{V}1}\), than active smokers.\(^15,16 \) However, much of the difference can be explained by the differences in the total reported cigarette consumption between current and former smokers. One of the most useful cross-sectional studies is that of Dockery et al\(^18 \) (n = 8,191, men and women). These investigators demonstrated that for men and women, loss of FE\(_{\text{V}1}\), is associated with total cigarette consumption, to which is added an acute effect of current consumption. The model indicates that smoking cessation is associated with an acute increase in FE\(_{\text{V}1}\), (~125 ml for men, ~100 ml for women), the significance of which is determined by the amount of irreversible loss that has occurred due to cumulative years of smoking. Moreover, their data highlight the importance of the starting level of FE\(_{\text{V}1}\), in the determination of the functional consequences of long-term decline due to smoking.

Longitudinal epidemiologic studies have demonstrated that, relative to lifetime nonsmokers, active smokers have excessive annual rates of decline in FE\(_{\text{V}1}\), which return
weakening of chronic obstructive pulmonary disease (COPD). Since cigarette smoking has a chronic lung disease, chronic hypersecretion is a hallmark of smoking-associated chronic lung disease. Clinical studies have demonstrated that smoking cessation is usually associated with a rapid disappearance (as rapidly as 1 month), and even partial cessation is associated with some reduction in symptoms. Epidemiologic studies also have demonstrated the symptoms of cough, phlegm, and wheeze are diminished and/or reversed in former smokers.

Studies have demonstrated that active smokers are at increased risk for nonspecific acute respiratory illnesses and influenza and pneumonia mortality. Smoking cessation appears to be associated with a reduced burden of more severe respiratory illness, at least as measured by decreased relative mortality risk in exsmokers vs smokers. However, factors of disease severity influence mortality, and few detailed data are available on the types of benefits to be obtained over the short-term for smoking cessation.

Airways Reactivity (AH). It is now well recognized that wheezing in adults is commonly associated with smoking and that smoking cessation leads to a reversal or mitigation of wheezing. Interest in the relationship of AH and smoking stems from hypotheses that relate AH to the natural history of COPD, an hypothesis that has motivated the DLD LHS referred to previously. To date, a causal relationship between AH and COPD remains unproven. Thus, despite the fact that airways reactivity in exsmokers more closely resembles that of nonsmokers, the health implications of this finding are unknown at present.

Cardiovascular Disease: The 1983 Surgeon General's Report provides an exhaustive summary of the relationship of cigarette smoking to cardiovascular disease (ischemic heart disease, stroke, and peripheral vascular disease). Moreover, the report summarizes the prospective and epidemiologic studies that clearly demonstrate that smoking cessation leads to a reduction in coronary heart disease (CHD) morbidity and mortality. This section will review selected studies that provide refinements to the 1983 smoking changed little over the period 1965 to 1985 (84%, 95% CL 78% to 88%). Due to the increase in smoking among women, smoking AR for COPD mortality increased from 67% in 1965 to 79% (95% CL 73% to 83%) in 1985. Translated into preventable mortality, the 1985 AR data represent 37,000 and 20,000 "preventable" COPD deaths for men and women, respectively.

The above data indicate the savings in COPD mortality that could be affected by abstinence. Less is known about the mortality sparing effects of cessation. A number of studies have pointed out that low FEv, is an important predictor of COPD mortality, and several studies suggest that male and female exsmokers have a lower risk of COPD mortality than current smokers. However, the data are incomplete with regard to the following: (1) actual magnitude of mortality-sparing after adjustment for underlying FEv,; (2) age-specificity of the COPD mortality-sparing expected by cessation, after adjustment for underlying lung function; and (3) sex-specificity of the relationship, if any. Nonetheless, since cigarette smoking is the major cause of low FEv,, it can be assumed that the earlier cessation occurs, the greater the COPD mortality-sparing effect.

Mucus Hypersecretion and Acute Respiratory Illness. Mucus hypersecretion is a hallmark of smoking-associated chronic lung disease. Clinical studies have demonstrated that smoking cessation is usually associated with a rapid disappearance (as rapidly as 1 month), and even partial cessation is associated with some reduction in symptoms. Epidemiologic studies also have demonstrated the symptoms of cough, phlegm, and wheeze are diminished and/or reversed in former smokers.

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Surgeon General's estimates of the benefits of smoking cessation and cardiovascular disease.

Cardiovascular Disease Mortality. Across all ages ≥35 years, both male and female former smokers have a decreased risk of death from CHD, cerebrovascular disease, and other circulatory diseases relative to active smokers. \(^{(10)(30)(31)}\) For cerebrovascular and other circulatory diseases in women, the risks for former smokers are not significantly different from those who never smoked regularly. In terms of attributable risk, cigarette smoking accounts for 41% to 45% of the risk of CHD in women and men, respectively, under age 65 years and for 12% to 21% for those ≥65 years. \(^{(32)(33)}\) For cerebrovascular disease, the comparable data are 55% to 51% and 6% to 24% for ages below and above age 65 years, respectively. Since these analyses include the effects of current and former smoking, they do not segregate out the effects of cessation per se.

Coronary Heart Disease. Several studies (since the 1983 Surgeon General's Report) provide evidence that the benefits of smoking cessation in terms of CHD are realized relatively promptly. \(^{(11)(34)}\) A case-control study of men has suggested that the risk (adjusted for important covariates) of an MI for exsmokers returns to that of nonsmokers after 2 years of smoking cessation, although a population based study suggested that >10 years of cessation might be required to return risk to levels observed in nonsmokers. Data from the CASS study has demonstrated that individuals who quit smoking within 1 year of study onset had a decrease in the covariate-adjusted risk of death and MI relative to those who continued to smoke. The benefit was similar for men and women and was identical to that observed for smokers who had quit >1 year before study onset. Data from the Nurses Health Study has shown that former smokers have the same adjusted risk for fatal and non-fatal MI as nonsmokers. Smoking as few as 1 to 4 cigarettes per day increases the risk. \(^{(35)}\) In all of these studies, the benefits of smoking reduction were apparent for subjects in most risk categories (eg, older age, hypertension, hypercholesterolemia, family history). Even among subjects 65 to 74 years of age, decreased CHD mortality risk has been observed within 5 years of smoking cessation. \(^{(36)}\)

Summary—It would appear that smoking cessation is a worthwhile secondary and tertiary intervention for all groups of people with CHD, especially if the endpoint is survival. The data for recurrent infarction are less clear.

Cerebrovascular Disease. As for CVD, new data since the 1983 Surgeon General's Report provide evidence that smoking cessation leads to relatively rapid reduction in the cigarette-associated risk of cerebrovascular disease. \(^{(37)(38)}\) Data from the Honolulu Heart Project have demonstrated that men who quit smoking during the 6-year follow-up had a "risk-factor adjusted" relative risk for subsequent stroke that was only marginally greater than that for nonsmokers. A similar conclusion has been drawn for men and women in the Framingham Study, in which the risk of stroke for quitters reverted to levels of nonsmokers within 5 years and was significantly reduced within 2 years. In the Nurses Health Study, former smokers had only a slightly increased risk of stroke in the first 2 years after cessation. In all of these studies, adjustment for confounders did not alter the magnitude and timing benefits from cessation.

Atherosclerotic Peripheral Vascular Disease (ASPD). Relatively little new data are available since the 1983 report. Not much can be added to the observation that smoking, especially in diabetics, \(^{(39)}\) is a major cause of ASPD. The kinetics of benefits are not as clearly defined, although in diabetics, the benefits may occur rapidly (within 2 years). \(^{(40)}\)

Summary and Conclusions—Ideally, intervention studies would provide the data from which benefits derived from smoking cessation could be quantitated. Despite the general lack of such data, the overwhelming consistency demonstrated in epidemiologic data makes it reasonable to use these data to estimate the magnitude and timing of such benefits. The problem is more straightforward for atherosclerotic diseases than for COPD, since for the former, reasonably discrete events and event-times can be identified. Since the definition of COPD is somewhat arbitrary, a highly variable physiologic process (decline in lung function) has been utilized. Nonetheless, even in this latter case, smoking so overwhelmingly contributes to lowering of lung function, that inferences drawn from change in lung function over time can be used to estimate benefits in terms of decreased morbidity and mortality.

The most significant limitation of the available data relates to the classification of a subject as a "former" smoker or a "quitter." The process of smoking cessation is not dichotomous, as has been recognized by classification schemes such as that of AUTS. \(^{(41)}\) In MRFIT, only one half of the 12.7% of subjects who quit during year 1 remained persistent quitters throughout the trial; the results were worse for the heaviest smokers. \(^{(42)}\) It is quite likely that in many studies, misclassification of subjects with regard to cessation status is occurring. This possibility makes the available data all the more compelling, since this misclassification is likely to be in the direction of underreporting smoking with a consequent bias toward relative risk of 1 and risk differences of 0. While efforts to provide more accurate descriptions of the actual smoking history and status of subjects are necessary on scientific grounds, such a requirement should not deter efforts to act on the basis of extant data.

Although much of the data with regard to the effect of smoking cessation on morbidity and mortality from COPD are couched in terms of secondary prevention, and to a lesser extent, tertiary prevention, the data clearly imply that there is a window of exposure in which primary prevention is possible. This window is represented by young subjects (probably <35 years) for whom it may be possible not only to stop smoking-related deterioration of lung function but to restore lung function to near normal levels for the individual. Obviously, this group must be targeted for smoking cessation efforts. For individuals further along, the natural history of impaired lung function, smoking cessation, on average, should reduce the above-normal declines in function, especially for those with only modest total exposure. For those with established disease, smoking cessation offers the prospect of reduced morbidity, and perhaps mortality, from acute respiratory infections.

As for COPD, smoking cessation, early enough in the exposure continuum, would be a major contributor to the primary prevention of atherosclerotic cardiovascular disease. In the case of clinical CHD and cerebrovascular disease, it appears that smoking cessation, even after many...
years of exposure may still be an important primary preventive intervention and that the benefits of cessation may be realized rapidly. The data suggest that clinical benefits are to be derived at all ages.

Given that the data that support the health benefits of smoking cessation are so compelling, future epidemiologic studies should not be conducted just to document benefit. If nonintervention studies are to be carried out, they should focus on identification of the following factors that relate to health benefits: (1) maximum time-duration of exposure compatible with primary prevention of clinical disease (atherosclerotic disease) or reversal of functional abnormality (lung function); (2) the effect of age of smoking initiation on No. 1, (3) effect of gender on No. 1 and 2; (4) the independent and combined effects of race and socioeconomic status on No. 1, 2, and 3; (5) the effects of repeated cycles of cessation and recidivism on the smoking exposure-health-response relationship and how the factors in No. 1 to 4 influence the relationship; and (6) the effect of prolonged exposure to nicotine replacements (eg, gum, patch) on cardiovascular disease outcomes. More data are required on the epidemiology of and health effects (lung function, blood pressure, endocrine function, etc) of early teenage smoking both during the time of smoking and potential lasting effects after cessation. This issue is a special case of the relationships in No. 1 to 4 above, but it deserves special attention, since smoking may have particularly deleterious long-term effects (even after adjustment for total exposure) when exposure begins during periods of rapid growth and development. Identification of the “health-at-risk” teenager will be central for targeted interventions to prevent initiation of smoking or achieve rapid cessation during the teen years.

Data derived from public health surveillance studies have been extremely useful to date, but they could be made more useful by refinements in their descriptions of smoking activity. Data to provide classifications like that employed in AUTS should become the norm if intervention studies are to be developed to reduce smoking in “hard-core groups,” especially early in life.

Physicians’ Role in Smoking Cessation for the Prevention and Control of Respiratory Diseases

Introduction

The benefits of smoking cessation for the prevention and control of respiratory diseases indicate that interventions directed at smoking cessation are of primary importance. In the last few years, it has become evident that intensive smoking intervention programs have a limited effect on the general population since they reach relatively few smokers. More than 90% of smokers who have quit smoking have done so on their own without the aid of formal smoking intervention programs, and most smokers who continue to smoke would prefer to stop without the aid of such a program. In addition, there have been increasing demands on the medical and public health sectors to include in their contacts with smokers the delivery of smoking cessation interventions.

The Physicians Role in Smoking Intervention

Physicians and other members of the health care system have contact with at least 70% of all smokers each year and with 60% of smokers who consider themselves to be in “excellent health.” Approximately 38 million of the 50 million adult smokers in the United States could potentially be reached by physicians during the course of ongoing medical care. This high contact rate coupled with even a small cessation effect has the potential to produce substantial changes in smoking behavior in the general population of smokers.

Most individuals go through several stages of change before they stop smoking: contemplating change, attempting change, making the change, and maintaining the change. Thus, physicians and other members of the health care system can also aid smokers during the process of change before cessation actually occurs. Some smokers may stop smoking as a result of these encounters, while others may benefit from a referral to a formal smoking intervention program or simply from continued surveillance and contact with the physician’s office.

There is a growing consensus that the physician is uniquely qualified to take primary responsibility to help meet our national goals of a substantially reduced mortality rate by the year 2000.

Impact of Physician-Delivered Interventions on Smoking Cessation

Observational studies and earlier randomized trials suggested that physicians who intervene with smokers have an impact on their cigarette smoking behavior. Several of these earlier studies suffered from deficiencies in some aspect of experimental design, thereby limiting the potential impact and/or generalizability of these observations.

However, 4 recently completed randomized clinical trials have demonstrated that physicians who receive special training to assist smokers during the course of regular medical encounters, using approaches such as setting a quit date, prescribing nicotine-containing gum (NCG), providing self-help materials, and providing follow-up contact, and/or physicians who are prompted or cued to intervene, have a greater effect on the smoking behavior of their patients than do physicians not so trained or cued. Ockene and colleagues demonstrated that patients receiving brief patient-centered, behaviorally oriented counseling, with or without the prescription of NCG, were much more likely to change their smoking behavior than were patients who were only provided brief advice to stop smoking. The differential impact of the interventions on smoking behavior was observed immediately after the intervention took place and at 6-month follow-up and also was evident in terms of length of time off cigarettes.

In all 4 studies, physicians in the intervention conditions were cued to intervene, usually by chart stickers. Taken collectively, these studies support the conclusion that some combination of physician training and prompting to intervene has a significant effect on cessation rates. The studies also provide support for the conclusion that when physicians are taught to use specific smoking intervention skills, cessation rates increase significantly; cueing alone does not have as strong an effect as cueing combined with the use of these smoking intervention skills. More research is needed to determine which particular combination of training and prompting is most effective and whether there are additional...
feasible interventions which can increase cessation rates even more. The study by Cohen and his colleagues, which suggested the need for training and cueing of physicians, was the only one which targeted a low-income, low education population. More studies targeting this population are needed.

In contrast to the above 4 trials, 2 other recently completed studies have demonstrated no significant differences in smoking cessation rates between patients seen by physicians who had attended a Continuing Medical Education (CME) program in which physician-delivered smoking intervention was discussed and patients seen by physicians who had not attended such a program. Several problems are of note regarding these 2 studies. While the use of certain physician smoking intervention practices, as measured by patient exit interviews, were significantly different between the physicians who attended training programs and those who did not, these intervention practices were used with only a small minority of patients. In a study by Kottke and colleagues, there was no significant difference in the percent of smokers who were asked about their smoking by the physicians in the 3 intervention conditions. The rates for the practice of "asked about smoking" were 59%, 61%, and 51% for the physicians in the workshop (training), materials (MDs were provided with patient educational materials but not trained), and no assistance conditions, respectively (Table 1). These rates are similar to the 60% rates reported in general population studies. In an investigation by Cummings and colleagues, smoking was brought up by physicians in the group who received CME with only 50% of their smoking patients while physicians in the control (no training) condition brought up smoking with 45% of their smokers. Thus, training alone did not seem to increase physicians' intention to carry out smoking intervention with his or her patients.

In this later study, managers of physicians' practices in the experimental condition also received stickers to put on smokers' charts to prompt the physicians to intervene. However, it was not mandatory for them to use these stickers, and only a small percentage actually did so. The investigators did not note what percentage of charts were stickered.

When taken together, these 6, recent randomized trials demonstrate that physicians who are trained to intervene with smoking and cued to intervene can have a significant impact on their patients' smoking rates. However, it is not clear what combination of training and prompting is optimal. Although these randomized studies are difficult to compare, they suggest that more cessation occurs when physician interventions are relatively more intensive than regular physician advice. A counseling approach, which provides more time and physician-patient interaction than does advice alone, helps the smoker determine a plan for cessation and is associated with higher cessation rates. Adding modalities such as self-help booklets and NCG, appears to augment the effect of advice and/or counseling.

Impact of Physician-Delivered Smoking Interventions on "High Risk" Smokers

The smoker who is at high risk for lung or heart disease has been studied in several clinical and community trials; however, in only 2 of these trials was the intervention delivered by physicians. In the London Civil Servants Study, the 2-year cessation rate was 51% for smokers in the intervention group and 10% for smokers in the control group. Of those individuals abstinent at one year, 80% reported stopping immediately after the first session with a physician. The 51% cessation rate is somewhat surprising, since intensive multicomponent interventions have not been able to achieve as high a rate. The investigators offer no discussion or insights regarding how such a high rate could have been achieved with physician intervention. The World Health Organization Belgian Factories Study demonstrated a 50% increase in cessation rate for the subjects counseled by physicians in the intervention factories when compared with the subjects not so counseled in the control factories. In both of these trials, advice was augmented with written materials and follow-up contacts. No information was provided to indicate whether any training of physicians took place, who the physicians were who implemented the intervention, and whether they were prompted or reminded to intervene.

Impact of Physician-Delivered Smoking Interventions on Pregnant Women

Five recently completed randomized trials have assessed the effects of smoking intervention on the cessation rates of pregnant women. However, only 2 of these trials have involved physician-delivered interventions, while the other 3 used more intensive interventions delivered by specially trained interventionists. Donovan studied smokers, aged 35 years or younger at the start of pregnancy, who smoked more than 5 cigarettes per day and were less than 30 weeks pregnant at their first prenatal visit. They were seen in 3 maternity clinics in London and were randomly assigned to a control group of patients (n = 289), who received usual prenatal care, or to a test group of patients (n = 263), who were given "intensive" individual antismoking advice by a physician at each prenatal care visit. Records of these patients also were labeled, and hospital staff members were asked to reinforce the antismoking message, and their primary care physicians were also instructed to do so. The overall results of the study were inconclusive, and the investigators noted that the women reported little reinforcement by other health care providers.

In another British randomized trial, women who smoked at the time that they were scheduled for a prenatal visit at a large hospital were randomly assigned to a control group of subjects (n = 489) who received routine care, or to an intervention group of subjects (n = 483) who received advice to stop smoking and information about the effects of smoking on the fetus presented visually by a booklet or verbally by the obstetrician. Nine percent of the women in the intervention group quit smoking entirely, compared with 6% of the women in the control group. In the intervention condition, 28% of the women reduced the number of cigarettes smoked per day compared with 19% of the women in the control group.

A third randomized trial recruited women in a large metropolitan area from various sources. Smokers who smoked at least 10 cigarettes per day at the beginning of pregnancy, were randomly assigned to a control condition (n = 472) in which they received routine advice, or to a
Table 1—Physician-Delivered Smoking Intervention Trials

<table>
<thead>
<tr>
<th>Investigators</th>
<th>Physician Population</th>
<th>Patient Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohen et al (1989)*</td>
<td>97 Residents</td>
<td>A total of 1,430 pts agreed to ppt; less than 5% refused; x age = 46 yr; 63% female; 39% white; x nic dep = 5.5. Patients who return to clinic for other med visits were assessed for cessation.</td>
</tr>
<tr>
<td>Cummings et al (1989)*</td>
<td>81/189 Internists from 4-Kaiser Medical Ctrs in SF area (randomized by MD units)</td>
<td>15-30 Pts/MD; 2,056 smokers; x age = 45 yr; 56% female; x cigs = 18; x desire to quit = 6.9; x confidence = 5.0.</td>
</tr>
<tr>
<td>Janz et al (1987)*</td>
<td>63 MDs at 2 outpatient med clinics (denominator not provided)</td>
<td>250 Pts; x age = 46 yr; 62% female; x cigs = 24/day; previous quit; attempts = 5. No information given on percent refusal</td>
</tr>
<tr>
<td>Öckene et al (in press)*</td>
<td>196/198 Int med and family practice residents at UMMC</td>
<td>1,944 Smokers; x age = 35 yr; 57% female; x cigs = 23/day; x desire to quit = 7.4; x confidence = 5.6; x nic dep = 6.1. (All smokers who consented were randomized (~50% consented.)</td>
</tr>
<tr>
<td>Kottke et al (1989)*</td>
<td>66/1110 Members of Minn Acad FP in November 1984 (unit of randomization and analysis)</td>
<td>6,767 Adults; x age = 40 yr; 67% female; x cigs = 20/day; x desire to quit = 6.4. Most outcomes measured by telephone and visit for saliva cotinine.</td>
</tr>
<tr>
<td>Wilson et al (1986)*</td>
<td>83/460 FP MDs within 40 miles of McMaster Univ</td>
<td>1942 Smokers; 2 smokers each day per practice; 60% female</td>
</tr>
</tbody>
</table>

*p = 0.005; t* = 0.004; t* = 0.002; $Significant difference; [There was a 17% dropout rate at 6 mo; §p<0.01; §p<0.05; **p<0.025; ††p<0.001.
Table 1—Continued

<table>
<thead>
<tr>
<th>Physician Interventions</th>
<th>Outcomes</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Control MDs—Given booklet about what to do with smokers, encouraged to counsel; (2) Gum—sticker attached to pt chart to cue MD could Rx gum, up to 10 boxes free; (3) Reminders (cues)—9 stickers asked &quot;Did you talk to pt about smoking?&quot; and &quot;the pt has agreed to the following quit date _______&quot;; (4) Both 2+3 apply. All MDs attended 1 h training which included: (a) ask about smoking, (b) advise cessation, (c) set a quit date, (d) check progress at each visit.</td>
<td>Cessation outcomes</td>
<td>6(±3) mo validated cessation</td>
<td>1.3</td>
<td>7.7</td>
<td>7.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All pts (n = 1,420)</td>
<td>0.9</td>
<td>5.0</td>
<td>4.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Returnees only (n = 825)</td>
<td>2.7</td>
<td>8.8</td>
<td>15.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All pts (n = 1,420)</td>
<td>1.5</td>
<td>4.7</td>
<td>7.9</td>
</tr>
<tr>
<td>(1) Control group—usual care-no special help; (2) Provider intervention—MD message: personal susceptibility; self-efficacy; physician concern. Nurses counseled pts on strategies and barriers; (3) Provider intervention and self-help manual MD and nurses intervention same as in #2; plus pts given manual &quot;The Step by Step Quit Kit&quot;; (MDs in 2+3 given &quot;brief&quot; tutorial); (MDs in 2+3 cued to intervene with study smokers marker cards on each chart.) (Card lists intervention components.)</td>
<td>Cessation outcomes</td>
<td>1 Mo self-report</td>
<td>(n = 106)</td>
<td>(n = 69)</td>
<td>(n = 75)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Attempt quit</td>
<td>40</td>
<td>70</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quit</td>
<td>2</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 Mo self-report</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Attempt quit</td>
<td>71</td>
<td>89</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quit</td>
<td>10</td>
<td>12</td>
<td>21</td>
</tr>
<tr>
<td>(1) Advice only—advised all pts to quit, personalized advice; (2) Counseling—advised cessation, used 6 step &quot;pt-centered&quot; counseling; (3) Counseling + NCG—Advised cessation, used 6 step &quot;pt-centered&quot; counseling plus prescribed NCG and instructed in its use. Physicians were cued with stickers on charts and &quot;scripts&quot; to intervene in each condition.</td>
<td>Intervention outcomes (patients perspective)</td>
<td>(n = 441)</td>
<td>(n = 402)</td>
<td>(n = 380)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Asked about smoking</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Advised cessation</td>
<td>91</td>
<td>91</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Set date to quit/taper</td>
<td>28</td>
<td>88</td>
<td>91†</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gave written materials</td>
<td>70</td>
<td>93</td>
<td>90†</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Offered MCG Rx</td>
<td>2</td>
<td>9</td>
<td>74†</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cessation outcomes</td>
<td>6 Mo self-report</td>
<td>9.1</td>
<td>12.0</td>
</tr>
<tr>
<td>(1) No assistance (n = 17); (2) Materials (Free Quit + Win) (n = 22); (3) Workshop (n = 27) — Free &quot;Quit + Win,&quot; 6 h training in smoking + health, counseling skills, office practice set-up. All MDs told to ask about smoking, advise cessation, set quit date, set return for follow-up.</td>
<td>Intervention outcomes</td>
<td>(n = 90)</td>
<td>(n = 90)</td>
<td>(n = 90)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Asked if smoke</td>
<td>51</td>
<td>61</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Advised to stop</td>
<td>40</td>
<td>55</td>
<td>54**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Asked to set &quot;quit date&quot;</td>
<td>5</td>
<td>10</td>
<td>19*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Given follow-up apt</td>
<td>4</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Received materials</td>
<td>11</td>
<td>36</td>
<td>37††</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cessation outcomes</td>
<td>Reported 1 yr quit</td>
<td>14.3</td>
<td>12.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Verified 1 yr quit</td>
<td>5.0</td>
<td>5.4</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intervention outcomes</td>
<td>(n = 90)</td>
<td>(n = 90)</td>
<td>(n = 90)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Asked about smoking</td>
<td>31</td>
<td>70</td>
<td>85††</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Advised cessation</td>
<td>24</td>
<td>64</td>
<td>84††</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Set quit date</td>
<td>2</td>
<td>12</td>
<td>54††</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Requested follow-up</td>
<td>4</td>
<td>22</td>
<td>83††</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gave materials</td>
<td>2</td>
<td>17</td>
<td>80††</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Suggested MCG</td>
<td>9</td>
<td>5</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cessation outcomes</td>
<td>Validated 12 mo (3 mo) cessation rate</td>
<td>4.4</td>
<td>6.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Validated 12 mo (1 wk) cessation rate</td>
<td>7.2</td>
<td>8.4</td>
<td>9.9</td>
</tr>
</tbody>
</table>

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treatment condition (n = 463) in which they received intensive, ongoing advice throughout pregnancy from specially trained professional staff. Of the women in the treatment condition, 43% had stopped smoking entirely by the eighth month of pregnancy, compared with 20% of the women in the control condition. However, these rates become 27% and 3%, respectively, when cessation rates prerandomization are subtracted. The intervention was very effective in helping women to stop smoking. However, it is of note that this intervention was implemented by staff not generally available in a physician's office and was very intensive rather than physician-delivered.

In a study by Windsor and colleagues, interventions that were delivered by ancillary staff in a health care setting were demonstrated to be effective. Women in a public obstetrics clinic were randomized to 3 groups: usual care, health education using American Lung Association material, and health education using a special self-help manual for pregnant women, "A Pregnant Women's Self-Help Guide to Quit Smoking." Instruction in the use of the materials was provided by health educators. The investigators did not indicate whether the women were seen by the ancillary staff at each visit or the length of the first instructional visit. The cessation rates at 9 months, 2%, 6%, and 14%, respectively, demonstrate the short-term effectiveness of the tailored self-help materials, when used with a low income, low education population of women.

Finally, Ershoff and colleagues distributed self-help materials to an experimental group of 165 women enrolled in an HMO. Each week, 1 of the 8 booklets was mailed to the women. Women in both the control and experimental groups were involved in a 45-min group session when they entered prenatal care. The cessation outcome of the self-help materials condition was significantly different from the control group (26% vs 17% cessation).

Review of these 5 randomized trials leads to the conclusions that physicians can have an impact on pregnant women's smoking cessation rates and that intensive interventions spanning the entire period of gestation may be necessary to effect large changes. In addition, materials tailored to particular populations also may be needed. However, more research is needed to address this latter point, in addition to the need to follow women postdelivery in order to determine long-term effects of prenatal intervention. This long-term follow-up has not occurred.

Other programs have also been developed to target low-income pregnant women in a variety of settings where they receive prenatal health education and social services. However, the efficacy of these programs has not been specifically tested. In 1986, ACS developed a program, "Special Delivery," designed to reach low-income women, which included a video, slides, and a self-help book for cessation. In 1986, ALA developed a smoking cessation program, "Freedom From Smoking for You and Your Baby." This kit is distributed to health care professionals providing services to pregnant women and includes instructions to the provider, posters, and self-help materials for pregnant women. The ALA also developed a special smoking intervention program for low-income pregnant women enrolled in the Los Angeles women, infants and children (WIC) nutrition program's, Healthy Mothers, Healthy Babies. The program began in 1986 and includes slides, handouts, and reminder messages. Evaluation of these programs would be useful as they have targeted populations which are the least likely to stop smoking.

Issues to Consider in Physician-Delivered Smoking Intervention

Intervention Continuum: It is not realistic to expect a significant intervention effect from a minimal level of physician intervention, which is in turn implemented with a minority of smokers. Kottke and colleagues indicate 3 points (points 2, 3, and 4 of the following list) at which an effect needs to occur in order for a final smoking cessation impact to be demonstrated. A fourth point should be added (point 1). Thus, the following 4 steps need to occur before a significant smoking cessation effect can occur:

1. Change in physician skills.
2. Change in physician behavior.
3. The advocated physician behavior has to be able to stimulate patient smoking cessation attempts.
4. The patient cessation attempt has to be strong enough to translate into long-term abstinence from smoking.

At each step, its likelihood of occurrence and, therefore, its potential impact decreases, making it necessary either to start out with a relatively strong intervention or to add interventions along the way.

Ancillary Counseling: Since physician follow-up is time consuming and may require more behavioral expertise than physicians typically have, extended follow-up might be more efficiently and effectively provided by trained smoking intervention counselors via contacts such as telephone calls. Evaluation of the latter has occurred in only 1 investigation. Ockene and colleagues tested the effect of 3 physician-delivered interventions (advice, counseling, counseling plus the prescription of NCG) in combination with no additional intervention vs follow-up counseling contacts via telephone by health counselors at 3-month intervals. Contrary to expectations, while there was a tendency toward an effect (p<0.09), follow-up telephone counseling did not contribute at a statistically significant level to smoking behavior change.

Use of Nicotine Replacement Therapy: Some smokers are physiologically addicted to nicotine and benefit from nicotine replacement therapy. Such therapy provides the patient with a safer form of nicotine which can decrease withdrawal symptoms such as anxiety, difficulty concentrating, irritability, and hunger while the drug is gradually discontinued. When combined with intensive behavioral treatment, therapy with nicotine polacrilex (nicotine containing gum) has demonstrated significantly higher cessation rates than placebo gum. However, it appears to be most effective in significantly increasing short-term cessation rather than long-term (ie, 1 year) cessation. Tonnesson and colleagues used level of nicotine dependence to block a clinic sample of volunteer smokers who were motivated to stop smoking and randomized them to use of 2 or 4 mg gum. The subjects were highly compliant with gum use. Both groups also attended group counseling sessions. They reported significant outcome differences between gum and placebo at 1 and 2 years and support for a dose-response relationship. However, since 4 mg gum is not available in the United States, the results of the study are not generalizable.
Since 99.5% of smokers who receive the gum are not enrolled in behavioral programs and usually receive it in conjunction with a brief visit with their physicians, it is important to determine the efficacy of these interventions.\textsuperscript{47} Hughes and colleagues\textsuperscript{47} summarized the results of 10 trials in which smokers were randomly assigned to advice and advice plus NCG, and cessation rates were determined. They concluded that 6 trials found support for the gum and 4 did not. Results of their own study of 315 smokers demonstrated a significantly higher cessation rate at 6 months but not at 12 months for smokers treated with NCG than with placebo. Wilson and colleagues\textsuperscript{47} demonstrated significantly higher cessation rates at 12 months for patients treated with gum and behaviorally-oriented brief counseling from a physician trained to counsel compared to patients who were just prescribed the gum by physicians who did not receive counseling training. Ockene and colleagues\textsuperscript{47} also demonstrated significant differences at 6 months between those patients advised to stop smoking compared to those who were seen by trained physicians and prescribed gum.

In conclusion, nicotine gum is an effective aid to smoking cessation when combined with clinical behavioral intervention. In addition, when prescribed to smokers during a brief physician-delivered intervention, there is also evidence that it is effective. However, there are some studies which do not support this outcome long-term.

Clonidine, a drug used in the treatment of hypertension, has been found in one study to have a significant effect on 6-month smoking cessation outcomes when administered orally.\textsuperscript{47} The effect was observed in women but not in men or women who were depressed. A randomized trial suggested that transdermal clonidine may decrease withdrawal symptoms associated with cessation.\textsuperscript{47} Further studies are needed to assess the long-term impact of clonidine as well as the mechanism by which it reduces withdrawal symptoms.

\textbf{Maintenance/Relapse Prevention Intervention:} There have been minimal opportunities to assess the effect of maintenance or relapse prevention interventions implemented by physicians on smoking cessation rates. All of the studies completed with a general medical population, except the one by Wilson and colleagues,\textsuperscript{47} used a protocol in which only one physician-patient encounter was required. In the studies involving physician-delivered interventions with pregnant women,\textsuperscript{47} physician contacts occurred at each of their prenatal visits. However, these studies did not look at effects postdelivery. There is little information with regard to maintenance of smoking cessation postdelivery. It can be hypothesized that multiple physician contacts over a long period of time would have a beneficial effect on patients’ smoking cessation rates.

Helping patients plan quit dates increases their attempts to quit. Routine follow-up to support patients who attempt to quit and more effective treatment of withdrawal symptoms may help to turn more attempts into long-term abstinence. In several of the studies reviewed, physicians were trained to ask about smoking, advise quitting, request quit dates, and give follow-up appointments. However, they were not taught how to help patients remain abstinent once they initiated quitting. These omissions may be crucial in the design of the intervention.

\textbf{Training to Set Up Office Practice Systems for Facilitating Physician-Training Smoking Intervention:} Systems that remind physicians and office staff to counsel about smoking should also be integrated into office routines. This intervention provides the physician with materials and brief additional education. However, in none of the studies reviewed was a structured experience provided for the clinic staff. Implementation and assessment of such staff training programs are needed.

\textbf{Interventions Targeting Minority Populations in Health Care Settings:} To date, there have been few studies which specifically targeted minority populations in health care settings.\textsuperscript{47} Each indicates that significant effects can occur as a result of intervention. Presently, there are several ongoing NIH-supported studies that are investigating the use of community-mobilization as a way of facilitating smoking behavior change in hard-to-reach smokers. Studies to determine how to tailor interventions towards hard-to-reach populations in health care settings are strongly needed.

\textbf{Effective Steps in Physician-Delivered Smoking Intervention}

The use of a multifaceted, long-term approach to physician-delivered smoking intervention resembles the present-day approach to hypertension, which has become relatively well controlled in the last 2 decades. This control is in part a result of effective screening approaches and well-developed treatment and follow-up protocols. Similar control over smoking is likely to occur as health care providers utilize effective screening and consistent intervention and follow-up.

For physicians to have an impact on the prevalence of smoking, it is necessary, at the least, that they identify all smoking patients by asking whether they smoke and advise them to stop smoking; inform them of the health risks of smoking; personalize their reasons for cessation; provide and discuss self-help materials; assess nicotine dependency and consider prescribing nicotine replacement therapy for the addicted smoker; and continually reinforce the non-smoking message at regularly scheduled office visits. Systems which facilitate the identification of smokers and monitor their progress can be set up.\textsuperscript{48} Physicians can provide smoking cessation advice effectively and do preventive counseling in a relatively short period of time. Such intervention is likely to have a greater impact on the health of their patients than any other intervention carried out in the outpatient setting.

\textbf{Physician Smoking Intervention Knowledge, Attitudes, and Practices}

Since physicians and other care providers can have a strong impact on the cessation of cigarette smoking, it is important that they intervene; many, however, do nothing.\textsuperscript{48} Most physicians are aware of the health benefits of smoking cessation for their patients, and they agree that physicians do have a responsibility to help smokers; however, generally less than one half of physicians report advising all patients to stop smoking, with well patients being less likely to receive advice\textsuperscript{48,116-118} than those who are sick. Generally, less than one quarter of physicians report that they actually go beyond providing advice for cessation. Physicians often underutilize supportive aids that could be helpful, such as written materials and referrals.\textsuperscript{48}

Smokers may underestimate how much physicians intervene; however, patient reports also indicate that healthy patients are less likely to receive advice to stop smoking.
than are diseased patients, with only one half of patients with smoking-related symptoms or no smoking-related problems reporting advice being given. A study completed at the University of Massachusetts Medical School indicated that about two-thirds of all smokers reported ever having been given advice to stop smoking by their physicians, and such advice was significantly more likely to be given if a smoking-related disease was present. Only 50% of patients with smoking-related symptoms and/or no smoking-related diseases received advice. These figures represent an increase over what had been reported in the literature in the late 1970s, when only 20% of smokers reported that advice was being provided. This increase may be due in part to the greater emphasis that is being placed on the need for interventions to be delivered by physicians. It is, of course, quite likely that some advice is selectively forgotten, especially by smokers who are not interested in stopping smoking. While there may be psychologic and situational factors affecting recall, if patients are not hearing smoking cessation advice advanced by their physicians, then this too has implications for physician intervention training and the skills needed.

Smoking Intervention Training Programs

Educational programs to develop physician smoking-intervention skills have demonstrated that significant stylistic changes in smoking-intervention skills can occur within the constraints of a brief training program. These skills increase the physician's effectiveness with smokers. The findings of the Physician-Delivered Smoking Intervention Program by Ockene and her colleagues demonstrate that a training program can significantly affect physicians' knowledge, attitudes, and acquisition of skills to counsel patients about smoking cessation and can have a significant effect on patients' smoking cessation rates when compared to when physicians only offer advice. The program used for training physicians in smoking intervention is also time-efficient, requiring only 2.5 contact hours. Investigators have also demonstrated that reminders and stickers on charts can have an effect on how much a physician will intervene with patients and can have a beneficial effect on cessation rates. The development of basic counseling skills combined with an adequate office monitoring and reminder system can encourage health care providers to intervene with smokers.

Medical schools and residency training programs do little to teach and promote the counseling skills necessary for physicians to feel confident in their ability to intervene effectively with their smoking patients. A 1986 survey of United States medical schools' educational programs for housestaff relating to smoking found that in 1983 and 1984, only 30% and 25% of programs, respectively, offered such instruction. Considering that the counseling skills needed for smoking intervention are similar to those necessary for facilitating changes in other health-related behaviors such as weight loss, dietary change, medication compliance, and exercise regimens, the value of providing medical personnel with training in such skills is further heightened.

Educational interventions designed to train physicians, residents, and medical students in behavioral counseling techniques range from traditional lecture/discussion models used in CME, to more active models which include demonstrations and role-play. No specific studies have addressed the most effective ways for physicians to learn smoking intervention skills. However, studies provide evidence for the short-term benefits of using active learning methods, such as role-play with review and systematic feedback.

New goals for medical education, housestaff training, and CME are needed, which include the development of intervention skills to allow providers to effectively and efficiently facilitate health-promoting behaviors among their patients. Physicians can effectively provide smoking cessation advice and preventive counseling in a relatively short period of time.

Barriers to Physician-Delivered Interventions

The low success rate that physicians perceive themselves to have with smokers is likely to affect their desire and ability to work further with such patients. Thus, training programs where preventive counseling skills are taught need to be incorporated into medical and postgraduate medical education. It is encouraging that physicians think educational programs would help them to increase their impact on smokers, and they would like these opportunities made available to them in order to increase their smoking intervention skills. It has already been indicated in the previous section that physicians can increase their smoking intervention skills which has a significant impact on their effectiveness with patients.

Other barriers to physician-delivered interventions for smoking include concerns with financial reimbursement, organizational priorities which do not provide time and space for prevention, educators' attitudes toward teaching preventive rather than the more traditionally taught curative medicine, and lack of available information about the effectiveness of various approaches to smoking intervention. These barriers must be dealt with effectively if the health-care system is to have a significant effect on smoking cessation. They have been reviewed extensively elsewhere. There have been no investigations or research which indicates how to best deal with the noted barriers in order to increase the likelihood that physicians will intervene with smokers.

Recommendations for Action and Directions for Further Research

The research completed to date on the physician's role in smoking intervention and methods to enhance his/her impact on patients' smoking cessation rates supports the following conclusions:

1. Educational programs designed to enhance physicians' awareness of the importance of physician-delivered smoking intervention and to facilitate the development of skills to do such intervention have a significant effect on physicians' skills and, in turn, on their impact on smokers.

2. A system which is set up to prompt the physician to intervene with smokers has a significant impact on patients' smoking cessation rates.

3. Nicotine-containing gum is an effective aid to smoking cessation when combined with clinical, behavioral intervention and prescribed as part of brief physician-delivered interventions. (At the time of writing, research on the effects

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Smoking: Epidemiology, Cessation, Prevention (Frey, Ockene, Tager)
4. There is some supportive evidence that indicates that physicians can have an impact on pregnant women's smoking cessation rates. However, only a few studies have been completed which target this population.

5. The few studies which have targeted minority populations in health care settings support the conclusion that these interventions can have a significant effect on their smoking cessation rates. However, only a few studies have been completed which target this population.

The research also leaves some questions unanswered and points to the following directions for further research: (1) to determine the optimal combination of training and prompting to enhance physicians' effectiveness with smokers; (2) to develop methods to teach counseling techniques in a variety of settings and to physicians at different levels of professional development; (3) to develop brief counseling techniques to be used by physicians to intervene effectively with behavioral risk factors other than smoking, for example, as has been called for recently in relation to physical exercise and cholesterol lowering; (4) to develop methods that physicians and other health care providers can use to help patients maintain smoking cessation, given the minimal intervention that actually occurs at each patient-physician encounter; (5) to develop methods which physicians and other health care providers can use to help harder-to-reach less-educated populations to stop smoking; and (6) to develop smoking interventions which target pregnant women in health care settings to enhance their maintenance of cessation rates. This would require research designs that allow for postdelivery long-term follow-up of pregnant smokers.

Substantial evidence is available to demonstrate that physicians and other providers in the general health care system are important sources of intervention for the large group of smokers who have annual contact with them during the course of ongoing health care. Given the current prevalence of smoking of approximately 30% of the adult US population, and given that 70% of these smokers are seen by physicians annually, the use of physician-delivered interventions which produce 8% to 16% cessation rates could decrease the population smoking prevalence to a significant degree with estimates ranging from 2.8 million to 5.6 million individuals per year. Therefore, a substantial number of deaths from respiratory diseases and other smoking-related diseases could potentially be averted each year.

**Pediatric Cigarette Smoking: Patterns, Prevention and Control**

**Nature and Scope of the Problem**

**Prevalence and Demographics of Smoking Among Youth: Initiation.** Onset Patterns—As with the adoption of any behavior, the adoption of smoking by youth follows an S-shaped curve, with few starting very young, most youth trying it between ages 11 and 15, and a few not trying it until high school or later. Regardless of the age of first trying a cigarette, youth progress (or not) through a reasonably well-defined sequence from that first try to the acquisition of dependence or addiction. The preparatory stage (stage 1) involves the formation of knowledge, beliefs, and expectations about smoking and the functions it can serve (definition of self as glamorous, etc). Initial trying (stage 2) concerns the first 2 or 3 tries. These usually occur in the presence of friends or occasionally alone in the home (eg, by latch-key children). The physiologic effects of and reactions to the first cigarette (dizziness, taste, etc), as well as the psychosocial reinforcements obtained from its use, determine whether or not a person advances to the next stage (Leventhal H, Fleming R, Ershler J. Unpublished data, 1988). Experimentation (stage 3) involves repeated, irregular use over an extended period, perhaps several years. It tends to be situation-specific (eg, at parties). Regular smoking (stage 4) for youth means smoking on a regular basis, perhaps every weekend, perhaps every day on the way to or from school.

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**Figure 1. Six domains of determinants of tobacco use.**
Smoking becomes increasingly regular, over a wide variety of situations. Nicotine dependence or addiction (stage 5) occurs with the development of an internally regulated need for nicotine. About one third of adult smokers probably became addicted before the end of high school (the approximately 10% of students who smoke 10 or more cigarettes per day), while two thirds do not become addicted until after the transition to college or work. A few adults continue to smoke regularly without becoming addicted. Note that the process of addiction to nicotine is no different from the process of addiction to any other substance. The major differences concern the probability of addiction (very high for nicotine and cocaine, lower for marijuana, even lower for alcohol), the speed of the addiction process (slower for nicotine, faster for cocaine), and the seriousness of the consequences of addiction (more serious in the short term for many illicit drugs and alcohol, almost as serious in the long term for nicotine). Although the process of becoming a smoker is clearly developmental, it is a stochastic one, with the probability of advancing from one stage to another always less than one. The progression involves multiple social, psychological, and biologic factors, and different factors may play different functions at different points in the progression, and play different roles for different people. These are now reviewed briefly.

Predictors of Initiation—The determinants of nicotine addiction are traditionally considered in 3 domains—social, psychological, and biologic. In this section, we consider these same domains as determinants of initiation of nicotine use (indeed any substance use and abuse) by youth.184 (Fig 1). The social domain involves terms of social organization and disorganization, and social bonding with family, school, and peers. The psychological domain relates to social learning and intrapsychic variables. The biologic domain includes pharmacologic processes and conditioning.

Sociologists and others have established that social organization variables are the most distal predictors of drug use (see the left of Fig 1). The structure of the economic, legal, social, and educational systems of a society are determinants of behavior. In particular, role strain and social disorganization or breakdown may lead to inadequate socialization which, in turn, alters the social bonding and social learning variables (Fig 1 and text below). These may then lead to increased drug use, for example, among the disadvantaged.188 The extent to which this class of variables is predictive of cigarette smoking, as opposed to illicit drug use, is unclear given the lower rates of smoking among black as compared to white subjects. However, the relationship of smoking to socioeconomic status supports it.

Regardless of levels of socialization, the primary determinants of smoking by youth are probably the norms of the larger society in which they grow up and live. To the extent that youth see smoking as a sign of maturity, they will be motivated to do it. Tobacco advertising and promotion clearly encourages such views,197 and the tobacco industry will go to extraordinary lengths to ensure that this continues.198 On the other hand, the extensive antitobacco activities of the last decade have clearly discouraged such views. Youth now see the consequences of substance use as more serious and hold less positive attitudes toward substance use than in previous years.199,180 This change in societal norms may have reached well educated youth but has not yet reached less well educated youth. Thus, less educated youth are still exposed to a norm of smoking (and other substance use) as an aid to coping with the hardships of life. They are still not convinced of the seriousness of the consequences of smoking and still hold relatively positive attitudes towards use.

Sociologists have identified social bonding (Fig 1) as a primary determinant of substance use and abuse.180-181 In normal social development, strong social bonds are formed between children and parents, between adolescents and schools, and between youth and other conventional social groups including conventional peers. When normal social development is disturbed, either by social disorganization (such as living in disadvantaged situations) or by family disruption or inadequate family support (divorce, latch-key status, poor family functioning), youth are more likely to form bonds with deviant peers. Such deviant bonding increases the exposure to substance use by others, disturbs patterns of social learning, and increases the probability of problem behavior.

Social learning variables include opportunities for observation and modelling of behavior, opportunities to use (or availability), social normative beliefs (including collective ignorance or norms), and social reinforcement (positive and negative). Bandura184-185 and Akers186 have developed the relations among these variables from the psychological and sociological perspectives, respectively. Any particular behavior is more likely to occur when it is differentially reinforced and is seen as desirable by important others. Fishbein and Ajzen187-188 have incorporated social normative beliefs into their theory of reasoned action (TRA) for the prediction of behavioral intentions. Several groups189-192 have also applied Akers' version of social learning theory to predict and explain delinquency behavior, including tobacco use.

In the above context, youth alienated from conventional culture (bonded with deviant culture) have more opportunities to observe smoking and its positive functions. Cigarettes are also more readily available to them, and they have more opportunities to try them. They are also more likely to overestimate the proportion of their peers who smoke—because they are likely to be hanging out with groups who actually do so.193-194 For example, youth who identify themselves as belonging to groups exhibiting "problem behavior" are much more likely than others to have friends who smoke and to smoke themselves.195-196 Finally, deviant cultures reinforce these youth when they do smoke, for example, by acceptance into groups.

Youth alienated from conventional culture or who otherwise hang out with smoking peers are obviously not the only ones susceptible to social learning variables. Youth with smoking parents have many opportunities to observe smoking and its functions, have a ready source of cigarettes, are likely to select friends from the same socioeconomic status and background, and are likely to overestimate the proportion of adults who smoke. Indeed, many studies, both cross-sectional and prospective, have found parental smoking to be the strongest predictor of smoking.196 Parental smoking often vies for first place with peer smoking, at least until youths reach puberty.

Both sociologists and psychologists have suggested that
“intrapsychic” variables, such as self-esteem, stress/distress, social skills, and self-efficacy, might complete the link between social bonding and knowledge, attitudes and behavior (Fig 1). Sociologists and clinical psychologists suggest that poor family bonding leads to stress (inability to cope, rebelliousness, risk taking) and distress (withdrawal, self-derogation, depression). Several researchers have shown a link between stress or distress variables and substance use, including smoking,125-127 some as early as grade 1.128

On the other hand, strong family and other conventional bonding can lead to the development of positive social skills and competencies, strong self efficacy regarding these, and high self-esteem. Psychologists have also suggested that personality factors (eg, locus of control) affect one’s ability to cope with social situations and one’s desire for and response to drug use.129-130

The most proximal determinants to actual cigarette smoking are the cognitive variables of knowledge, attitudes, and behavior regarding tobacco and other substances and their use (see the right side of Fig 1). These are precisely the same variables considered in the first stage of onset, the preparation or anticipation stage. They include knowledge of the physiologic and social consequences of use, personal beliefs (expectancies, perceived risk, susceptibility) regarding consequences, general values (eg, toward health, independence) and specific evaluation of these consequences, attitudes toward drug use and related issues, behavioral intentions, and related behaviors (eg, alcohol use/abuse).131-132 They all play a role in determining behavior; no one of them (eg, knowledge) is sufficient to determine behavior on its own, and so they all must be considered in prevention and treatment programs.

Finally, pharmacologic and conditioning processes may play a role at each stage of onset (Fig 1). Leventhal et al (unpublished data, 1988) provide the most comprehensive discussion of the role of pharmacologic and conditioning variables in the onset of nicotine use and its prevention. Clearly, its role increases as adolescents smoke more cigarettes more frequently.

It is also important to note that adolescents do not fully understand the nature of addiction. When it comes to themselves, they hold illogical and contradictory beliefs about addiction.133-134 For example, they sometimes do and sometimes do not believe that they can become addicted. They sometimes do and sometimes do not believe that they would be able to tell if they were becoming addicted. They believe that they will be able to stop if they do become addicted at the same time as they believe that addiction means being unable to quit. Youth clearly underestimate the power of addiction. Ironically, youth whose parents attempted to quit and failed believe that it is easy to quit smoking, while youths whose parents quit successfully believe that it is difficult.135

Summary on Initiation—As Figure 1 and the above discussion suggest, each of the above domains of variables may have different effects at different stages of the onset process,136 and the biologic, psychological, and social determinants may interact in complex ways. For example, parents have a greater influence than peers in determining attitudes and intentions (the preparation stage) among younger adolescents, while peer influences increase during and after puberty. Social factors are more influential for beginning smokers, and pharmacologic factors and coping patterns become more important for the older and more established smokers. We do not yet understand all of these complexities. However, it is clear that successful prevention of cigarette smoking and early cessation programs will need to include consideration of all of the above determinants and their interactions as we understand them. Any program that emphasizes only one or a few of the determinants or stages of onset is doomed to mediocrity at best, probably failure, and possibly worsening the situation.

Prevention. The complexity of the process of acquiring nicotine addiction and the seriousness of addiction suggest that primary prevention should be chosen over the alternative of treatment of people once they are addicted. Unfortunately, the complexity of the acquisition process also makes prevention difficult. Researchers, health educators, and other health personnel have tried many different approaches to prevention, but to date, no one approach has proven totally effective, though progress is being made. Before addressing existing approaches to prevention, we discuss the barriers to prevention.

Barriers to Prevention—The barriers to effective prevention are multiple. First, as noted above, is the complexity of the acquisition process. Without a full understanding of the acquisition process, plus an equally full understanding of behavior change processes in general, we cannot design very effective prevention programs. Second, despite the massive changes in societal norms of the last 30 years, youth still perceive many pressures to smoke. As noted earlier, some of these are restricted to families with adult smokers and to relatively alienated youth. However, the tobacco industry has insured that some pressures to smoke are ever present. While tobacco advertising via television and radio has been banned since 1970, tobacco advertising in print media and promotion through other avenues continues at ever-higher rates. In addition, tobacco promotion currently targets those groups least able to resist it (and nicotine addiction) because of their social circumstances (minorities, blue-collar workers, less educated, women, third-world countries). Even more insidiously, the tobacco industry influences coverage of the health effects by magazines because of their dependence on tobacco advertising revenue.137-138

Historical Approaches to Prevention—Smoking education traditionally has consisted of information about the negative health consequences of smoking. While such an approach is effective in altering knowledge, it typically has not effectively prevented smoking onset. This is true for both programs imparted to school children in classrooms139 and to broader campaigns directed to the general public through mass media.140 Information simply is not sufficient to alter behavior,141 regardless of how it is delivered. Thus, altering the teaching style (lectures, discussion, peer leaders, use of media, etc) may not help much, if at all. In addition, information about long-term health consequences is just not salient to youth, who are focused very much on the present. Information about immediate physiologic effects might be more useful because adolescents have limited future orientations.171,172

Current Emphases in Prevention—The failure of information-
based approaches to prevention is probably due to not considering the broad set of social, psychological, and pharmacologic determinants of smoking onset reviewed earlier. Consideration of the broad sets of social influences has led to the development of psychosocial approaches to classroom-based smoking prevention curricula. These fall into "social influences" programs that are specific to nicotine (and possibly other substance) use and broader "life/social competence" programs in which substance use in general, or cigarette smoking in particular, are not so specifically targeted. Social influence curricula typically include the following: (a) information on the consequences of smoking, with special emphasis of the short-term health and social consequences; (b) information and the correction of estimates of the prevalence of smoking by peers and adults; (c) discussion of social influences from peers, family, and the media on smoking, and ways of dealing with them; (d) modelling to show these influences, situations, and coping behaviors on video/film or by same-age peers; (e) role playing and explicit learning and practice of behavioral skills; and (f) the making of a public commitment regarding smoking intentions. The life/social skills curricula include most of the above elements, together with more general social skills development and self-esteem enhancement, though often they are not so highly focused on the circumstances of tobacco use. Most of both types of curricula also emphasize implementation strategies, such as the use of socratic methods (rather than just lecturing), active role play, and practice of skills by the students. Some include assignments with parents, or the development of activism or advocacy behavior in the community. Some emphasize the role of media, and others, the use of peers.

Over 25 studies of these psychosocial approaches suggest that they are somewhat effective at delaying onset. When implemented optimally, these programs appear to reduce the proportion of students starting to smoke by 30% to 50% within 1 and 2 years of the intervention. It is not possible to determine whether one approach is better than another, eg, life/social skills vs social influence, because of many differences between studies in sampling, measures, and analytic strategies. However, it is unclear what components of the content or strategies of the programs are responsible for these positive effects. In addition, in the long term, they have questionable effects on ultimate smoking acquisition, although too few studies have included long-term follow-up to be confident about this yet.

A National Cancer Institute Advisory Panel advised a minimum of 3 components for effective school-based smoking prevention: information about the short-term physiologic effects and social consequences of tobacco use; information about social influences on tobacco use, especially peer, parent, and media influences; and training of resistance skills, including modelling and practice of resistance skills. The panel also recommended quality delivery by (a) providing special training to motivated educators and (b) emphasizing that existing curricula be implemented completely as designed rather than being adapted (except for special groups such as different ethnic groups). Although the research evidence is unclear, the panel recommended the use of peer assistants to trained teachers, with responsibility for carrying out specified program components such as leading discussion groups or modelling peer pressures and resistance skills. Parental involvement was also recommended, and recent research supports this.

The effectiveness of these programs when implemented on a broad scale by regular classroom teachers (rather than research staff) is also unclear. Because they are so different from most school-based curricula, teachers require special training to implement them correctly. In addition, effective programs need better dissemination. It is unfortunate that at present, those programs or packages most widely disseminated are the least well evaluated, while the best evaluated are not widely available. The lack of effective dissemination strategies and policies is currently a barrier to effective prevention. Dissemination policies must consider teacher training, demands on teachers' time, costs of materials, and competing educational and health priorities.

Developing and Future Approaches to and Needs in Prevention—

The review of determinants provided above suggests that social skills approaches to prevention might be more effective when combined with other levels of community intervention. Project STAR is a social skills program delivered by specially trained teachers to grade 6 and 7 students in Kansas City middle schools. Parents also are encouraged to participate in the program with their children and trained to influence policy at their school. In addition, media coverage and other community involvement supports the program and reinforces its messages. Effects 2 and 3 years after initiation are impressive, and preliminary long-term effects are also (Pentz MA, et al. Unpublished data, 1990). The review of determinants also suggests that prevention programs should consider the role of pharmacologic processes in prevention. However, it would be a gross over-simplification to simply use noxious first experiences as a deterrent to further smoking. The symptoms must be interpreted as signs of genuine danger, and many youth do not interpret them as such. Thus, prevention programs should include efforts to influence how youth interpret the first effects of smoking so as to strengthen their deterrent effects. Hirschapman et al. for example, taught students to reinterpret adaptation to noxious symptoms as the smoke killing the body's warning system, making one unaware of danger. This program reduced movement from first to later tries. Such an approach combined with the social influences approach should be more effective than either alone.

The stage model also suggests that smoking prevention programs need to start in elementary school (or before) and follow a developmentally sensitive path through high school and beyond. The NCI Advisory Panel concluded that smoking prevention education conducted within a broader health focus appeared as effective as programs with an exclusive focus on smoking as long as the smoking component received a minimum level of attention. They advised a minimum of 5 classroom sessions in each of at least 2 years. One shot programs, whether of 20+ sessions or only 1 to 10, are doomed to mediocre short-term success because the students are still exposed to the many influences in their environments. Those influences most salient to them, and the role they play, keep changing as children develop, enter puberty, change schools, and become young adults. Effective smoking prevention needs to do the same.

Social policy also should play an important role in preven-
tion. "In marked contrast to the trends in virtually all other areas of smoking control policy, the number of legal restrictions on children's access to tobacco products has decreased over the past quarter century. Studies indicate that vendor compliance with the minimum-age-of-sale laws is the exception rather than the rule."181a We still need strengthened policies regarding youth access to tobacco products at stores and vending machines.180,188

School policy clearly influences smoking onset rates.193 Parents can influence school policy (e.g., Project STAR). Recent legislation against smoking in public places and worksites also helps reduce smoking and probably prevents some youth from becoming addicted smokers when they join the workforce. We still need more focus on making smokefree other environments frequented by children and youth, such as day-care settings, YMCAs, youth clubs, and disco.

The Role of the Pediatrician—Pediatricians, as well as the general medical and public health sectors, can and should play a more positive and visible role in smoking prevention. Physicians should monitor family and child cigarette smoking and other substance use and their precursors (see predictors above). They should work with complete families to remove the youth's exposure to smoking—by having parents quit (see section on Physician's Role), and by providing patients with age-appropriate prevention materials. Parents should be encouraged to quit, not only for their own health, but for the health of their children. Information on the consequences of their smoking on their child's health can motivate parents. Providing information to young children, age 3 to 11, about the bad health effects of cigarette smoking can motivate them to not wish to smoke themselves. Information on how they can help their parents quit smoking, by providing social support, might also be useful. By puberty, information about consequences is no longer sufficient to maintain abstinence, and youth should be made aware of social influences and provided with social skills training. Physicians can provide some of this directly to patients or they can work with school systems to provide it. However, making students aware of social pressures without successfully providing them with skills to resist such pressures may actually make the situation worse.

Medical students, interns, and practicing physicians can help deliver effective prevention programs to students in schools and youth in other settings. However, they should be trained to deliver programs of proven effectiveness or programs derived from strong theory to be more effective than existing programs, rather than focusing on one determinant such as advertising (as the Doctors Ought to Care [DOC] program appears to). The review of determinants provided earlier makes it very clear that any approach focused on only one determinant, regardless of its assumed importance, is doomed to only partial success at best or even failure. Medical and public health groups can also help smoking prevention by actively campaigning against unfair practices by the tobacco industry and by not entering into any supportive relationships with them. The AMA's support of the movement against tobacco advertising is a positive example. A negative example is the California Medical Association's recent agreement with the tobacco industry to support the transfer of public education funds derived from Proposition 99 taxation into medical care. Such a move would benefit physicians, not to mention the tobacco industry, at the expense of the long-term health of the population of California.

Early Cessation—Barriers to Early Cessation—Failure to prevent every youth from starting to smoke gives rise to the need for effective approaches to early smoking cessation (early nicotine addiction treatment for some). Unfortunately, smoking cessation for youth is no easier than it is for adults. Indeed, it may be more difficult, in that youth are less motivated by the possible consequences to their long-term health.

Youth make frequent and unsuccessful attempts to quit smoking. Over one half of US smoking youth attempt to quit each year. Less than one fifth of those youth smoking 10 or more cigarettes per day are successful for even 1 month.10 Only 5% of smoking youth believe that they will still be smoking 5 years later: in actual fact, 75% of them are still smoking 8 years later.184 Youth report many of the same reasons for difficulty in quitting as adults—social pressure, urges, withdrawal symptoms.190,198-201 Data from these studies suggest that the factors which motivate youth to attempt quitting are different from those that predict success at quitting. The reports of withdrawal symptoms and the high relapse rates, together with the fact that one half of high school weekly smokers smoke 10 or more cigarettes per day, attest to the strength of nicotine dependence and addiction, even among youth.1

The need for early cessation opportunities are great. Youth who desire to quit have great difficulty finding a program tailored for them. Unfortunately, researchers (and those that fund research) have been slow to meet this need. Effective cessation programs for youth will need to educate them about the importance and power of addiction, and teach them how to handle social and stressful situations, as well as address all those issues of importance to adults (see above). The barriers to early cessation are just as great as and similar to those barriers to prevention. Early cessation programs must be offered to individuals, whereas prevention programs can be offered to whole schools or classrooms of students. Schools would be an ideal location in which to offer early cessation programs to students. Unfortunately, the educational system does not support therapeutic programs during school hours, and it is difficult to motivate young smokers to attend a cessation program outside of school hours because of numerous competing activities with more immediate reinforcement for youth.184 Medical practices would be another ideal location in which to offer youth cessation clinics. Unfortunately, the medical system does not reimburse such treatment, at least not at an adequate level. Of course, youth would still need to be motivated to attend such clinics if they were available. Self-help programs are of benefit only to those individuals highly motivated to quit, and most youth are not so motivated. None of the above approaches adequately addresses the needs of youth not in school.

Existing Approaches—Many existing approaches to youth cessation are based on adult models. Adult programs are based in large part on the addiction model (see section on Physician's Role). Some research projects are investigating
different combinations of traditional adult approaches and approaches derived from the newer psychosocial approaches to prevention.25 As noted earlier, some young smokers exhibit a wide variability in their smoking, while others are already clearly addicted.26 The optimal balance of "prevention" and traditional cessation approaches for youth is difficult to determine because of the limited research in this area.17,19,89,107,197

Much more research and program development is needed regarding cessation of both cigarette smoking and smokeless tobacco use. This is especially so for young female subjects, who seem to find it much more difficult to quit than male subjects.301,302

Researchers and voluntary health organizations have developed several cessation programs especially for youth.303-307-310 However, without further research, none of them can yet be recommended highly.

DEVELOPING AND FUTURE NEEDS. Prevention programs at the high school level or later should also include a component on quitting. Youth programs also need to consider pharmacologic and social processes in more detail than many adult programs may. Adolescents apparently do not identify desires for a cigarette as a sign of dependence or addiction, and as noted above, they believe that they will be aware of becoming addicted in time to avoid it.

Youth programs also need to include a motivational component to attract the early starters. Those youth who started smoking in elementary school are least motivated to want to quit, but may be more successful at doing so if they try.197 However, in general, just as with adults, those youth who smoke more frequently and more heavily have the greatest difficulty in quitting.197,198

The Role of the Pediatrician—Clearly, intensive research efforts are needed to develop educational efforts to convince youth of the importance of avoiding addiction and to provide ways for them to do so. However, in the meantime, physicians and other health personnel can play an important role in early cessation in several ways. First, they can identify early smoking behavior. Second, they can attempt to motivate youths to quit smoking sooner rather than later. Unfortunately, exactly how best to achieve this is not yet known, so physicians also need to cooperate with and support research efforts to find out. Third, physicians can hopefully then refer motivated youth to cessation programs and materials, though we cannot yet identify effective materials and programs. Fourth, medical personnel should do all they can to support the development, dissemination, and delivery of effective tobacco cessation and nicotine treatment programs for youth.

RESEARCH NEEDS. Prevention—There are many unanswered questions regarding the prevention of cigarette smoking by youth. Many of these concern refinements of the school-based curricula, such as the following: (1) the long-term effectiveness of even the most effective current prevention strategies; (2) the importance of (a) multiyear interventions, (b) addressing the multiple determinants of smoking behavior in prevention interventions, (c) teacher training for effective prevention, (d) using other program delivery personnel, and (e) development of a dissemination system for effective programs; and (3) the role of pediatricians and other health professions in smoking prevention.

Early Cessation—Only limited research has been conducted on early cessation with youth. This area deserves much greater support, because early cessation is the next level to strive for prevention of respiratory diseases for those individuals for whom complete prevention of smoking fails. There is a special need to find approaches useful for early school leavers.

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