Smoking prevention, cessation, and maintenance: Review for the primary care physician

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Tobacco use is a major risk factor for many life-threatening and life-diminishing illnesses and a primary focus of attention for preventive medicine. Smoking typically begins in adolescence as a result of psychosocial causes, but, once established, it is maintained by both psychosocial forces and physiologic dependence. Better than 75 percent of smokers have attempted to stop at least once. Those who succeed will have tried an average of 6-7 times. The primary barrier to cessation is the discomfort of withdrawal. The primary cause of

relapse following successful cessation is psychosocial stress. Adjunctive use of a nicotine-containing chewing gum with behavioral treatment enhances cessation rates but does not affect maintenance rates. Traditional behavioral treatment is still required to enhance the likelihood of cessation and minimize the likelihood of relapse. Recent research holds the hope that prevention programs directed at adolescents can significantly reduce the incidence of smoking in the general population.

In 1604, King James of England declared tobacco use a branch of drunkenness and prescribed the first known graded series of behavior-dependent contingencies for continued smoking. An initial offense resulted in excommunication from the Church, a second in public whipping, a third in cutting off the nose (based on the theory that the smell of burning tobacco was what made smoking desirable), and a fourth in death.¹ To the best of our knowledge, James' behavioral program was no more, nor less, effective than current treatment. It does seem highly likely that convicted four-time losers did not continue the habit!

Tobacco use is a multibillion dollar industry in

the United States.^{2,3} This widespread use occurs in the face of overwhelming evidence that tobacco use causes about 30 percent of all cardiovascular disease,⁴⁻²⁰ 50 percent of all neoplastic disease,²¹⁻²⁵ and 90 percent of all severe chronic obstructive lung disease.²⁶ In addition, smoking has been implicated in the development of dental disease,²⁷ osteoporosis,²⁸ ischemic cerebrovascular events,^{29,30} neuropathies,³¹ peripheral vascular disease,^{32,33} gastrointestinal disorders,³⁴ reproductive dysfunction,^{35,36} and premature births with related higher rates of infantile mortality or disorders.³⁷⁻³⁹ Sufficiently chronic passive or "sidestream" exposure to the smoke of others appears to increase

heart disease,^{40,41} cancer,^{42,43} respiratory diseases,^{44,45} psychologic disorders,⁴⁶ or other illnesses in coworkers, spouses, and offspring.⁴⁷ It has been estimated that 10 percent of all medical costs are attributable to smoking.⁴⁸⁻⁵⁰

Clearly, enough evidence has been marshaled to justify a major public health initiative to diminish tobacco use.⁵¹⁻⁵³ Yet, smoking prevention, cessation, and maintenance have often been viewed as activities of secondary importance by organized medicine, third-party payers, and the government alike.⁵⁴ In one study, only 1 in 3 smokers reported that their physicians had ever encouraged them to stop tobacco usage. With increasing emphasis on cost containment in medicine, such preventive activities probably will assume a greater role in the professional life of the primary care physician. The present paper reviews the empiric basis for tobacco use prevention, treatment, and relapse avoidance.

Diagnosis

Tobacco users may, or may not, qualify for a formal diagnosis of Tobacco Dependence Disorder (305.1x) under the DSM III nosologic criteria.⁵⁵ The health risks are probably greater for patients who are dependent than for those who are merely users, because dependent individuals will smoke more per unit time and have more difficulties stopping when they choose to try.^{56,57} Users will, by definition, have no problems stopping if they desire to do so. Thus, few of them will appear in a physician's office asking for help in cessation. The number of these individuals probably has become increasingly smaller since the health risks of smoking have become accepted public knowledge and the panache associated with smoking that existed prior to the first Surgeon General's report on smoking and health⁵⁸ has largely evaporated. According to Spitzer and associates,⁵⁵ true tobacco dependence is characterized by continuous use of tobacco for at least 1 month, with at least one of the following situations: serious attempts to stop or significantly reduce the amount of tobacco use on a permanent basis have been unsuccessful; attempts to stop smoking have led to the development of tobacco withdrawal (craving for tobacco, irritability, anxiety, difficulties in concentrating, restlessness, headache, drowsiness, and/or gastrointestinal disturbances); and/or the person continues to use tobacco despite a serious physical disorder that he or she knows is exacerbated by such use.

Epidemiology

Having decreased from a high incidence for males

of about 55 percent in the early 1960s and increased from about 24 percent for females during the same period, the current prevalence of smoking in the adult U.S. population appears to be about 32 percent.⁵⁹⁻⁶¹ This means that at least 55 million Americans continue to smoke.

Perhaps the most disturbing epidemiologic trend is continued experimentation with tobacco by about 1 in 5 adolescents.^{62,63} While a slight downward trend in cigarette smoking among adolescents has been observed in the last several years, the use of smokeless tobacco (snuff, chewing tobacco) appears to be on the increase.⁶⁴⁻⁶⁷ Given what is known about the natural history of tobacco use, this continued use of tobacco among adolescents portends a significant group of tobacco-dependent individuals who will continue to develop serious tobacco-related illnesses at a high rate.

Natural history

Tobacco use typically begins in adolescence. The odds of becoming a tobacco user among those who have not started by age 20 are less than 5 percent.⁶⁸ However, 1 of 5 adolescents reports at least occasional use (1 episode/month) of tobacco. People who start smoking in their teens will smoke more heavily than those who start later, will inhale more deeply, and will have greater difficulties stopping.^{48,56}

Smokers typically want to stop smoking. Most persons will initially try to stop without professional help. About 77 percent have made at least one serious (that is, professionally assisted) attempt at cessation.¹ The person who finally succeeds at cessation will have tried an average 6-7 times to stop.⁶⁹ Unfortunately, each failure discourages 10-15 percent from trying again.¹ Those who do eventually seek help will be heavier smokers with a stronger intensity of nicotine dependence.⁶⁹

Etiology

The causes of smoking are complex, but current evidence suggests that initiation of the habit is most commonly caused by psychosocial pressures to conform to subcultural peer norms during adolescence.^{1,68,70-73} The desire to conform to perceived peer expectations is generally strong during adolescence.⁷⁴ It is intriguing to note that these psychosocial contingencies are sufficiently powerful to override the ocular, nasal, oral, esophageal, and pulmonary irritation that smokers experience during the initial period of dependence formation. Those adolescents whose parents smoke and are

permissive about smoking by their children are more likely to develop the habit.⁷⁵⁻⁷⁸ And adolescents with friends who smoke and who are lacking in school achievement are also at greater risk to start smoking.⁷⁹⁻⁸¹

By the time local tissue irritation has habituated, the smoker will have begun to display physiologic tobacco dependence. While smoke contains some 4,000 substances, the dependence phenomenon appears to be primarily caused by nicotine.⁵⁶ Withdrawal at this stage, which typically lasts 10 days to 3 weeks, results in a number of subjective (depression, anxiety, irritability, restlessness, intense craving, and decreased concentration) and objective (changes in sleep stage architecture, sweating, gastrointestinal disturbances, decreased heart rate and blood pressure, disturbed time perception, impaired psychomotor performance, and an increase in delta wave electroencephalographic density) symptoms.⁸²⁻⁸⁶ At this stage smokers will, unknowingly, titrate their habit to maintain a given serum level of nicotine.⁸⁷⁻⁸⁹ By this time, smoking has also come to serve a new set of psychosocial coping functions. The patient will smoke more during periods of exposure to acute or long-term psychologic stressors.⁹⁰⁻⁹⁴ The mild euphoria experienced some 2-30 seconds after initiating smoking appears to be the subjective correlate of the rapid rise in serum nicotine levels observed in smokers^{95,96} and the event that serves the psychologic need for affective self control in response to such stressors.⁹⁷

Treatment

General observations

It is obviously preferable to prevent the onset of smoking as opposed to treating it once established. Effective smoking prevention programs for adolescents are being developed^{63,81,98-108} but these have not yet been widely adopted by school systems.

For example, a program developed by Evans⁷⁰ took 1 hour per day with seventh grade classes, on each of 4 consecutive days, to present, test understanding of, and discuss a 10-minute videotape depicting peer, parental, and media pressure to smoke. Each videotape contained similarly aged children being encouraged to smoke and successfully resisting the pressure. This particular program has been demonstrated^{109,110} to reduce experimentation with tobacco by about half over the course of the 9-month academic year (from 18.3 to 9.6 percent). Its long-term efficacy is unknown at present. The efficacy of this program appears to depend on emphasizing the immediate social con-

sequences of smoking (bad taste and smell leading to bad breath, unpleasant kissing, or social ostracism) rather than the long-term health consequences.

While most smokers initially will attempt cessation on their own, the first professional consultation a tobacco-dependent individual will arrange usually is with his/her primary care physician. Many physicians are frustrated by these contacts because they feel unprepared to cope adequately with the problem. A high proportion of these patients will not succeed at cessation (defined as 1 month of abstinence), will relapse following cessation (70-80 percent), or cannot be entirely trusted to be candid when reporting their smoking behavior.¹¹¹⁻¹¹³ It will help the physician faced with these patients to bear in mind that cessation and maintenance is a lifelong process.^{1,69} Six, seven, or more attempts are typical for the patient who eventually succeeds at long-term abstinence.⁶⁹ This long-range perspective hopefully will reduce the physician's frustration about being repeatedly confronted with failures and thus enable him/her to be of greater assistance to the patient. In addition, it may help the physician to know that even very brief discussions with patients about the health risks of smoking and the discomfort of stopping increases the odds of the patient successfully stopping.¹¹⁴⁻¹¹⁶ Brief discussions with general practitioners accompanied by a leaflet and a promise of follow up increased 1-year, patient-reported (but not objectively confirmed) abstinence rates from 10.3 to 19.1 percent.¹¹⁷ Unfortunately, this percentage is probably an overestimate of the actual abstinence rate because the self-report data were not validated with urinary or serum measures, and it is known that 10-30 percent of self-reported abstainers misrepresent their smoking status.¹¹¹⁻¹¹³ While this abstinence rate does not approach that typically seen in behavioral treatment programs, it is significantly better than no intervention at all. It should be noted that this study indicates at least 81 percent of smoking patients will not be able to cease usage or will relapse within a year following this kind of minimal help. This high failure rate is probably what discourages many physicians from trying to intervene with smokers.

Characteristics of patients likely to succeed at cessation and maintenance include having non-smoking friends,¹¹⁸ an emotionally healthy relationship with his/her spouse,¹¹⁸ supportive friends and family,¹¹⁸⁻¹²⁰ a history of lengthy abstinence(s) and fewer experiences with relapse,^{121,122} higher socioeconomic status,¹²³ good physical health,¹²³

later onset of smoking,¹²³ and spontaneous use of cognitive coping strategies during withdrawal.¹²⁴

Behavior modification

Behavioral treatment has proved to be highly efficacious in achieving cessation of smoking. Cessation rates of 60-80 percent for periods of up to 1 month are typically reported, thus accomplishing the task of physiologic withdrawal.^{56,59} But long-term maintenance has been poor in the past, with 70-80 percent of those who accomplish withdrawal relapsing within a year.¹²⁵⁻¹²⁹ It has become apparent that smoking cessation must be viewed as a lifelong process if abstinence is to be permanent. This means that efforts must be made to prepare patients to cope with the causes of relapse as well as the causes of failure at withdrawal, which has been neglected in behavioral treatment programs until very recently.¹³⁰⁻¹³⁷ The primary cause of failure to achieve cessation appears to be an inability to tolerate the initial period of withdrawal discomfort.^{1,56,95,96,138-140} The primary cause of relapse following successful withdrawal is an inability to cope with periods of elevated psychosocial demand (that is, stress) without resuming usage.^{90-93,131-137,141-144} Patients who have accomplished withdrawal typically report a yen to pick up the habit when confronted with events they find distressing. Behavioral programs attending to relapse prevention have typically reported 40-50 percent abstinence rates at 6-12 month follow up.¹⁴⁵

The application of classic (Pavlovian) conditioning principles, using electric shock as the unconditioned aversive stimulus, has demonstrated that smoking is a complex process.¹⁴⁶ For example, the primary determinant of successful treatment in such regimens was not the application of the shock, but the psychologic health and motivation of the patient to stop.¹⁴⁷ More sophisticated—and more effective—treatment programs have been designed according to operant conditioning principles that incorporate an accurate understanding of the interpersonal/cognitive/affective processes involved in smoking.¹²⁵⁻¹²⁷ Among the useful techniques identified by behavioral research are: identification and avoidance of environments that elicit smoking and the yen to smoke during withdrawal¹⁴⁸; preparation of the patient for the duration and nature of withdrawal and the likelihood that the impulse to smoke will return during periods of psychosocial stress^{90-93,141-143,149}; preparation of others in the patient's environment for his/her irritability/moodiness during withdrawal; con-

tracting with the patient for negative contingencies if he/she resumes smoking¹⁵⁰⁻¹⁵²; making available alternative modes of coping at those points in time when the impulse to smoke is particularly intense^{153,154}; use of self-administered contingencies using imagery¹⁵⁵; rapid smoking to produce a taste-aversion conditioned association¹⁴⁴; group treatment in which social cohesiveness is fostered¹⁵⁶; programmed relapse practice¹⁵⁷; substitution of other forms of oral stimulation during withdrawal¹⁵⁸; use of relaxation/hypnosis as a coping technique during withdrawal^{159,160}; and minimization of withdrawal symptoms.¹⁶¹ In contrast, ineffective techniques have also been identified; these include rapid cessation¹⁶² and graduated use of filters.¹⁶³

Nicotine-containing chewing gum

Recently, a nicotine-containing chewing gum has become available as an adjunct to behavioral treatment. Available in 2- and 4-mg. doses in Europe, the FDA has only approved the 2-mg. dose for use in the U.S. To date, the most common side effects with gum use include hiccups (30 percent), nausea (25 percent), dizziness (30 percent), sore gums (30 percent), and stomachache (40 percent); less common side effects include irritation of the tongue, mouth, and throat, ulceration of the tongue, and flatulence.^{96,164-166} Absolute contraindications to the use of the gum include pregnancy, unstable coronary heart disease, and temporomandibular joint syndrome. Gum use may aggravate coronary heart disease, vasospastic conditions, hypertension, peptic ulcers, diabetes, hyperthyroidism, and esophagitis.¹⁶⁷ These patients should try behavioral treatment alone before being placed on the gum because of the known pathogenic effects of nicotine for these conditions.

Research regarding the efficacy of the nicotine gum has tried to answer a variety of questions, such as: Is the gum more effective than usual care (physician counseling or behavioral treatment)? Is any positive effect of the gum attributable to the active ingredient (nicotine) or to a placebo response? and How does gum use affect cessation versus maintenance?

Because cessation without maintenance is a Pyrrhic victory with regard to the patient's health, the present summarization (Table 1) and discussion will be limited to studies meeting the following criteria: follow-up periods of at least 10 months; use of total abstinence as the outcome measure; verification of patient self reporting with urinary or

TABLE 1. SUMMARIZATION OF EFFICACY STUDIES INVOLVING NICOTINE-CONTAINING CHEWING GUM THAT MEET THE METHODOLOGIC CRITERIA STATED IN THE TEXT.*

Authors	Form of treatment							
	No treatment	Gum alone	Physician counseling	Gum and physician counseling	Placebo and physician counseling	Behavioral treatment	Gum and behavioral treatment	Placebo and behavioral treatment
Russell and associates ¹³⁹							23% (43)	
Jarvis and associates ¹⁶⁴							47% (58)	21% (58)
Fee and Stewart ¹⁶⁶							12.7% (180)	8.7% (172)
Russell and associates ¹¹⁵	3.9%	(584)	4.1% (675)	8.8% (679)				
Schneider and associates ¹⁶⁸		8% (13)					30% (30)	20% (30)
Crofton and associates ¹⁶⁹			8.5% (377)	9.8% (400)	11.4% (402)			
Fagerström ¹⁷⁰	3% (27)	22% (46)	15% (22)	27% (50)				
Jarvik and Schneider ¹⁷¹							27% (30)	11% (18)
Jamrozik and associates ¹⁷²				9.9% (101)	8.1% (99)			
Killen and associates ¹⁴⁰		23% (22)				30% (20)	50% (22)	
Hjalmarson ¹⁷³							29% (106)	16% (99)
Marshall and Raw ¹⁷⁴		14% (100)		17% (100)				
WAA =	3.8%	16.7%	5.9%	10.5%	10.7%	ID	25.3%	13.5%

*Both percentages of patients abstinent at 10-12 months and treatment form sample size (in parentheses) are presented. All outcomes are at 12 months, with the exception of Killen and associates,¹⁴⁰ which followed patients to 10.5 months. The weighted average abstinence (WAA) for each treatment form was calculated by multiplying each study's abstinence percentage for a given treatment form by the sample size, summarizing across the column and then dividing by the total number of patients in the column. ID means insufficient data.

serum measures of cotinine, thiocyanate, or carboxyhemoglobin or expired carbon monoxide values; random assignment of patients; and, when appropriate to the purpose of the study, placebo-controlled and double-blinding regarding gum use.^{115,139,168-179} If patients were subgrouped (high versus low nicotine dependence) in a study, the subgroups were averaged to assess treatment form effects. If more than one form of treatment were used in a study (low- versus high-contact physician counseling), the more aggressive of the two treatment regimens (high-contact physician counseling) is classified as "physician counseling," while the less aggressive regimen is classified as "no treatment." Dropouts are included as treatment failures. The data in Table 1 are summarized by weighing the percentage of abstinent patients by the sample size for the respective treatment form and averaging the available data on each of the forms of treatment (gum use alone with minimal or no counseling, physician counseling alone, gum and physician counseling, placebo and physician counseling, behavioral treatment alone, gum and behavioral treatment, placebo and behavioral treatment) and no treatment. No weighted average abstinence is presented if less than two studies contained a given form of treatment regimen. This type of summarization assumes commonalities across diverse forms of physician counseling and behavioral treatment. Nonetheless, it may serve to illustrate the general effectiveness of each form of treatment. No direct test of statistical significance of the summarized data is possible, because variance measures were not provided by most of the studies meeting the inclusion criteria.

As can be seen in Table 1, the average 1-year abstinence rate with gum use alone is 16.7 percent. This appears substantially better than no treatment (3.8 percent) or physician counseling alone (5.9 percent) and, paradoxically, may be better than gum use combined with physician counseling (10.5 percent). But clearly the most effective use of the gum occurs when it is incorporated into some form of behavioral treatment, with 1-year abstinence rates increasing to 25.3 percent. The best designed programs using both behavioral interventions and gum yield 1-year, verified abstinence rates as high as 50 percent.^{140,164}

While the effects of solo use of the chewing gum are superior to no treatment and physician counseling, adjunctive use of the gum within traditional behavioral programs appears to enhance the likelihood of the patient tolerating withdrawal and, thus, short-term (approximately 1 month) cessa-

tion rates, but not long-term (approximately 1 year) abstinence. This is particularly true for the highly nicotine-dependent individual.^{171,176,177} For example, 6-week follow up in a study¹⁴⁰ providing nicotine gum (NG), self-regulation training (ST), or both (NG + ST) to three randomly assigned groups yielded abstinence rates as follows: NG = 64 percent; ST = 55 percent; and NG + ST = 86 percent. For 10.5-month follow up, the abstinence rates were: NG = 23 percent; ST = 30 percent; and NG + ST = 50 percent. Thus, relapse rates for those patients who had successfully accomplished cessation were: NG = 64 percent; ST = 45 percent; and NG + ST = 42 percent. Reduction of relapse is almost entirely dependent on the presence of a behavioral treatment regimen. From these results, and a number of other similar studies, it appears that the gum is maximally effective at assisting patients in accomplishing withdrawal.^{115,138,139,164-174,177} But long-term maintenance requires cognitive and behavioral changes that will allow the individual to prophylactically recognize and anticipate environments and events that will induce the impulse to smoke, and to cope with these psychosocial stressors without resuming usage. By diminishing the discomfort of withdrawal, and possibly helping patients control the desire to smoke during periods of high psychosocial demand, the gum appears to enhance the efficacy of behavioral treatment in accomplishing cessation. Because short-term cessation offers little or no benefit to the patient's health, and each successive failure at cessation makes another attempt less likely, use of the gum alone without behavioral treatment is generally considered unacceptable.^{138,167,178-181} Appropriate use of the gum requires careful monitoring and instruction.^{139,182} For example, patients must understand that the gum will not provide the mild euphoria attendant to smoking.^{95,96} Thus, the psychologic need for affective self control served by this euphoria will not be met by gum use. Patients must develop other means (for example, relaxation, exercise, and/or changes in interpersonal style) of coping with such events.

Smoking and the primary care physician

Possibly the most important contribution the primary care physician can make to the health of his/her patients is to promote the introduction into the schools of programs developed for preventing the onset of smoking in adolescents. Such programs are not expensive or time consuming. And little can be said against their value vis-à-vis standard classroom topics. Adolescents who are spared depen-

dence upon tobacco as a result of such programs will increase, on average, both the quantity and quality of their lives and the lives of those who occupy the same environment. Few nobler endeavors can capture the time and energy of the physician. Yet the problem most frequently confronting the primary care physician in the context of his/her practice will continue to be the individual who smokes and wants or needs to stop.

The roles a primary care physician can play in this secondary prevention enterprise include support and encouragement for the patient's efforts. Such support from a trusted physician is demonstrably effective in increasing the likelihood of attempted and successful cessations.^{114,115,117} Prescription and monitoring of gum use are also appropriate activities.^{138,167} While behavioral treatment is probably best conducted by trained mental health professionals¹⁸³⁻¹⁸⁶ the epidemic nature of the smoking problem and the shortage of adequately trained professionals makes this preferred format frequently difficult to realize.¹⁸⁷ In our opinion, primary care physicians who undertake serious education and training in the behavioral techniques for smoking diagnosis, cessation, and relapse prevention can conduct behavioral treatment programs for patients who do not have a life-threatening, smoking-related illness. They must, however, take pains to recognize and pretreat patients with psychologic problems that are likely to interfere with smoking treatment (depression, anxiety disorders, periods of elevated life change) and/or are not amenable to group-style treatment (sexual disorders and dysfunctions). Such efforts must not be limited to monthly, or even weekly, 15-minute office visits.^{185,186,188} Extensive evaluation of the circumstances, and concomitant behavioral and subjective responses, preceding periods of desire to smoke must be undertaken in order to accurately understand naturally occurring stress-response relationships, which will continue to influence smoking desires and behaviors during and after withdrawal.

Many physicians may not find behavioral treatment an effective use of their time or feel unprepared to apply behavioral principles within the idiosyncratic circumstances of an individual patient's life. In these cases, cooperative efforts with a psychologist or psychiatrist should be considered.

Summary

Tobacco use is a major cause of a number of life-threatening and life-diminishing illnesses. While significant gains have been made over the last two

decades in reducing the incidence of tobacco use among adults in this country, continued experimentation among adolescents makes it clear that widespread tobacco use will be with us for a long time to come. Significant gains have been made recently by adjunctive use of nicotine-containing chewing gum within traditional behavioral treatment regimens. The gum enhances success at cessation but is ineffective in improving long-term maintenance. Given the epidemic nature of the problem, the primary care physician must play a major role in the treatment of smoking. In an era of medical cost containment and disease prevention/health promotion, risk reduction activities such as smoking cessation will likely occupy an increasing proportion of the physician's time. The advocacy of preventive programs directed at adolescents may help some avoid the physical pain, emotional anguish, and spiraling costs of tertiary care for smoking-related diseases.

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