

Smoking and Diabetes: Helping Patients Quit

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Cigarette smoking is the most important cause of preventable morbidity and mortality around the world. In the United States, smoking is responsible for one in five deaths. It costs the economy > \$167 million in yearly health care costs and lost productivity. In 2004, an estimated 20.9% of people \geq 18 years of age, equaling 44.5 million people, were current smokers. The prevalence of smoking in the United States decreased 40% between 1965 and 1990 but has remained level thereafter. Additionally, smoking rates have increased in people aged 18–24 years recently, which may indicate higher initiation rates of smoking in young adults.¹

The prevalence of smoking in patients with diabetes is similar to that in the general population, but the health repercussions are more severe.² Cigarette smoking has been shown to increase the risk of cardiovascular disease (CVD) more in patients with diabetes than in those without diabetes, and CVD is responsible for 65% of deaths in patients with diabetes.^{3–6} Smoking also increases the risk of peripheral vascular disease and resultant amputations.⁷ In addition to increasing the risk of macrovascular disease in patients with diabetes, smoking cigarettes increases the risk of microvascular disease, contributing to nephropathy, retinopathy, and neuropathy.^{2,8–11}

Quitting smoking reduces the risk of mortality in patients with diabetes who smoke, but the risk of mortality is correlated with the duration of smoking, highlighting the importance of addressing the issue of smoking in all patients with diabetes.¹² To reduce the burden of illness

from smoking, health professionals should encourage smoking cessation. In this report, we outline techniques for helping patients quit.

Our approach is based on the transtheoretical, or “stages of change,” model. The transtheoretical model of change is a principle of change management that places patients in stages based on their current desire or readiness to change and then tailors interventions specific to that stage.¹³ The transtheoretical model of change has been used extensively in smokers to motivate those not willing to quit and properly encourage those who are. The five stages of change described in the transtheoretical model are outlined in Table 1.¹³ The goal of the transtheoretical model is to transition patients from an earlier phase (precontemplation or contemplation) to the preparation, action, and then maintenance phases. The U.S. Surgeon General and the U.S. Department of Health and Human Services have released guidelines for treating tobacco use and dependence that follow the transtheoretical model and are described in detail below.¹⁴

Helping Smokers Quit

The “5 A’s”—ask, assess, advise, assist, and arrange—are five intervention steps used to help patients quit.¹⁴

Ask: Systematically identify all tobacco users at each visit. Asking patients about tobacco use is the first step in treating tobacco abuse and should be done systematically at all visits to a health care provider.¹⁴

Office-wide procedures to ensure that all patients are screened for tobacco use at every visit should be implemented unless there is clear documentation that a patient has never used tobacco or has not done so for many years. This can be done by including tobacco use screening in the vital sign documentation, identifying patients with tobacco use status stickers on patient charts, or using a flag in electronic medical records.¹⁴

Assess: Determine willingness to make a quit attempt. To determine their current stage, assess whether patients are prepared to make a quit attempt within the next 30 days.¹⁴

Patients with a current or past history of tobacco use can be divided into three distinct categories: current tobacco users who are willing to make a quit attempt at this time (preparation or action phase), current tobacco users who are not willing to make quit attempt at this time (precontemplation or contemplation), and former tobacco users (maintenance). Identifying patients’ current willingness

Table 1. The Transtheoretical Model of Change¹³

Precontemplation	No intent to take action within the next 6 months
Contemplation	Intent to take action within 6 months
Preparation	Intent to take action within 30 days and has taken behavioral steps toward action
Action	Behavior changed for < 6 months
Maintenance	Behavior changed for > 6 months

to change is important in order to provide an appropriate intervention for each patient. Brief interventions as short as 3 minutes have been shown to be beneficial and can be used in patients in any of the preceding three categories. More intense and longer interventions, however, have been shown to be more successful and are cost-effective.¹⁴

Advise: Strongly urge all tobacco users to quit. Encourage all tobacco users to quit in a manner that is clear, strong, personalized, and appropriate to their behavioral stage. If patients are interested in making a quit attempt, then provide assistance. If patients are unwilling to quit, then provide motivation for future quit attempts.¹⁴

Assist: Aid patients in quitting. Assist patients by making a personalized quit plan including setting a quit date, requesting support from family members and friends, expecting challenges, and removing all tobacco products from the environment. Health care providers should also provide a supportive environment, encourage patients to seek social support, and recommend approved smoking cessation pharmacotherapy. Intensive interventions, which can be led by several types of providers, use either an individual or group format, provide interactions lasting > 10 minutes with four or more sessions, and should be offered to any patients who are willing to participate.¹⁴

Arrange: Schedule follow-up contact. Schedule close in-person or telephone follow-up, ideally within the 1st week after the quit date. Schedule additional follow-up thereafter, remembering that more contacts increase abstinence rates.¹⁴

Tobacco users not willing to make a quit attempt. After asking about tobacco use, advising patients to quit, and assessing their willingness to quit, the “5 R’s”—relevance, risks, rewards, roadblocks, and repetition—should be used

with patients who are not ready to quit at this time. Ask patients to explain why quitting would be personally *relevant* to them. Invite patients to identify potential *risks* or negative consequences of tobacco use, *rewards* or benefits of quitting tobacco use, and *roadblocks* or barriers to quitting. It is also helpful to ask patients to acknowledge the reasons they wish to continue smoking (e.g., to relieve stress). Providers can then help patients determine other ways of reaching the same goals without tobacco. Finally, this motivational intervention should be *repeated* every time patients who are unwilling to make a quit attempt are seen in the clinic setting to help move them into the next stage of change.¹⁴

Former tobacco users. Interventions to prevent relapse should be undertaken during every encounter with patients who have recently quit smoking. During these encounters, clinicians should use open-ended questions to encourage patients’ active discussion of the benefits of smoking cessation, successes they have experienced, problems they have encountered, and potential threats to maintaining abstinence.¹⁴

Pharmacotherapy for Smoking Cessation

There are six currently available treatments that are approved by the Food and Drug Administration (FDA) for smoking cessation: one nonnicotine treatment and five nicotine replacement products that differ based on delivery mechanism. There is not sufficient evidence to compare various therapies, so all FDA-approved treatments are considered first-line therapy and should be selected based on the individual needs and smoking habits of each patient.¹⁴

Nicotine replacement therapy. The five nicotine replacement products currently available in the United States include the nicotine patch, gum, and lozenge, which are available without prescription, and nicotine nasal spray and inhaler, which are available by prescription. It is important to remember that patients should be advised to completely stop smoking before beginning treatment with nicotine replacement products to increase their chances of success. Nicotine released from nicotine replacement products does not enter the systemic circulation as quickly as that from smoking a cigarette and also produces lower peak concentrations.^{15,16} Patients should be counseled that these products will not completely remove the desire for a cigarette, but rather, when used properly, should decrease the number and intensity of cravings that patients experience.

Nicotine patches

Nicotine patches are available without prescription in three different strengths (21, 14, and 7 mg) and release nicotine at a constant level during a 24-hour period. Selection of the appropriate patch strength should be based on the number of cigarettes smoked per day and should be tapered over several weeks. The details are outlined in Table 2. Clinicians should also consider patient-specific factors, such as previous experience with a patch and degree of addiction/dependence, when recommending dosing.¹⁴ Meta-analysis indicates that the use of nicotine patches produces abstinence rates of 17.7% compared to 10% with placebo (odds ratio [OR] 1.9, 95% CI 1.7–2.2).¹⁴

The most commonly reported adverse effects of nicotine patches are sleep disturbance and local skin reac-

Table 2. Nicotine Patch Dosing Guidelines¹⁷

Weeks	> 10 cigarettes daily	≤ 10 cigarettes daily
1–6	21-mg patch daily	14-mg patch daily
7–8	14-mg patch daily	7-mg patch daily
9–10	7-mg patch daily	none

tions.^{14,16} Sleep disturbance can be minimized by asking patients to remove the patch before bedtime. Patients should be aware, however, that this will blunt the ability of the patch to reduce early-morning cravings.

Advise patients to apply a patch first thing in the morning on the selected start day. The patch should be applied to a clean, hairless location on the upper body, with sites rotated daily. Old patches should be discarded and a new patch applied each day. Instruct patients to wash their hands after applying or removing a patch.¹⁷ Patches are an appropriate choice for chronic smokers who may benefit from continuous nicotine release, providing coverage throughout the day and at waking.

Nicotine gum

Nicotine gum is available without prescription in 2- and 4-mg dosages. The 2-mg dosage is recommended for patients who smoke < 25 cigarettes per day, and the 4-mg dosage for those who smoke ≥ 25 cigarettes per day.^{14,18} Nicotine is absorbed from the buccal mucosa, and peak concentrations are reached within 30 minutes.¹⁶ The 2-mg nicotine gum produces abstinence rates of 23.7% compared to 17.1% with placebo (OR 1.5, 95% CI 1.3-1.8). Further studies indicate that the 4-mg dose is more effective in highly dependent smokers.¹⁴ Adverse effects reported with nicotine gum include mouth soreness, jaw ache, hiccups, and dyspepsia.^{14,16}

To obtain the maximum benefit of nicotine gum, patients must be properly trained in its use. Chewing the gum on demand or on an as-needed basis does not lead to concentrations sufficient to reduce cravings. Therefore, patients should be instructed to use one piece of nicotine gum every 1–2 hours for the first 6 weeks of treatment, one piece every 2–4 hours during weeks 7–9, and one piece every 4–8 hours during weeks 10–12. The maximum daily use is 24 pieces.

Patients should be counseled to chew gum slowly until a peppery or

minty taste appears and then “park” the nicotine piece between the cheek and gum to allow the nicotine to be absorbed through the buccal mucosa. When the peppery or minty taste disappears, about 1 minute later, patients should resume chewing until the taste returns, at which time the gum should be parked in a different location next to the buccal mucosa. Patients should repeat the cycle of chewing and parking until the peppery taste does not return with chewing, usually 30 minutes after initiation.^{14,19}

The nicotine gum may be a good option for patients who enjoy the oral fixation of smoking and can substitute the nicotine gum for cigarettes. It is also a good option for patients who smoke less because there is more ability to change and titrate doses than with a patch.

Nicotine lozenges

Nicotine lozenges are the most recent FDA-approved nicotine replacement therapy and are available without prescription as 2- and 4-mg fast-acting lozenges. The appropriate dose of nicotine lozenges is dependent on the time to first cigarette, which is an indicator of nicotine dependency, based on the Fagerstrom Nicotine Dependence Questionnaire.^{20,21} If the time between waking and the first cigarette of the day is < 30 minutes, this indicates a high level of dependence, and > 30 minutes between waking and the first cigarette of the day indicates lower levels of dependence. Patients who smoke their first cigarette within 30 minutes of waking should use the 4-mg lozenges, and those who smoke their first cigarette > 30 minutes after waking should use the 2-mg lozenges.^{20,21}

When dosed according to the time to first cigarette, both the 2- and 4-mg lozenges have been shown to be superior to placebo at producing abstinence at 6 weeks (2-mg vs. placebo OR 2.1, 95% CI 1.59–2.79; 4-mg vs. placebo 3.69, 2.74–4.96). Abstinence rates remained higher with the lozenges at 52 weeks

compared with placebo.²¹ At equivalent doses, the lozenges result in higher maximum concentrations and area under the concentration-time curve compared to nicotine gum.²² Nausea, hiccups, cough, heartburn, and headache have been reported with the nicotine lozenges.^{20,21}

Patients should be instructed to place a lozenge in their mouth and allow it to dissolve without chewing or swallowing it, but they should shift it from one side of the mouth to the other. Complete dissolution will take 20–30 minutes. Dosing instructions for nicotine lozenges are similar to those for nicotine gum; the initial treatment period (weeks 1–6) consists of one lozenge every 1–2 hours, followed by a step-down period (weeks 7–9) of one lozenge every 2–4 hours, and finally one lozenge every 4–8 hours (weeks 10–12). During the initial treatment period, patients should use a minimum of nine lozenges per day. The maximum daily allotment of lozenges is 20.²⁰

Similar to nicotine gum, lozenges are appropriate for patients who are looking for an oral fix to take the place of cigarettes or those who may need lower doses or easy titration.

Nicotine nasal spray

Nicotine nasal spray delivers 0.5 mg of nicotine per spray with 200 metered doses per bottle. The nasal spray offers the advantage of a quick onset, with peak concentrations reached 4–15 minutes after dosing.²³ The nasal spray produces abstinence rates of 30.5% compared to 13.9% with placebo (OR 2.7, 95% CI 1.8–4.1).¹⁴

The most common adverse effect of the nicotine nasal spray is nasal irritation, which is experienced by 94% of patients during the first 2 days of treatment. Most patients rated the irritation as moderate to severe with some improvement over time, but after 3 weeks of treatment, 81% of patients continued to report irritation, but of a lesser severity.²³ Nicotine nasal spray should not be used in patients with severe reactive airway disease because of the risk of bronchospasm.^{14,23}

Nicotine nasal spray should be dosed as one 0.5-mg spray in each nostril to total 1 mg per dose and tailored to each patient's individual needs. The starting regimen is 1–2 doses per hour and may be increased to a maximum of 40 doses per day (80 sprays) or 5 doses per hour (10 sprays). For maximum benefit, patients should use at least 8 doses (16 sprays) per day.

The recommended treatment duration is 3 months, after which patients can either taper or completely discontinue the nasal spray.^{14,23} It is important to counsel patients to tilt their head backwards slightly and not sniff, swallow, or inhale through the nose while the dose is being administered. The nicotine nasal spray offers the advantage of a rapid peak for patients who desire quick relief; however, its poor tolerability limits its use.

Nicotine inhaler

The nicotine inhaler is available by prescription only. It consists of a mouthpiece and plastic cartridge, which delivers a total of 4 mg of nicotine to the buccal mucosa if used for the recommended inhalation for 20 minutes. With the recommended regimen of 80 inhalations over 20 minutes (1 cartridge), peak serum concentrations are reached within 15 minutes after the end of inhalation.²⁴ Meta-analysis results indicate that patients using the nicotine inhaler have an abstinence rate of 22.8% compared to 10.5% with placebo (OR 2.5, 95% CI 1.7–3.6).¹⁴ The main adverse effects reported with the nicotine inhaler are local irritation in the mouth and throat and headache.²⁴

Dosing for the nicotine inhaler should be individualized, and patients may titrate the dose based on the amount of nicotine they require. Patients should be counseled to use a minimum of 6 cartridges per day up to a maximum of 16 cartridges per day.^{14,16,24} The best effects are seen when each cartridge is puffed frequently for a continuous 20-minute period.²⁴ The recommended duration of treatment is 3 months, with an additional 6–12 weeks for gradual tapering.

The nicotine inhaler mimics the physical movement of smoking a cigarette, which can be helpful in patients who find breaking the habit of the hand-to-mouth movement of smoking a barrier to cessation.

Combination nicotine replacement therapy

Small studies support the use of combination nicotine replacement therapy consisting of a nicotine patch, which provides relatively steady blood concentrations of nicotine, combined with as-needed dosing that allows patients to use nicotine replacement on an acute basis. Meta-analysis of these small studies indicates that combination nicotine replacement leads to higher abstinence rates (28.6%) compared to placebo (17.4%; OR 1.9, 95% CI 1.3–2.6).¹⁴ Because studies on its use are limited, combination therapy is only recommended for patients who fail monotherapy.¹⁴

Sustained-release bupropion.

Sustained-release bupropion (bupropion SR) is the first nonnicotine medication to be FDA-approved for smoking cessation.^{14,25} It is available by prescription in 150-mg tablets. Bupropion SR is well tolerated, and the most commonly reported adverse effects are insomnia and dry mouth. It is known to lower the seizure threshold and is, therefore, contraindicated in patients at risk for seizures.^{14,15,25} Meta-analysis results indicate that bupropion SR increases abstinence rates compared to placebo with abstinence rates of 30.5 and 17.3%, respectively (OR 2.1, 95% CI 1.5–3.0).¹⁴

For smoking cessation, the starting dose of bupropion SR is 150 mg once daily for 3 days, increased to the target dose of 150 mg twice daily thereafter. The main adverse effect of insomnia can be reduced by administering the second dose in the afternoon, but at least 8 hours after the morning dose. Bupropion SR should be started before patients quit smoking, with a quit date set during the

2nd week of treatment. Treatment should continue for a minimum of 7–12 weeks and can continue up to 6 months for maintenance.^{14,25} Patients who do not respond to bupropion SR with significant progress by week 7 of treatment are unlikely to quit during this attempt, and bupropion SR should be discontinued.²⁵

Combination nicotine replacement and bupropion SR. The combination of nicotine patches plus bupropion SR has been compared with nicotine patches alone, bupropion SR alone, and placebo in patients smoking a minimum of 15 cigarettes per day. The combination, which produced abstinence in 35.5% of patients at 12 months, was superior to placebo (15.6% abstinence, $P < 0.001$ for the comparison) and nicotine patches alone (15.4% abstinence, $P < 0.001$). There was no statistically significant difference noted between the combination and bupropion SR alone (30.3% abstinence with bupropion SR alone, $P = 0.22$).²⁶

Other antidepressants. One tricyclic antidepressant, nortriptyline, has been shown to increase abstinence rates in smokers. Because of the risk of adverse effects and the fact that it has not been evaluated for this use by the FDA, nortriptyline is recommended only as a second-line agent for smoking cessation.¹⁴ Other tricyclic antidepressants, monoamine oxidase inhibitors, and selective serotonin reuptake inhibitors are not recommended as smoking cessation treatments because of the lack of evidence indicating efficacy and the potential for adverse effects.^{14,27}

Conclusion

Smoking contributes to significant morbidity and mortality in the general population and specifically in patients with diabetes. Discussing smoking status at every visit, tailoring interventions to patients' stage of change, and recommending personalized pharmacotherapy when appropriate are important interventions to increase abstinence rates,

decrease tobacco-related morbidity and mortality, and save health care dollars.

REFERENCES

- ¹American Lung Association: Trends in tobacco use [article online]. American Lung Association Epidemiology and Statistics Unit Research and Programs Services, January 2006 Available from http://www.lungusa.org/att/cf/%7B7A8D42C2-FCCA-4604-8ADE-7F5D5E762256%7D/TRENDS_IN_TOBACCO_USE_2003.PDF
- ²Haire-Joshu D, Glasgow RE, Tibbs TL: Technical review: smoking and diabetes. *Diabetes Care* 22:1887–1898, 1999
- ³Manson JE, Colditz GA, Stampfer MJ, Willett WC, Krolewski AS, Rosner B, Arky RA, Speizer FE, Hennekens CH: A prospective study of maturity-onset diabetes mellitus and risk of coronary heart disease and stroke in women. *Arch Intern Med* 151:1141–1147, 1991
- ⁴Moy CS, LaPorte RE, Dorman JS, Songer TJ, Orchard TJ, Kuller LH, Becker DJ, Drash AL: Insulin-dependent diabetes mellitus mortality: the risk of cigarette smoking. *Circulation* 82:37–43, 1990
- ⁵Stamler J, Vaccaro O, Neaton JD, Wentworth D: Diabetes, other risk factors, and 12-yr cardiovascular mortality for men screened in the multiple risk factor intervention trial. *Diabetes Care* 16:434–444, 1993
- ⁶American Diabetes Association: Complications of diabetes in the United States [article online]. Available from www.diabetes.org. Accessed 21 March 2006
- ⁷The health consequences of smoking: a report of the Surgeon General [article online]. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, Washington, DC, 2004. Available from http://www.cdc.gov/Tobacco/sgr/sgr_2004/index.htm
- ⁸Muhlhauser I, Bender R, Bott U, Jorgens V, Grusser M, Wagener W, Overmann H, Berger M: Cigarette smoking and progression of retinopathy and nephropathy in type I diabetes. *Diabet Med* 13:536–543, 1996
- ⁹Chase HP, Garg SK, Marshall G, Berg CL, Harris S, Jackson WE, Hamman RE: Cigarette smoking increases the risk of albuminuria among subjects with type I diabetes. *JAMA* 265:614–617, 1991
- ¹⁰Sawicki PT, Didjurgeit U, Muhlhauser I, Bender R, Heinemann, Berger M: Smoking is associated with progression of diabetic nephropathy. *Diabetes Care* 17:126–131, 1994
- ¹¹Corradi L, Zoppi A, Tettamanti F, Malamani G, Lazzari P, Fogari R: Association between smoking and micro-albuminuria in hypertensive patients with type 2 diabetes mellitus. *J Hypertens* 11:S190–S191, 1993
- ¹²Chaturvedi N, Stevens L, Fuller JH: Which features of smoking determine mortality risk in former cigarette smokers with diabetes? The World Health Organization Multinational Study Group. *Diabetes Care* 20:1266–1272, 1997
- ¹³Glanz K, Rimer BK, Lewis FM (Eds): *Health Behavior and Health Education: Theory, Research, and Practice*. 3rd ed. San Francisco, Jossey Bass, 2002
- ¹⁴U.S. Department of Health and Human Services Public Health Service: Clinical practice guideline: treating tobacco abuse and dependence, 2000 [article online]. Available from http://www.surgeongeneral.gov/tobacco/treating_tobacco_use.pdf
- ¹⁵Rigotti NA: Treatment of tobacco use and dependence. *N Engl J Med* 346:506–512, 2002
- ¹⁶Okuyemi KS, Ahluwalia JS, Harris KJ: Pharmacotherapy of smoking cessation. *Arch Fam Med* 9:270–281, 2000
- ¹⁷Nicoderm CQ Product Information [article online]. Available from <http://www.nicodermcq.com>. Accessed 9 March 2006
- ¹⁸Hughes JR, Goldstein MG, Hurt RD, Shiffman S: Recent advances in the pharmacotherapy of smoking. *JAMA* 281:72–76, 1999
- ¹⁹Nicorette Product Information [article online]. Available from <http://www.nicorette.com>. Accessed 9 March 2006
- ²⁰Commit Lozenge Product Information [article online]. Available from <http://commitlozenge.quit.com>. Accessed 9 March 2006
- ²¹Shiffman S, Dresler CM, Hajek P, Gilbert SJA, Targett DA, Strahs KR: Efficacy of a nicotine lozenge for smoking cessation. *Arch Intern Med* 162:1267–1276, 2002
- ²²Choi JH, Dresler CM, Norton MR, Strahs KR: Pharmacokinetics of a nicotine polacrilex lozenge. *Nicotine Tob Res* 5:635–644, 2003
- ²³Nicotrol NS prescribing information. Morris Plains, NJ, Pfizer Consumer Healthcare, February 2005 Available online from www.nicotrol.com
- ²⁴Nicotrol inhaler prescribing information. Morris Plains, NJ, Pfizer Consumer Healthcare, February 2005 Available online from www.nicotrol.com
- ²⁵Zyban prescribing information. Research Triangle Park, NC, GlaxoSmithKline, November 2005. Available online from http://us.gsk.com/products/assets/us_zyban.pdf
- ²⁶Jorenby DE, Leischow SJ, Nides MA, Renard SI, Johnston JA, Hughes AR, Smith SS, Muramoto ML, Daughton DM, Doan K, Fiore MC, Baker TB: A controlled trial of sustained-release bupropion, a nicotine patch, or both for smoking cessation. *N Engl J Med* 340:685–691, 1999
- ²⁷Hughes JR, Stead LF, Lancaster T: Antidepressants for smoking cessation. *Cochrane Library*, Issue 1, 2006

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