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## Regular article

# An algorithm for choosing among smoking cessation treatments

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**Abstract**

Currently, there are nine validated medications, four validated psychosocial strategies, and three validated ways to deliver psychosocial treatments for smoking cessation. This article presents an algorithm based on a literature review and the author's clinical experience. The algorithm integrates the recommendations of the major guidelines and meta-analyses and provides rationales for its treatment decisions. The algorithm suggests a brief assessment followed by use of one to two medications and counseling in most smokers. Because all treatments appear equally effective and have few adverse events, the algorithm suggests clinicians inform smokers of the pros and cons of the different treatments, and recommend use of one or more of each. If a smoker fails to quit, the algorithm suggests an assessment of why relapse occurred and then a more intense treatment, a new treatment, or both. © 2008 Elsevier Inc. All rights reserved.

*Keywords:* Adaptive treatment; Algorithm; Smoking; Smoking cessation; Tobacco use disorder

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**1. Introduction**

Several consensus books, guidelines, monographs, Web sites, and review articles have presented concrete recommendations on which therapies should be used to help smokers stop (Abrams et al., 2003; Bittoun, 2006; Fiore et al., 2000; Hughes, 1994; Kleber et al., 2006; McEwen, Hajek, McRobbie, & West, 2006; Rigotti, 2002; Sutherland, 2002; West, McNeill, & Raw, 2000) ([www.treatobacco.net](http://www.treatobacco.net)). The current review adds to this literature in two ways. First, it presents an algorithm or flow chart of treatment decisions. Algorithms, decision trees, or adaptive treatment strategies can be useful because they (a) clarify decision rules, (b) clearly indicate how to integrate different treatments, and (c) provide a single visual overview of a comprehensive program ([www.ipap.org](http://www.ipap.org)) (Murphy, Lynch, Oslin, McKay, & TenHave, in press). Second, most prior reviews have focused on recommendations based on the consensus of several randomized controlled trials (RCTs). In contrast, many of the common decisions necessary in treatment of

smoking cessation are unlikely to ever be tested in RCTs (Norcross, Beuther, & Lavant, 2006). In addition, RCTs rarely address aspects of treatment delivery other than efficacy, e.g., timeliness and efficiency (Institute of Medicine, 2001). Thus, this algorithm uses an “evidence-based” approach (i.e., “the integration of best research evidence with clinical expertise and patient values”; Norcross et al., 2006) and “adaptive treatment strategies” (i.e., “considerations of the ordering of treatments, the timing of changes in treatments, and the use of response, burden and adherence to make further treatment decisions”; Murphy et al., in press).

The algorithm is intended for clinicians who provide advice about cessation strategies and treatment methods. The algorithm focuses solely on choosing among treatments; that is, it does not describe the details of how to provide the treatment in an optimal manner. For this type of information, the reader is referred to recent textbooks (Abrams et al., 2003; McEwen et al., 2006) and guidelines (Fiore et al., 2000; Kleber et al., 2006; West et al., 2000). The algorithm does not cover “special populations,” such as adolescents (Sussman, Sun, & Dent, 2006), pregnant smokers (Lumley, Oliver, Chamberlian, & Oakley, 2004), and those with mental disorders (Williams & Ziedonis, 2004), or use of inpatient treatments (Gastfriend, 2003; Hurt et al., 1992). The algorithm also attempts to include core proposed values

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of optimal health care, that is, patient control, continuous healing relationships, customization based on patient needs and values, and timeliness (Institute of Medicine, 2001).

## 2. Methods

The author searched PubMed, PsychInfo, and the Smoking and Health Library (<http://apps.nccd.cdc.gov/shrl/>) for books, guidelines, algorithms, meta-analyses, systematic reviews, and narrative reviews since 1994—the date of the prior algorithm by the author (Hughes, 1994). Several search strategies were used but the one that was most successful searched for review articles and meta-analyses, and crossed (tobacco OR nicotine OR cig\* OR smok\*) AND (cessation OR treatment OR therap\* OR algorithm OR guideline). These searches resulted in 1242 nonredundant sources. The titles and abstracts of these suggested 129 were likely to have applicable information and these were read.

Many of these reviews referenced three influential sources: the Cochrane Database of Systematic Reviews on various aspects of smoking cessation treatment (Cochrane Collaboration, 2007), the United States Public Health Service (USPHS) meta-analyses and guidelines (Fiore et al., 2000),

and the update of the United Kingdom guidelines (West et al., 2000). For brevity, this article cites only these three sources when appropriate. If none of these makes a recommendation on a decision, other empirical data are cited. As recommended for making evidence-based decision, this algorithm used not only empirical data but also the author's clinical expertise and patient values (Norcross et al., 2006).

### 2.1. Initial decisions

The algorithm assumes a smoker has declared he or she wishes to set a quit date in the near future or not (Fig. 1). If not, the algorithm suggests the smoker enter a separate algorithm (not covered herein) in which the smoker receives a motivational intervention based on either stages of change (Velicer, Prochaska, & Redding, 2006), motivational interviewing (Rubak, Sandbaek, Lauritzen, & Christensen, 2005), the United States Public Health Service 5 R's (Fiore et al., 2000), reduction in smoking (Hughes & Carpenter, 2006), presentation of treatment options, or other models.

If a smoker does want to quit, he or she should be advised to use counseling and, if a daily smoker, one to two medications (Abrams et al., 2003; Fiore et al., 2000; McEwen, et al., 2006; West et al., 2000). In contrast, one

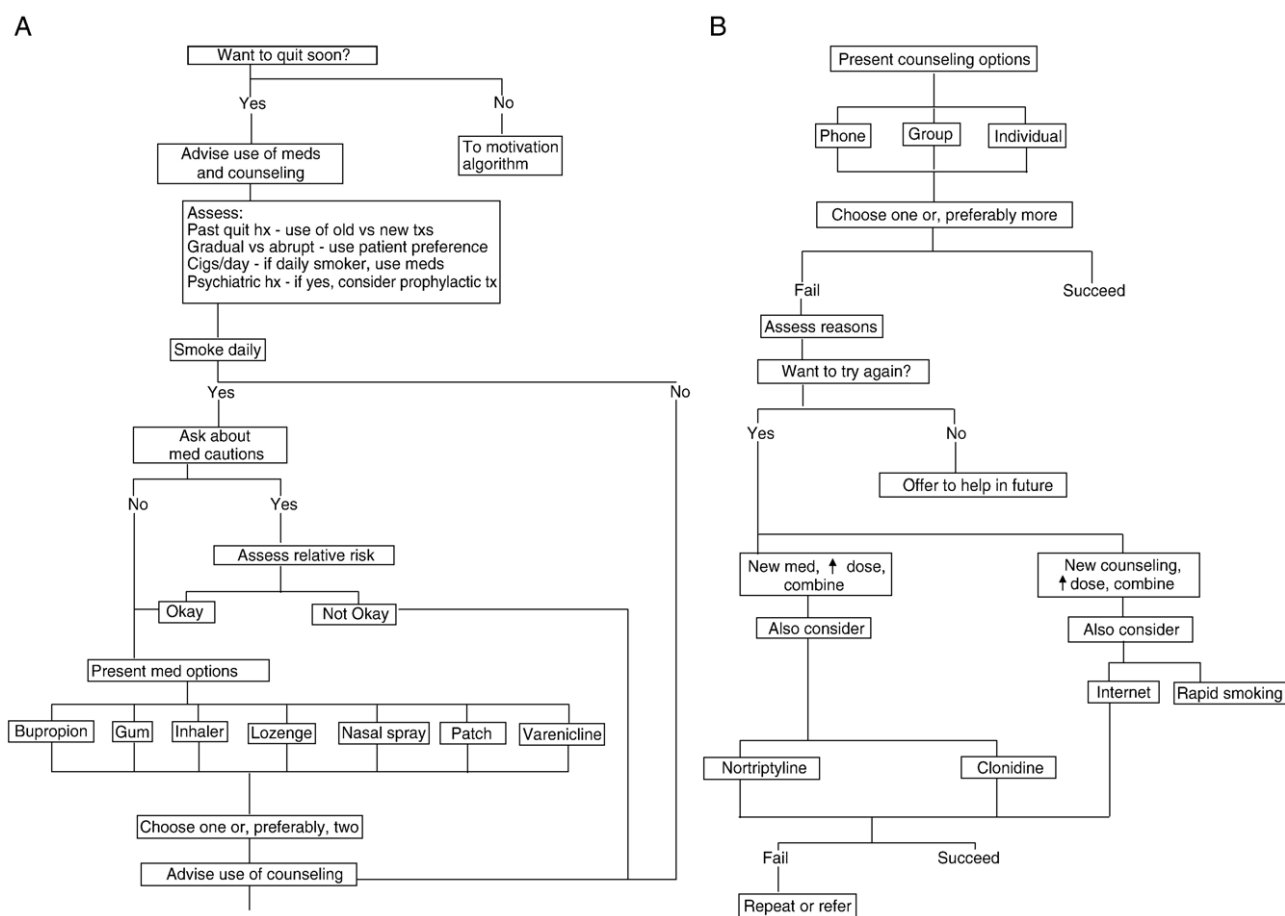


Fig. 1. An algorithm for assigning treatments to smokers who plan to stop smoking. Cigs = cigarettes; hx = history; med = medication; tx = treatment; ↑ = increase.

could use a stepped-care algorithm in which smokers are given minimal treatment first, because many smokers will stop with such treatment (Abrams et al., 2003). The current algorithm does not endorse stepped care for several reasons. First, the major determinant of a tobacco-related illness is the duration of smoking (Peto, Deo, Silcocks, Whitley, & Doll, 2000). Often smokers who fail to quit wait years to try again (National Cancer Institute, 2000), and during that time, an irreversible smoking-related event may occur; thus, it is not only important to quit but to quit early on in the smoking career. Having to try to stop on several occasions before being offered optimal care in such a situation does not make sense. In addition, smoking cessation is the most important outcome to increase health in the developing countries (Department of Health and Human Services, 2004), and treatment clearly reduces morbidity and mortality (Raw, McNeill, & West, 1998). Finally, the more intensive the smoking cessation treatment, the greater its efficacy (Fiore et al., 2000; Watkins, Koob, & Markou, 2000). In many areas of medicine, the optimal, the most intensive treatment, occurs with the first treatment encounter. Given the above, this should also be the case for smoking cessation.

One could also use a treatment-matching algorithm (Abrams et al., 2003); however, treatment matching has not been validated in studies on smoking (Cochrane Collaboration, 2007; Fiore et al., 2000; Niaura & Abrams, 2002; West et al., 2000). Although there is a plethora of variables known to predict which smokers will versus will not stop smoking (U.S. Department of Health and Human Services, 1990), which variables predict who will need treatment and if so, which treatment, to have a good chance of quitting, is unknown. On the other hand, there are many areas of medicine in which clinicians tailor treatment in the absence of RCTs confirming the tailoring.

### 3. Assessment

Although several assessments have been suggested to aid in choosing treatments for smokers (Abrams et al., 2003; McEwen et al., 2006), only a few have a high chance of changing treatment choices. First, the smoker's prior quitting history should be reviewed (Abrams et al., 2003; Fiore et al., 2000; McEwen et al., 2006; West et al., 2000). The perceived reasons for prior failure and perceived barriers to attempting to stop and to remaining abstinent should be reviewed. If the smoker states craving and withdrawal symptoms early on prevented abstinence, then the use of medications should be encouraged. If the smoker states that a stressful event several weeks after quitting caused relapse, then a discussion of alternate coping methods and of increasing the response cost to obtain cigarettes should be discussed. If weight gain undermined relapse, then use of medications for the initial period of abstinence should be encouraged because (except for varenicline) they reduce postcessation weight gain. Prior treatments should also be reviewed for their perceived

efficacy, compliance, and adverse events. This assessment should include the duration and daily dose of medication and the number of psychosocial sessions in prior treatments. If the smoker used an adequate dose of the treatment and found it unhelpful, a different treatment should be used. If the treatment was somewhat helpful but the smoker did not persist, then brainstorming ways to improve compliance is indicated. If the prior treatment was helpful (e.g., patch reduced craving) but the smoker relapsed for a reason not addressed with the treatment (e.g., relapsed during alcohol binge), then the treatment should be repeated and a new treatment added.

Second, whether the smoker wishes to quit abruptly or gradually (e.g., by decreasing cigarettes per day by 25% per week over 3 weeks before the quit day) should be determined. Meta-analyses, guidelines, treatment programs, and regulatory agencies vary widely in whether they include gradual cessation as a valid option (Fiore et al., 2000; West et al., 2000). Currently, gradual cessation aided by nicotine replacement therapy (NRT) is approved by regulatory agencies in some countries but not in others. This algorithm recommends allowing gradual cessation for smokers who wish to stop gradually because (a) there are several rationales for why gradual cessation prior to the quit date should be effective (e.g., increased self-efficacy and decreased nicotine dependence; Cinciripini, Wetter, & McClure, 1997), (b) the more rigorous RCTs have found gradual as effective as abrupt cessation (Cinciripini et al., 1997), and (c) RCTs of using NRT to reduce before quitting find this increases quit rates (Hughes & Carpenter, 2006) and does not cause adverse events (Fagerstrom & Hughes, 2002).

Third, whether smokers are daily smokers and, if so, the number of cigarettes/day should be determined. Nondaily smokers are less likely to be nicotine dependent (Okuyemi, Harris, Scheibmeir, Choi, Powell, & Ahluwalia, 2002) and, thus, less likely to benefit from medications. Many studies have shown those who smoke  $\geq 10$  cigarettes per day benefit from medications (Cochrane Collaboration, 2007; Fiore et al., 2000; West et al., 2000). One study of those smoking 1–10 cigarettes daily indicated they are also likely to benefit from medications (Shiffman, 2005).

Fourth, the presence of current or past psychiatric/drug symptoms/problems should be determined. Those with active psychiatric symptoms or nonnicotine drug problems appear to be unlikely to quit unless these problems are treated prior to or along with the quit attempt (Hughes & Kalman, 2005). In addition, those with a history of alcohol/psychiatric problems who abstain may be at greater risk for a reoccurrence of these problems and, thus, require greater monitoring or a prophylactic treatment (Hughes, 2006; Kalman, Morissette, & Goerge, 2005).

#### 3.1. Choosing among medications

Seven medications help smokers stop and are first-line medications: bupropion, nicotine gum, inhaler, lozenge/

microtab, nasal spray and patch, and varenicline (Cochrane Collaboration, 2007; Fiore et al., 2000; West et al., 2000). Two other medications have efficacy but are classified as second line due to the likelihood of increased adverse events (clonidine and nortriptyline). All first-line medications appear to be of similar efficacy, none have significant adverse events, and there is no validated treatment-matching program to choose among medications (except for choosing higher doses for heavier smokers) (Cochrane Collaboration, 2007; Fiore et al., 2000; West et al., 2000). Thus, the algorithm calls for clinicians to first assess for precautions for each of the medications (Zapawa et al., 2005). If none exist, the clinician should describe the pros and cons of all first-line medications (Table 1) and let the smokers choose the medication. If some precautions exist, then the clinician and patient should weigh the risks of the medication against

the probability of success and the relative merit of using alternate medications (Zapawa et al., 2005). Prior success or failure with medication is often a major determinant of medication choice.

The one possible exception to stating that all medications are equally efficacious is that three RCTs have found varenicline produces higher quit rates than bupropion (Keating & Siddiqui, 2006) ([www.cochrane.org](http://www.cochrane.org)). Whether this is sufficient to recommend varenicline over other first-line medications is debatable; for example, no studies have compared varenicline versus nicotine patch. Given this, the algorithm recommends informing smokers that some evidence suggests varenicline is more effective, but whether this is true has not been conclusively proven.

The algorithm also recommends combining medications (Fiore et al., 2000; West et al., 2000). Two types of combined therapy have been recommended. One is to combine nicotine patch with the ad-lib use of a short-acting NRT (gum, inhaler, lozenge/microtab, or nasal spray). The patch is used to provide more adequate and stable nicotine levels and the ad-lib medication to provide emergency relief in risky situations. Another possibility is to combine a nicotine and nonnicotine treatment, for example, combining bupropion or nortriptyline with an NRT; however, the empirical evidence for this combination is less clear (Cochrane Collaboration, 2007). Combining varenicline and an NRT makes less sense, as varenicline blocks the effect of nicotine (Keating & Siddiqui, 2006). Medication can be delivered via specialty clinic, primary care settings, and, in some cases, via over-the-counter (OTC) sale. Although more intense medication management improves outcomes (Hall, Humfleet, Reus, Munoz, & Cullen, 2004), OTC medications are effective (Hughes, Shiffman, Callas, & Zhang, 2002).

### 3.2. Choosing among psychosocial treatments

All smokers trying to stop should be encouraged to use as intense a psychosocial treatment as is acceptable. Psychosocial treatments (also known as advice, coaching, counseling, or psychotherapy) can be categorized by content and format (Cochrane Collaboration, 2007; Fiore et al., 2000; West et al., 2000). The validated contents are intrasession and extrasession social support and behavioral skills training. Rapid smoking is also a validated treatment, but given its poor appeal and possible safety problems, it is considered a second-line treatment. Most cessation programs do not specialize in any one content and, thus, smokers cannot usually choose psychosocial treatments by their content.

The validated formats are telephone, group, and individual in-person treatments (Cochrane Collaboration, 2007; Fiore et al., 2000; West et al., 2000). The pros and cons of these formats are listed in Table 1. Whether one content or one format is more efficacious than the other is unclear. There are also some RCTs indicating Internet treatments are efficacious (Walter, Wright, & Shegog, 2006), but given the

Table 1  
Pros and cons of different treatments

Treatment	Pros	Cons
<b>First-line medications</b>		
Bupropion	Nonnicotine, twice a day pill, used prior to stopping	Some contraindications, requires prescription, no emergency relief, seizure risk
Nicotine gum	OTC, can control dose, use for emergencies	Multiple dosing, poor social acceptability, rare dependence
Nicotine inhaler	Mimics smoking, can control dose, use for emergencies	Multiple dosing, requires prescription, need to puff intensely, low bioavailability at <10°C
Nicotine lozenge, microtab	OTC, can control dose, use for emergencies, more acceptable?	Multiple dosing
Nicotine nasal spray	Higher nicotine levels, use for emergencies	Many adverse events
Nicotine patch	OTC, once a day, not conspicuous	No emergency relief
Varenicline	Blocks nicotine, used prior to stopping, more effective?	No emergency relief, little effect on weight gain
<b>First-line psychosocial treatments</b>		
Group	Social support, advice from other smokers	Scheduling problems, requires disclosure and travel
Individual in-person	Tailored, more intense help	Less social support, often not available
Telephone help line	Confidential, ease of access	Less intense therapy
<b>Second-line treatments</b>		
Clonidine	Nonnicotine, once to twice a day	More adverse events
Nortriptyline	Nonnicotine, once to twice a day	Higher risk for adverse events
Rapid smoking	Efficacious	Poor compliance, more adverse events
Internet programs	Ease of access, able to choose info, tailoring, chat rooms	Less intense, less social support

paucity of data, this is considered a second-line format. Written materials by themselves appear to have little efficacy but may help boost other treatments (Cochrane Collaboration, 2007; Fiore et al., 2000). Combining formats (e.g., telephone plus group therapy) typically, but not always, increases outcomes (Fiore et al., 2000).

As with medications, the different contents and formats appear to be of similar efficacy; however, greater time in treatment predicts greater efficacy (Fiore et al., 2000). Thus, smokers should be given these as options and encouraged to choose one or more. Prior experience with the treatments will likely be a major determinant of choices.

Psychosocial and medical treatments appear to produce similar efficacy (Cochrane Collaboration, 2007; Fiore et al., 2000; West et al., 2000). Several studies have found that combining medications and psychosocial treatments increases quit rates (Cochrane Collaboration, 2007; Fiore et al., 2000; West et al., 2000). However, psychosocial treatment is not essential for medications to work and should not be a prerequisite for obtaining medication (Cochrane Collaboration, 2007; Fiore et al., 2000; West et al., 2000). Whether psychosocial treatments are available varies widely. Therapists should query local insurance plans, health maintenance organizations, state health departments, voluntary agencies, and so forth to determine content and availability of local psychosocial treatments.

### 3.3. Choices after relapse

Even with the best treatment, most smokers will relapse (Hall et al., 2004). Most smokers who relapse want to try to stop again in the near future (Partin et al., 2006), and there is no evidence for the common notion that smokers who wait before trying to quit again are more successful. The RCTs that explicitly tested retreatment (also known as recycling) of treatment failures found poor results (Partin et al., 2006). However, these studies used a one-time intervention, often used the same treatment that previously failed, and did not tailor the second treatment to the reasons the first treatment failed. In contrast, the three studies with the highest long-term quit rates in the literature were the only studies that continued to see smokers even after they relapsed, continued to motivate them to try to quit again, and tailored further treatments to their needs (Anthonisen et al., 1994; Hall et al., 2004; Hughes, Hymowitz, Ockene, Simon, & Vogt, 1981). These continued-care programs had much higher abstinence rates (35–50% at  $\geq 1$ -year follow-ups).

Thus, the algorithm recommends that upon relapse, clinicians estimate the likely reasons for failure (e.g., due to psychosocial stressors, poor treatment compliance, distressing withdrawal symptoms, or use of alcohol) and suggest a new quit attempt with a new treatment that is likely to address these reasons. Often, the recommendation will be to increase the intensity of treatment, for example, moving from telephone to in-person treatment or from medications

alone to combined medications and psychosocial treatment. Other times the recommendation will be to use a new treatment, for example, a second-line medication (Fiore et al., 2000). Sometimes an underlying problem must be addressed before a smoker can stop; for example, a smoking spouse must be convinced to stop as well. If a smoker has failed despite several rounds of use of validated treatments, a clinician may be tempted to recommend a nonvalidated treatment, such as acupuncture, under the rationale that maybe this treatment works for some smokers. The current algorithm suggests a better option is referral to another specialist for a second opinion.

## 4. Implementing the algorithm

Most tobacco smokers who plan to quit have no strong, imminent contingency for abstinence. Most know many smokers who have quit without treatment; thus, they believe they “should” be able to quit without treatment as well, and will see treatment use as a marker for weak character, and so forth. In addition, most smokers will have to pay their own treatment costs. Finally, many smokers have incorrect ideas about the content or effectiveness of treatments. For example, some believe that nicotine medications are as deadly as cigarettes (Cummings et al., 2004) or that telephone counselors will use coercive and guilt-laden statements to try to get them to stop (Bayer & Stuber, 2006). Because of these, most smokers will choose the least intensive treatment—in stark contrast to what this algorithm recommends. Telling smokers that using treatment is becoming the norm (i.e., currently over half of all smokers have used a stop smoking treatment), telling them their insurance carrier or local state health department often can provide free or heavily discounted treatment, and eliciting and combating false beliefs about treatment can change these misbeliefs. Of course, the latter two require knowledge of the treatments and their local availability.

### 4.1. Summary

There are nine validated medications, four validated psychosocial contents, and three validated psychosocial formats for smoking cessation. The current algorithm is an attempt to provide a visual representation of a rational method to help clinicians/smokers choose the treatments most likely to be successful for an individual smoker.

The current algorithm is based on empirical evidence but extends this using the author's clinical expertise and accommodation of patient values. Research is needed to test whether the use of algorithms actually improves outcomes (Murphy et al., in press). Perhaps the first test would be whether specialty care via an algorithm is better than usual care. For example, an RCT could compare smokers who are given OTC medications and a written booklet about treatments with smokers who are seen by a

trained specialist who follows the enclosed algorithm. The study would compare the number abstinent 6 months after exposure to the two interventions (e.g., via self-report of no smoking in last week plus biochemical verification). Such a study would be important because the author knows of no RCT showing that specialty care increases smoking quit rates. If such an RCT were positive, it would help persuade organizations to reimburse for specialty care for smoking cessation. Further RCTs could test adaptive treatment strategies that tailor treatment based on initial responses to a treatment (Murphy et al., in press).

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