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Tobacco Cessation: Agency for Health Care Policy and Research (AHCPR)

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TWO QUESTIONS, THREE MINUTES, A LIFETIME OF DIFFERENCE FOR YOUR PATIENTS

AHCPR

Agency for Health Care Policy and Research

U.S. Department of Health and Human Services
Public Health Service
Agency for Health Care Policy and Research

AHCPR Publication No. 97-0062
July 1997

CTRI

Dear Colleague:

As chairman of the panel of tobacco intervention experts that developed the *Smoking Cessation Clinical Practice Guideline*, cosponsored by the Agency for Health Care Policy and Research and the Centers for Disease Control and Prevention, I am pleased to provide you with the enclosed Smoking Cessation Consumer Tools Kit. The materials inside are part of a new Smoking Cessation ***Two-Three Initiative*** based on the guideline recommending ***Two Questions:*** "Do You Smoke?" and "Do You Want To Quit?" be part of every medical assessment by clinicians. This should be followed by an intervention as brief as ***Three Minutes*** recommending smoking cessation treatments proven to work.

To be most effective, every component of the health care delivery team -- especially clinicians and systems -- must become involved and assume a critical role in tobacco cessation. Because of our unique access to the smoking population, doctors, nurses, dentists, pharmacists and other clinicians are an important part of any solution addressing strategies to help the millions of Americans who want to quit. New information on the cost-effectiveness of smoking cessation interventions should prove to be equally important to health care systems that frequently manage the type of care delivered by clinicians.

While there are no magic bullets that will automatically transform a smoker into an ex-smoker, our patients can achieve this critical health goal. Your brief intervention and the use of these tools can help pave the way to improving the overall health of your patients and assist them in attaining a smoke-free future.

Sincerely,

Michael C. Fiore, M.D., M.P.H.
Panel Chair, Smoking Cessation Guideline
Director, Center for Tobacco Research and Intervention
Associate Professor, Department of Medicine
University of Wisconsin Medical School

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How To Use The Materials In This Kit

Included in this folder are educational materials that can help you advise your patients who smoke on how to quit. Research shows that smokers have the best chance of cessation when their health care providers get involved.

Counseling your patients for as little as even three minutes a visit can be effective. The materials enclosed are designed to help you in that effort. They also can complement your counseling by directing patients to local stop smoking programs.

This kit offers quick and easy-to-read educational guides that can be customized and duplicated on your copier machine.

TOOLS FOR VARIOUS PATIENT PROFILES:

These one-page guides for patients address particular concerns of smokers, especially those in challenging situations. You will notice that the front of each guide is labeled on the bottom:

- First Time Quitters.
- Multiple Quit Attempts.
- Pregnancy and Smoking.
- Smokers Facing Surgery.

HOW TO USE THE PATIENT GUIDES:

- Make a photocopy of the enclosed master copies.
- The space provided on the bottom of the back pages allows you to write in local referral information such as smoking cessation programs or local chapters of the American Cancer Society, American Lung Association, or American Heart Association.
- Copy and distribute to selected patients.
- File the master copies for future use when the referral information has changed or to make more copies.

To obtain additional copies of the Smoking Cessation guideline products, write the AHCPR Publications Clearinghouse, P.O. Box 8547, Silver Spring, MD 20907 or call toll free 800-358-9295 or visit on-line at http://www.ahcpr.gov/.

WINNING TIPS FROM OVER 1 MILLION QUITTERS

FIRST TIME QUITTERS

IS THIS THE RIGHT TIME? You promised yourself that if you really wanted to quit smoking, you would. You know all the reasons why you should quit, but you have to be ready to do it — for you.

You are the best judge of when the time is right for you. You might be uncertain. It won't be easy. But with commitment, the right attitude, and the methods listed below, you can be off to a good start. Why not give it a try?

YOU ARE NOT ALONE. Over one million people each year make the decision and successfully quit smoking. Here are some of their tips that can help you:

- Set a quit date and stick to it.
- Get the support and understanding of your family, friends, and coworkers.
- Get rid of all tobacco products and ashtrays.

HOW CAN I QUIT? You have heard a lot about different ways to quit. Experts say you have the best chance of quitting if you use these proven methods together:

Use nicotine replacement therapy. This means the nicotine patch, gum, or nasal spray. Any one of these three can help cut back on the urge to smoke. Studies show that almost everyone can benefit from nicotine replacement therapy. It's best to talk with your health care professional about your choices. You can buy the nicotine patch and gum at any pharmacy, or get them from your doctor. The nicotine nasal spray is only available by prescription.

Get support and encouragement. Smoking cessation programs can help you learn how to deal with stress and other things that make you want to smoke. You may want to join a quit-smoking program or start your own informal group of smokers trying to quit. Studies show that the more support you have, the greater your chance for success. Check with your health care professional, local hospitals, the American Cancer Society, American Lung Association, or American Heart Association for a schedule of classes.

Learn how to handle the urge to smoke. Be aware of things that may cause you to want to smoke:

- Being around other smokers.
- Drinking alcoholic beverages.
- Being under stress.
- Getting into an argument.
- Feeling depressed.

It can be tough "unlearning" something that is so much a part of what you do everyday. There is no magic solution — but it can be done. Over one million people prove it every year — you can too!

REWARD YOURSELF

Here are some benefits you'll enjoy as a nonsmoker:

- You'll take a giant step toward improving your health.
- You'll feel less winded and have more energy.
- Food will taste better.
- Your sense of smell will improve.
- The money spent on tobacco products can now be spent on other enjoyable things.
- You'll control your own schedule, instead of your habit controlling you.

What are some of the benefits you look forward to? Make a list and keep it where you can see it — in the car, at home, or at work.

For a free "You Can Quit Smoking" brochure, call toll free 800-358-9295 or write the Agency for Health Care Policy and Research, Publications Clearinghouse, P.O. Box 8547, Silver Spring, MD 20907.

LOCAL INFORMATION:

Why People Who Stop For Good May Quit More Than Once

HOW MANY TIMES HAVE YOU TRIED TO QUIT SMOKING? Maybe once, maybe more. You start out really wanting to quit, feeling that the time is right. But for whatever reason, you're smoking again. Perhaps you're ready to try again now, but you want to be sure it works this time. Who could blame you?

As hard as it is to believe, some smokers try a number of times before they quit for good.

WHAT WORKS? You've heard a lot about different ways to quit — and maybe even tried a few. Experts say you have the best chance of quitting if you use these proven methods together:

Use nicotine replacement therapy (nicotine patch, gum, nasal spray). Studies show that almost everyone benefits from nicotine replacement therapy. Even though you may have used one of these products in the past, it is still important to choose one of them as part of your program. Any one of the three can help cut back on the urge to smoke. It's best to talk with your health care professional about your choices. You can buy the nicotine patch and gum at any pharmacy, or get them from your doctor. The nicotine nasal spray is only available by prescription.

Get support and encouragement. This help can come from family and friends, or from a formal quit-smoking program. Smoking cessation programs can help you learn how to live life as a nonsmoker and are an effective means of support. Even if you've enrolled in the past, you may want to join a quit-smoking program or start your own informal group of smokers trying to quit. Studies show that the more support you have, the greater your chance for success. Check with your health care professional, local hospitals, the American Cancer Society, American Lung Association, or American Heart Association for a schedule of classes.

Learn how to handle the urge to smoke. Be aware of things that may cause you to start smoking again:

- Being around other smokers.
- Drinking alcoholic beverages.
- Being under stress.
- Getting into an argument.
- Feeling depressed.

Imagine yourself as a nonsmoker and focus on other things to help get you through the day. Whatever you do, don't give up. It can be tough "unlearning" something that is so familiar to you. There is no magic solution — but it can be done. Every attempt at quitting is a step in the right direction and will bring you closer to a smoke-free you.

REWARD YOURSELF

Here are some benefits you'll enjoy as a nonsmoker:

- You'll take a giant step toward improving your health.
- You'll feel less winded and have more energy.
- Food will taste better.
- Your sense of smell will improve.
- The money spent on tobacco products can now be spent on other enjoyable things.
- You'll control your own schedule, instead of your habit controlling you.

What are some of the benefits you look forward to? Make a list and keep it where you can see it — in the car, at home, or at work.

For a free "You Can Quit Smoking" brochure, call toll free 800-358-9295 or write the Agency for Health Care Policy and Research, Publications Clearinghouse, P.O. Box 8547, Silver Spring, MD 20907.

LOCAL INFORMATION:

What It Means To Be Smoking For Two

YOU'RE GOING TO HAVE A BABY — AND YOU SMOKE. What better time to quit? And for two very good reasons: you and your baby.

Pregnancy can be a time of joy and stress. It may seem overwhelming to think about quitting now. Even if someone you know may have smoked during her pregnancy and had a problem-free delivery and a healthy baby, quitting still offers you and your baby the best chance for a fresh start.

QUITTING IS HARD.

Maybe you've tried to quit before. And even now, it isn't easy giving up something that is so much a part of what you do every day. But studies show that the more times you try to quit, the more likely it will work out the next time. The stress of quitting won't harm your baby either. So whether you are in your first trimester — or your last — it is still the best decision you can make for both of you.

YOU ARE NOT ALONE.

Here are a few steps to help you:

- **Get help and advice.** Let your doctor or nurse know you want to quit. Once you set a quit date, they can also help you decide whether nicotine replacement therapy (the nicotine patch, gum, or nasal spray) would be good for you to use during your pregnancy.
- **Enroll in a quit-smoking class or program.** The more support you have, the greater your chance for success in fighting the urge to smoke. Check with your health care professional, local hospitals, the American Cancer Society, American Lung Association, or American Heart Association for a program near you.
- **Keep those close to you in the loop.** Family and friends can be a big help. Also remember that every prenatal care visit is another chance to update your doctor or nurse. Look to the people who care to help you stay on track.

Remember, a smoke-free you is the best gift you can give your baby — and yourself!

HOW WILL YOU AND YOUR BABY BENEFIT?

Experts say that there are both short- and long-term benefits to quitting smoking:

- As soon as you quit, your baby gets more oxygen.
- You'll feel less winded, and have more energy.
- There is less risk of delivering a low-birth weight baby.
- After your baby is born, there is less risk that your child will have health problems such as asthma.
- There is less risk of your baby having middle ear fluid and other infections, which are common in infants and young children of parents who smoke.
- You'll lower the chance of heart and lung diseases for you and your baby.

For a free "You Can Quit Smoking" brochure, call toll free 800-358-9295 or write the Agency for Health Care Policy and Research, Publications Clearinghouse, P.O. Box 8547, Silver Spring, MD 20907.

LOCAL INFORMATION:

AHCPR PUBLICATION NO. 97-0062C


WHY REHABILITATION AND RECOVERY
GO BETTER ONCE YOU'VE QUIT

YOU'VE HEARD IT A MILLION TIMES BEFORE — "You need to quit smoking," — from your friends and loved ones, even your doctors. It's not like you haven't thought about quitting. Maybe you've even tried to quit before. But for whatever reason, you're smoking again.

So now you're facing elective surgery.

While you're in the hospital, you'll be in a smoke-free environment. You've decided to have the surgery — why not decide to quit smoking at the same time? Doctors, nurses, and other health care professionals will be there to give you the support and help you need as you take the first step.

HERE ARE A FEW STEPS TO HELP YOU:

- **Set your quit date** around the time of your surgery and let your doctor know.
- **Ask for help** from doctors, nurses, and attending hospital staff. While you are in the hospital, they can start you on nicotine replacement therapy (nicotine patch, gum, or nasal spray) to help control your cravings, and increase your chance of quitting for good.
- **Enroll in a support class or program** to help you over the rough spots. Programs offer tips on coping with difficult situations that can trigger the urge to smoke.
- **Keep your doctor in the loop.** Many smokers who have tried to quit, even with the best of intentions, have relapsed. Relapse doesn't mean you've failed. The key is to learn from it. Studies show that the more times you try to quit, the greater your chance of success is with each new try. Your doctor is prepared for this and can help you get back on track.

It can be tough "unlearning" something that is so familiar. There is no magic solution — but you have the power to stop smoking. The right attitude, drive, commitment, and your willingness to get help from your health care professional will help you along the way.

IF YOU STOP SMOKING, DID YOU KNOW:

- You'll heal and recover faster, especially in the incision area or if your operation or injury involves any bones.
- You'll lower your chance of having a second heart attack if you have had a history of heart problems.
- You'll reduce your risk for a second cancer to occur, especially if your lung, head, or neck cancer has been successfully treated.

For a free "You Can Quit Smoking" brochure, call toll free 800-358-9295 or write the Agency for Health Care Policy and Research, Publications Clearinghouse, P.O. Box 8547, Silver Spring, MD 20907.

LOCAL INFORMATION:

AHCPR PUBLICATION NO. 97-0062D

From the AHCPR Report: The Cost-Effectiveness of AHCPR's Smoking Cessation Guideline

Table 4-2. Smoking Cessation Quit Rates

Type of Visit	Baseline (percent)	Odds Ratio	Intervention[a] (percent)	Marginal Quit Rate (percent)	Rebased Marginal Quit Rate[b] (percent)
Minimal (<3 minutes)	8.8	1.2	10.7	1.9	0.94
With Patch	8.8	2.1	19.6	10.8	6.70
With Gum	8.8	1.5	14.8	6.0	3.68
Brief (3-10 minutes)	8.8	1.4	12.1	3.3	1.86
With Patch	8.8	2.1	22.5	13.7	8.40
With Gum	8.8	1.5	17.1	8.3	4.95
Counseling (>10 minutes)	8.8	2.4	18.7	9.9	6.20
With Patch	8.8	2.1	32.6	23.8	16.00
With Gum	8.8	1.5	25.7	16.9	10.90
Intensive Counseling (4-7 visits @ 20-30 minutes)	10.4	2.5	22.6	12.2	6.62
With Patch	10.4	2.1	38.0	27.6	16.64
With Gum	10.4	1.5	30.5	20.1	11.50

[a]Quit rates using patch and gum derived by applying marginal odds ratios reprinted in guideline to quit rates without nicotine replacement (see Chapter 4 on methods).
[b]Derived by adjusting 5% underlying quit rate for at least 3 months in U.S. by odds ratios (see text).
Source: USDHHS, Clinical Practice Guideline Number 18: Smoking Cessation, PHS/AHCPR, No. 96-0692, April 1996.

counseling with patch is 13.7 percentage points (= 22.5 percent - 8.8 percent), as shown in Table 4-2.

The very high baseline quit rates in the meta-analyses are due to (a) some studies including only want-to-quit subjects, and (b) minimal cessation interventions (e.g., self-help materials) offered some control subjects. In order to apply the results of the meta-analyses to the entire U.S. smoking population, the odds ratios derived from the analyses were applied to the underlying 3-month-or-more quit rate in the U.S. (CDC, 1996). This rate was reported (by C. Husten at CDC) to be 5 percent (versus 5.7 percent for smokers quitting for at least 1 month). For example, the rebased marginal quit rate for brief counseling using the patch of 8.4 percent was derived by converting the 5 percent underlying quit rate into an odds ratio (= 0.0526), multiplying by the product of the two odds ratios (1.4 x 2.1 = 2.94), converting the result back into a percentage (= 0.1339 = 0.155/1.155), and subtracting off the original 5 percent. Finally, a 35 percent relapse rate is applied to derive an estimate of expected permanent quitters beyond 5 months. Thus, in determining the estimated number of permanent quitters under this intervention, 5.46 percent was used instead of 8.4 percent (or the 13.7 percentage point difference derived from the meta-analyses based on an 8.8 percentage point baseline).

Average and marginal quit rates are easily converted into an estimate of the total number of quitters by multiplying by the number of smokers involved in a given intervention. Approximately 25 percent of the adult population smokes, or slightly less than 50 million persons. If every smoker were to undergo minimal counseling, then the expected number of quitters would be 470,000 persons (= 50 million times 0.0094). With just brief counseling, about 930,000 persons (= 50 million times 1.86 percent) would be expected to quit versus 4.2 million (= 50 million times 8.4 percent) if they all used the patch as well.

Using quit rates to develop cost-effectiveness ratios allows one to compare alternative smoking cessation interventions, but they cannot be compared with other medical interventions whose cost-effective ratios are based on life-years saved, e.g., treatment of hypertension. In the next section, we describe the data and methods used to convert quit rates into life-years saved.

4.4.3 Life-Years Saved by Demographic Characteristic

Fortunately, the adverse effects of smoking have been well documented allowing researchers to link quit rates to health effects. Smokers have higher death rates than nonsmokers at all ages over 35

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Michael C. Fiore, MD, MPH
AMA/American Public Health Association Media Briefing
December 2, 1997
The Cost-Effectiveness of the AHCPR Smoking Cessation Clinical Practice Guideline
By Jerry Cromwell, Ph.D. and Colleagues

I'm here today to share an important public health message -- helping patients quit smoking will not only prevent illness and save lives, but will also reduce health care costs. In fact, our study, published today in the Journal of the American Medical Association, confirms that there is not a single preventive intervention a doctor can provide to all adult patients that will be as cost-effective as smoking cessation treatment.

I know I don't have to convince anyone in this room that tobacco addiction in the United States results in an enormous burden of illness and death. Recent estimates document that more than 400,000 deaths, *one out of every five deaths*, are caused directly by smoking. The illnesses that plague American families are, in large part, either caused directly by or worsened by tobacco use. We all know that smoking causes lung cancer, but fewer are aware of the statistics confirming that 30% of all cancers, 25% of heart attacks and strokes, and more than 90% of COPD -- are all caused by tobacco use. The health toll is staggering.

The economic toll is as well. Recent estimates have documented that 50 billion dollars in direct medical expenses -- about 10% of the total health care bill in America -- is caused directly by smoking. Given that there are about 50 million smokers -- we now can estimate that roughly one billion dollars can be saved in direct health care costs each year for every million smokers who successfully quit.

This week in JAMA, we have published a detailed economic analysis of the AHCPR Smoking Cessation Clinical Practice Guideline -- in essence, an estimation of the economic impact of providing American smokers with proven, effective, smoking cessation treatments. This analysis made the following findings:

- Effective smoking cessation treatments cost about $2,500 per year of life saved. In contrast, mammography screening costs about $50,000 per year of life saved and treatment for high cholesterol cost almost $100,000 per year of life saved. In fact, next to immunizations, there is not a single prevention intervention for adults that provides the same return on investment as smoking cessation treatment.

- Overall, the actual cost of providing effective smoking cessation treatment is about $165 per smoker. Compare that to the cost of treating a heart attack, stroke, or cancer -- illnesses we confront, treat, and pay for every day as a result of smoking.

- The more intensive the treatment, the more cost-effective the treatment. Treatments involving group and individual counseling and the nicotine patch were particularly meritorious.

- If clinicians across America implemented the AHCPR Smoking Cessation Guidelines, we could expect an approximate doubling of the rate of successful smoking cessation. This would result in more than one million new ex-smokers per year at a savings of more than one billion dollars in unnecessary medical costs.

These cost analysis estimates are based on the universal implementation of the AHCPR Smoking Cessation Clinical Practice Guidelines. These evidence-based recommendations were released in April, 1996 by the Agency for Health Care Policy and Research (AHCPR), a component of the United States Department of Health and Human Services. The recommendations were compiled by an expert panel who reviewed hundreds of studies on smoking cessation -- more than 3,000 articles -- and then completed more than 50 meta-analysis that synthesized the findings of these studies. Their goal was to answer one key question -- which clinical treatments help people to quit and which do not?

The AHCPR Smoking Cessation Guideline made six overriding recommendations:

- Every person who smokes should be offered smoking cessation treatment at every office visit.

- Clinicians should ask and record the tobacco-use status of every patient at every visit.

- Cessation treatments even as brief as 3 minutes are effective.

- The more intense the treatment, the more effective it is in producing long-term abstinence from tobacco.

- Three treatment elements were found to be particularly effective in promoting smoking cessation and should be part of such treatment -- nicotine replacement therapy, clinician-delivered social support, and skills training regarding quitting.

- Health care systems should be modified to routinely identify and intervene with all tobacco users at every visit.

The Guideline demonstrated that smoking cessation treatments are clinically effective. The cost analysis released today tell us that they are also *highly cost-effective*.

Over the last year, as we have discussed the possibility of a "Global Tobacco Settlement", much of the talk regarding this issue has focused on only one-half of the problem -- the disturbing fact that 3,000 American children become addicted to cigarettes every day in this country. Any tobacco settlement needs to have ironclad components to assure that this life threatening risk to our children is ended.

Unfortunately, the other half of this problem has been ignored in these discussions -- the fact that 50 million Americans are already addicted to tobacco. Individuals who, for the most part (more than 70%), now say they want to quit. Individuals who, when they try on their own, have a discouragingly low -- 7% -- quit rate. If Guideline treatments were made widely available, smokers' success in quitting would increase three- to five-fold! Current smokers have already paid for the proposed "Global Tobacco Settlement" -- they have paid with their health, and with their dollars -- one pack of cigarettes at a time.

The research findings released today provide further evidence of the critical need to provide smokers with effective cessation treatments. To do this, I would make the following suggestions:

- Mandate that all insurance plans cover effective smoking cessation counseling and pharmacotherapy -- the kinds of effective treatments outlined in the AHCPR Smoking Cessation Guideline as well as treatments approved by the FDA. Why is it that insurance plans consistently pay the tens of thousands of dollars for the outcomes of smoking -- whether it be heart attacks, strokes, cancer, or emphysema -- but, most will pay nothing to avoid these expenses?

- Alter the proposed "Global Tobacco Settlement" to provide coverage of smoking cessation treatment. We know how to promote successful smoking cessation -- the AHCPR Guideline provides a blueprint for this. The current, proposed settlement provides little for the 50 million Americans already addicted to cigarettes.

- Insure that any coverage for smoking cessation treatment mandates the use of treatments demonstrated by scientific evidence to be effective -- such as those outlined in the AHCPR Guideline and supplemented with the new medications approved for smoking cessation by the FDA. To be most effective, the AHCPR Guideline on Smoking Cessation should be updated to reflect the latest findings.

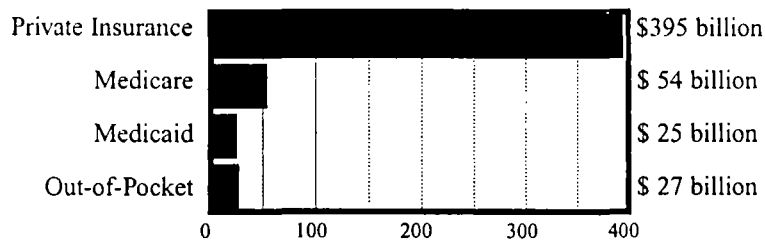
We know how to help our patients quit smoking. The findings released in JAMA today confirm that those treatments are extraordinarily cost-effective. As physicians, as insurers, and as policy makers, it is now time to provide smokers with these effective treatments.

The Economic Implications of Smoking and Smoking Cessation

Direct Medical Costs Only

Economics

- While the percentage of persons who smoke has declined, there are still nearly 50 million smokers in the United States.
- Smokers made 159 million office visits to physicians in 1995 and had more than 9 million hospital admissions. Smokers are 27 percent more likely to be admitted to a hospital than are nonsmokers.
- The lifetime excess health care costs for smokers are expected to add $501 billion to U.S. health care spending. Broken down by payer, this amounts to:



Impact of the Guideline

- The expected costs of all interventions recommended by the guideline—clinician counseling, nicotine replacement, and intensive individual or group counseling with smoking cessation experts—would be $6.9 billion per year, assuming all smokers are willing to quit.
- The cost per person who stops smoking, averaged across all interventions recommended by the guideline, is estimated to be $1,748.
- For the extra costs, the existing quit rate would rise by 8.2 percent, adding nearly 4 million new nonsmokers each year.

Cost-Effectiveness of Recommended Interventions

- Implementing the guideline would cost $2,321 for each life-year saved. This is very cost-effective compared with other medical and surgical interventions, such as annual mammography for women age 40-49 with an estimated cost per life year saved of $16,744 and hypertension screening for asymptomatic men age 40 with an estimated $23,335 in cost per life year saved.

Source: Eddy, *et. al.* (1988), Littenberg, *et. al.* (1990)

Cost-Effectiveness of Smoking Cessation Interventions Per Year of Life Saved

Intervention Type	Interventions Delivered By Primary Care Clinicians	Interventions Delivered by Smoking Cessation Specialists
Counseling Alone	$1,699.78 - $3,119.90	$1,051.31 - $1,803.07
Counseling with the Patch	$1,752.48 - $2,414.24	$1,391.98 - $1,724.28
Counseling with Nicotine Gum	$2,712.86 - $4,208.21	$2,159.18 - $2,615.47

Notes:

Analysis assumes all smokers undergo each intervention exclusively. This allows comparison of interventions.
Smoking cessation interventions and effects are based on AHCPR's Clinical Practice Guideline Number 18.
Costs by intervention vary depending on length and number of visits. Range (presented in table) reflects this.
This analysis assumes that smoking cessation specialists deliver more intensive and costly interventions that yield higher success rates.
Estimates assume that 30 percent of quitters relapse.
Years of life saved were discounted by 5 percent.

AHCPR
Agency for Health Care Policy and Research

AHCPR Pub. No. 96-R078
April 1996

Smoking Cessation

a systems approach

A Guide for Health Care Administrators, Insurers, Managed Care Organizations, and Purchasers

Health care systems face the daily challenge of balancing quality of care and costs for every patient. As health care administrators, insurers (including managed care plans), and purchasers, you play a vital role in tackling the leading preventable cause of illness and death—smoking. The most successful smoking cessation programs are supported by institutional policies. They incorporate reimbursement practices, clinical and systems procedures, incentives for providers, and clinician education. Interventions by many kinds of health care providers are also powerful components of successful programs. This brochure is intended to reach a broad audience; readers should consider how the key points could be addressed from their particular vantage point in the system.

The purpose of this guide is to provide you with tools to make smoking cessation a priority in your organization. You can help eliminate the roadblocks to developing standard procedures for assessment and treatment of tobacco use in every health care setting. Substantive change can occur when systems and providers work in tandem.

- Americans spend an estimated $50 billion annually on direct medical care for smoking-related illnesses. Lost productivity and forfeited earnings due to smoking-related disability account for another $47 billion per year.
- The average cost per smoker for effective cessation treatment is $165.61.
- Smoking cessation interventions are less costly than other routine medical interventions such as treatment of mild to moderate high blood pressure or high cholesterol and preventive medical practices such as periodic mammography.
- Smoking cessation interventions can save on costs by reducing health risks and complications for infants and young children.

Supporting institutionwide smoking cessation programs can yield both short- and long-term cost savings for patients. Working to make institutional change impacts not only the health of your patients but also the quality and costs of care.

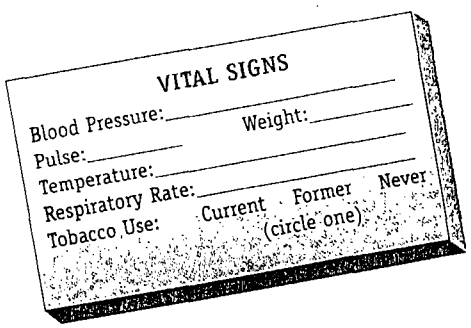
Strategies That Work

Effective smoking prevention interventions are readily available now and, if provided in a timely and effective manner, greatly reduce the smoker's risk of suffering from smoking-related disease. Following are five strategies that have been demonstrated to be effective in helping health care providers identify and treat tobacco users. Health care administrators, insurers, and purchasers each have an important role in promoting adoption of these strategies. For example, administrators can develop policies to be implemented at the office, clinic, and hospital levels; insurers, including managed care plans, can promote implementation through contract specifications, incentives, and performance expectations; and purchasers can tailor their agreements with insurers and delivery organizations to ensure that smoking cessation interventions are addressed at the delivery system level. Costs for implementing these strategies will vary among individual health plans depending on a plan's population mix, location, personnel conducting the intervention, intervention preferences of its members, and other variables such as costs for screening, advice, motivation, and counseling.

Strategy 1. Implement a tobacco-user identification system in every clinic

Evidence: Screening systems that systematically identify and document smoking status result in higher rates of smoking cessation interventions by clinicians and in higher quit rates among patients who smoke. This approach increases the probability that tobacco use is consistently assessed and documented. Studies show that smoking cessation interventions involving minimal contact with health care providers—physicians, nurses, social workers, counselors, and others—even in sessions lasting as few as 3 minutes, are more effective at increasing cessation rates than no contact at all. Intensive interventions are more effective and should be used when resources permit. Health care report cards such as the Health Plan Employer Data and Information Set (HEDIS) are now mandating that managed care organizations include information documenting delivery of effective smoking cessation services.

Action	Strategies for implementation	
Implement an office-wide system that ensures that, for EVERY patient at EVERY clinic visit, tobacco-use status is queried and documented.	**Office system change:**	Expand vital signs data to include tobacco use (see sample diagram below).
	Responsible staff:	Nurse, medical assistant, receptionist, or other individual already responsible for measuring the vital signs—no additional staff requirements. These staff must be instructed regarding the frequency and importance of this activity.
	Frequency of utilization:	Every visit for every patient regardless of the reason that brought the individual to the clinic. In other words, whenever health care staff collect the traditional vital signs data, they should query and document tobacco use.*
	System implementation steps:	Preprint note paper or preprogram computer record for every patient visit to include tobacco use along with the traditional vital signs. A vital sign stamp can also be effective. Alternatives to the vital sign stamp are to place tobacco-use status stickers on all patient charts or to indicate smoking status using computer reminder systems.



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Strategy 2. Provide education, resources, and feedback to promote provider intervention

Evidence. Smoking cessation interventions delivered by multiple types of health care providers (e.g., nurses, dentists, psychologists, social workers) markedly increase cessation rates compared with interventions where no provider intervenes (e.g., self-administered interventions). Results are consistent across diverse provider groups, with no clear advantage to any single provider type. To encourage provider interventions, health care administrators, insurers, and purchasers should provide both training and incentives, such as reimbursement for clinicians (see strategy 5). It is important to dedicate staff both to provide smoking cessation treatment and to assess the delivery of this treatment in staff performance evaluations.

National data suggest that, in a given visit with a clinician, most smokers are not advised to quit smoking and are not assisted with cessation. Factors that contribute to this problem include failure to (a) include smoking assessment and cessation in the performance expectations of clinicians and (b) provide clinicians with an environment that supports systematic intervention with smokers. Without supportive systems, policies, and environmental prompts, the individual clinician cannot be counted on to assess and treat tobacco use reliably.

Action	Strategies for implementation
■ Health care systems should ensure that clinicians have the knowledge and training to treat smoking, that clinicians and patients have cessation resources, and that clinicians are given feedback about their cessation practices.	**Educate**—On a regular basis, offer lectures/seminars/in-services with CME and other credit for smoking cessation treatment. **Resources**—Have patient self-help materials, as well as nicotine replacement "starter kits," readily available in every exam room. **Provide feedback**—Drawing on data from chart audits, electronic medical records, or computerized patient databases, evaluate the degree to which clinicians are identifying, documenting, and treating patients who smoke, and provide feedback to clinicians about their level of intervention.
■ Clinical sites should communicate to staff the importance of intervening with smokers and should designate one staff person (e.g., nurse, medical assistant, or other clinician) to coordinate and deliver smoking cessation treatments.	**Communicate** to each staff member (e.g., nurse, medical assistant, or other clinician) his or her responsibilities in the delivery of smoking cessation services. **Designate** a smoking cessation treatment coordinator for every clinical site. **Delineate** the responsibilities of the smoking cessation coordinator, including instructing patients on the effective use of cessation treatments (e.g., nicotine replacement therapy, telephone calls to and from prospective quitters, and scheduled followup visits, especially in the immediate post-quit period).

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Evidence. Every hospital in the United States must now be smoke free if it is to be accredited by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO). Implementing inpatient smoking cessation programs increases the rate at which hospitalized patients successfully quit. It is vital that hospitalized patients attempt to quit smoking because smoking may interfere with their recovery. Hospitalized patients may be particularly motivated to make a quit attempt for two reasons. First, the illness that resulted in their hospitalization may have been caused or exacerbated by smoking. Second, the hospital's smoke-free environment may enhance their motivation to quit. In addition, systematic, institutionalized mechanisms to identify exsmokers is a necessary first step in delivering relapse prevention messages. Furthermore, all clinicians have an important role as nonsmoking models for their patients.

Action	Strategies for implementation
Provide smoking cessation inpatient consultation services to all smokers admitted to a hospital and to all health care personnel who smoke.	**Implement** a system to identify and document the tobacco-use status of all hospitalized patients. **Offer** cessation treatment to all hospitalized patients who use tobacco. **Identify** a clinician(s) to deliver smoking cessation inpatient consultation services for every hospital. **Reimburse** providers for smoking cessation inpatient consultation services. **Expand** hospital formularies to include effective smoking cessation pharmacotherapy such as the nicotine patch and nicotine gum. **Ensure** compliance with JCAHO regulations mandating that all sections of the hospital be entirely smoke free. **Educate** all hospital staff regarding nicotine withdrawal, including effective treatments such as nicotine replacement therapy and counseling.

Strategy 4. Include smoking cessation treatments as paid services in all health benefits packages

Evidence. Smoking cessation treatments (both pharmacotherapy and counseling) are not consistently provided as paid services for subscribers of health insurance packages. The level of coverage is particularly surprising given that studies show that physician counseling against smoking is at least as cost-effective as several other preventive medical practices, including the treatment of mild or moderate hypertension or high cholesterol. The national health promotion and disease prevention objectives for the year 2000 as set forth in *Healthy People 2000* propose to increase to 100 percent the proportion of health plans that offer treatment of nicotine addiction, such as tobacco-use cessation counseling by health care providers, tobacco-use cessation classes, prescriptions for nicotine replacement therapies, and/or other cessation services.

Strategy 4. Include smoking cessation treatments as paid services in all health benefits packages

Action	Strategies for implementation
Provide coverage to all insurance subscribers for effective smoking cessation treatments, including pharmacotherapy (nicotine replacement therapy) and counseling.	**Coverage**—Include effective smoking cessation treatments (both pharmacotherapy and counseling) as part of the basic benefits package for all individual, group, and HMO insurance packages. **Evaluate**—Include the provision of smoking cessation treatment as part of "report cards" for managed care organizations and other insurers (e.g., Health Plan Employer Data and Information Set [HEDIS]). **Educate**—Inform subscribers of the availability of covered smoking cessation services and encourage patients to use these services.

Strategy 5. Address effective smoking cessation treatment in clinician compensation agreements

Evidence. Primary care clinicians frequently cite insufficient insurance reimbursement as a barrier to providing preventive services such as smoking cessation treatment. Insurance coverage has been shown to increase rates of cessation services utilization and therefore increase rates of quitting. Even the presence of prepaid or discounted prescription drug benefits increases patients' receipt of prescribed nicotine gum, the duration of gum use, and smoking cessation rates. Furthermore, an 8-year insurance industry study found that reimbursing physicians for providing preventive care resulted in reported increases in exercise, seat belt use, and weight loss, as well as decreased alcohol use and a trend toward decreased smoking.

Smoking cessation treatments (both pharmacotherapy and counseling) should be provided as paid services for subscribers of health insurance/managed care. Clinicians should be reimbursed for delivering effective smoking cessation treatments. Even if a smoker does not want to quit, clinicians are encouraged to ask questions at each visit that help the patient identify reasons to quit and barriers to quitting. Clinicians should pledge to assist the patient when he or she is ready to quit. For patients willing to attend such programs, insurers should encourage referral to intensive programs through education and incentives to primary care providers.

Action	Strategies for implementation
Reimburse fee-for-service clinicians for delivery of effective smoking cessation treatments; include smoking cessation treatments in the defined duties of salaried clinicians.	**Include** smoking cessation treatment as a reimbursable activity for fee-for-service providers. **Inform** fee-for-service clinicians that they will be reimbursed for using effective smoking cessation treatments with every patient who uses tobacco. **Include** smoking cessation intervention in the job description and performance evaluation of salaried clinicians.

Costs of smoking cessation interventions

The following table shows the average cost for each smoking cessation intervention, assuming that the entire U.S. population over the age of 18 years would be willing to undergo an intervention to quit smoking. The cost is the total average cost per smoker and includes the costs of screening, advising, motivation, and direct intervention with and without nicotine replacement for the interventions indicated. Across all types of interventions, the estimated cost per smoker is $165.61. The cost of each intervention varies according to the amount of provider counseling, the provision of nicotine replacement therapy, and the effectiveness of the intervention.

Total cost per smoker of smoking cessation interventions with and without nicotine replacement

Intervention	Without nicotine replacement	With transdermal nicotine	With nicotine gum
Minimal counseling (≤ 3 min in duration)	$33.20	$167.11	$172.18
Brief counseling (> 3 min to ≤ 10 min)	$56.48	$185.57	$192.40
Full counseling	$94.24	$231.30	$246.34
Individual intensive counseling	$123.19	$255.01	$271.01
Group intensive counseling (7 1-hour sessions)	$71.83	$203.65	$219.65

Source: Cromwell J, Bartosch W, Mitchell J. The cost effectiveness of AHCPR's smoking cessation guideline. Health Economics Research, Inc. Waltham, MA. December 1996 (contract analysis under direction of AHCPR).

To Get More Information

The information in this guide was taken from the *Clinical Practice Guideline on Smoking Cessation*. For more information about the guideline and related products, or to get more copies of this guide, call toll free 800-358-9295 or write to: AHCPR Publications Clearinghouse, P.O. Box 8547, Silver Spring, MD 20907.

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U.S. Department of Health and Human Services
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April 1997

Smoking Cessation

a systems approach

A Guide for Health Care Administrators, Insurers, Managed Care Organizations, and Purchasers

Health care systems face the daily challenge of balancing quality of care and costs for every patient. As health care administrators, insurers (including managed care plans), and purchasers, you play a vital role in tackling the leading preventable cause of illness and death—smoking. The most successful smoking cessation programs are supported by institutional policies. They incorporate reimbursement practices, clinical and systems procedures, incentives for providers, and clinician education. Interventions by many kinds of health care providers are also powerful components of successful programs. This brochure is intended to reach a broad audience; readers should consider how the key points could be addressed from their particular vantage point in the system.

The purpose of this guide is to provide you with tools to make smoking cessation a priority in your organization. You can help eliminate the roadblocks to developing standard procedures for assessment and treatment of tobacco use in every health care setting. Substantive change can occur when systems and providers work in tandem.

- Americans spend an estimated $50 billion annually on direct medical care for smoking-related illnesses. Lost productivity and forfeited earnings due to smoking-related disability account for another $47 billion per year.
- The average cost per smoker for effective cessation treatment is $165.61.
- Smoking cessation interventions are less costly than other routine medical interventions such as treatment of mild to moderate high blood pressure or high cholesterol and preventive medical practices such as periodic mammography.
- Smoking cessation interventions can save on costs by reducing health risks and complications for infants and young children.

Supporting institutionwide smoking cessation programs can yield both short- and long-term cost savings for patients. Working to make institutional change impacts not only the health of your patients but also the quality and costs of care.

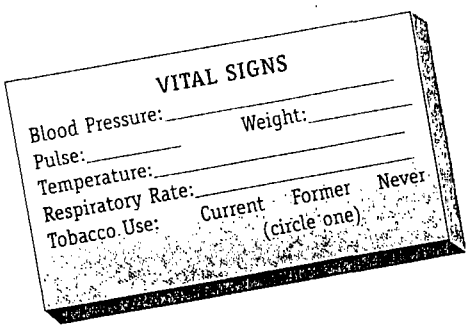
Strategies That Work

Effective smoking prevention interventions are readily available now and, if provided in a timely and effective manner, greatly reduce the smoker's risk of suffering from smoking-related disease. Following are five strategies that have been demonstrated to be effective in helping health care providers identify and treat tobacco users. Health care administrators, insurers, and purchasers each have an important role in promoting adoption of these strategies. For example, administrators can develop policies to be implemented at the office, clinic, and hospital levels; insurers, including managed care plans, can promote implementation through contract specifications, incentives, and performance expectations; and purchasers can tailor their agreements with insurers and delivery organizations to ensure that smoking cessation interventions are addressed at the delivery system level. Costs for implementing these strategies will vary among individual health plans depending on a plan's population mix, location, personnel conducting the intervention, intervention preferences of its members, and other variables such as costs for screening, advice, motivation, and counseling.

Strategy 1. Implement a tobacco-user identification system in every clinic

Evidence: Screening systems that systematically identify and document smoking status result in higher rates of smoking cessation interventions by clinicians and in higher quit rates among patients who smoke. This approach increases the probability that tobacco use is consistently assessed and documented. Studies show that smoking cessation interventions involving minimal contact with health care providers—physicians, nurses, social workers, counselors, and others—even in sessions lasting as few as 3 minutes, are more effective at increasing cessation rates than no contact at all. Intensive interventions are more effective and should be used when resources permit. Health care report cards such as the Health Plan Employer Data and Information Set (HEDIS) are now mandating that managed care organizations include information documenting delivery of effective smoking cessation services.

Action	Strategies for implementation	
Implement an office-wide system that ensures that, for EVERY patient at EVERY clinic visit, tobacco-use status is queried and documented.	**Office system change:**	Expand vital signs data to include tobacco use (see sample diagram below).
	Responsible staff:	Nurse, medical assistant, receptionist, or other individual already responsible for measuring the vital signs—no additional staff requirements. These staff must be instructed regarding the frequency and importance of this activity.
	Frequency of utilization:	Every visit for every patient regardless of the reason that brought the individual to the clinic. In other words, whenever health care staff collect the traditional vital signs data, they should query and document tobacco use.*
	System implementation steps:	Preprint note paper or preprogram computer record for every patient visit to include tobacco use along with the traditional vital signs. A vital sign stamp can also be effective. Alternatives to the vital sign stamp are to place tobacco-use status stickers on all patient charts or to indicate smoking status using computer reminder systems.



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Strategy 2. Provide education, resources, and feedback to promote provider intervention

Evidence. Smoking cessation interventions delivered by multiple types of health care providers (e.g., nurses, dentists, psychologists, social workers) markedly increase cessation rates compared with interventions where no provider intervenes (e.g., self-administered interventions). Results are consistent across diverse provider groups, with no clear advantage to any single provider type. To encourage provider interventions, health care administrators, insurers, and purchasers should provide both training and incentives, such as reimbursement for clinicians (see strategy 5). It is important to dedicate staff both to provide smoking cessation treatment and to assess the delivery of this treatment in staff performance evaluations.

National data suggest that, in a given visit with a clinician, most smokers are not advised to quit smoking and are not assisted with cessation. Factors that contribute to this problem include failure to (a) include smoking assessment and cessation in the performance expectations of clinicians and (b) provide clinicians with an environment that supports systematic intervention with smokers. Without supportive systems, policies, and environmental prompts, the individual clinician cannot be counted on to assess and treat tobacco use reliably.

Action	Strategies for implementation
■ Health care systems should ensure that clinicians have the knowledge and training to treat smoking, that clinicians and patients have cessation resources, and that clinicians are given feedback about their cessation practices.	**Educate**—On a regular basis, offer lectures/seminars/in-services with CME and other credit for smoking cessation treatment. **Resources**—Have patient self-help materials, as well as nicotine replacement "starter kits," readily available in every exam room. **Provide feedback**—Drawing on data from chart audits, electronic medical records, or computerized patient databases, evaluate the degree to which clinicians are identifying, documenting, and treating patients who smoke, and provide feedback to clinicians about their level of intervention.
■ Clinical sites should communicate to staff the importance of intervening with smokers and should designate one staff person (e.g., nurse, medical assistant, or other clinician) to coordinate and deliver smoking cessation treatments.	**Communicate** to each staff member (e.g., nurse, medical assistant, or other clinician) his or her responsibilities in the delivery of smoking cessation services. **Designate** a smoking cessation treatment coordinator for every clinical site. **Delineate** the responsibilities of the smoking cessation coordinator, including instructing patients on the effective use of cessation treatments (e.g., nicotine replacement therapy, telephone calls to and from prospective quitters, and scheduled followup visits, especially in the immediate post-quit period).

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Evidence. Every hospital in the United States must now be smoke free if it is to be accredited by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO). Implementing inpatient smoking cessation programs increases the rate at which hospitalized patients successfully quit. It is vital that hospitalized patients attempt to quit smoking because smoking may interfere with their recovery. Hospitalized patients may be particularly motivated to make a quit attempt for two reasons. First, the illness that resulted in their hospitalization may have been caused or exacerbated by smoking. Second, the hospital's smoke-free environment may enhance their motivation to quit. In addition, systematic, institutionalized mechanisms to identify exsmokers is a necessary first step in delivering relapse prevention messages. Furthermore, all clinicians have an important role as nonsmoking models for their patients.

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Evidence. Smoking cessation treatments (both pharmacotherapy and counseling) are not consistently provided as paid services for subscribers of health insurance packages. The level of coverage is particularly surprising given that studies show that physician counseling against smoking is at least as cost-effective as several other preventive medical practices, including the treatment of mild or moderate hypertension or high cholesterol. The national health promotion and disease prevention objectives for the year 2000 as set forth in *Healthy People 2000* propose to increase to 100 percent the proportion of health plans that offer treatment of nicotine addiction, such as tobacco-use cessation counseling by health care providers, tobacco-use cessation classes, prescriptions for nicotine replacement therapies, and/or other cessation services.

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U.S. Department of Health and Human Services
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2101 East Jefferson Street, Suite 501
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AHCPR Publication No. 97-0698
April 1997

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...as you requested

*It is our pleasure
to send you
the attached materials*

AHCPR
Agency for Health Care Policy and Research

TABLE 8

COMPARISON OF SMOKING CESSATION COST-EFFECTIVENESS RATIOS WITH OTHER MEDICAL INTERVENTIONS

SELECTED INTERVENTIONS		
Intervention	**Source**	**Cost-Effectiveness Ratio**
Cholestyramine/low cholesterol diet (versus diet) for men aged 35-39 & 290/dL	Oster, *et al.* (1987)	102,033
Annual mammography & breast exam for women 40-49	Eddy, *et al.* (1988)	61,744
Hypertension screening for asymptomatic men age 40	Littenberg, *et al.* (1990)	23,335
Beta-blockers for low-risk myocardial infarction survivors	Goldman, *et al.* (1988)	16,897
3-vessel coronary artery bypass graft surgery (versus medical management)	Weinstein, *et al.* (1980)	12,350
PTCA (versus medical management) for men age 55 with severe angina	Wong, *et al.* (1990)	7,395
AHCPR Guideline, Combined Smoking Cessation Interventions	**Cromwell, *et al.* (1996)**	**2,875**
One time cervical cancer screening for women age 65+	Fahs, *et al.* (1992)	2,053
Pneumonia vaccination for people age 65+	Sisk, *et al.* (1983)	1,769
Polio immunization for children age 0-4	Sisk, *et al.* (1983)	<0

Table taken from an earlier version of the AHCPR-commissioned Report on the Cost-Effectiveness of Implementing the Smoking Cessation Guideline. (Report ~~expected to be~~ released in ~~November~~ December 1997.

FAX TRANSMITTAL

PRIORITY

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Fax: 202/456-6027

[redacted] From: Christine Williams

Organization: AHCPR

Phone: 301/594-1360 x1346

[redacted] Comments: Information from the Cost-Effectiveness Report follows.

[redacted] No: 2 of pages (not including cover sheet): 2

THE COST-EFFECTIVENESS OF AHCPR'S SMOKING CESSATION GUIDELINE

U.S. Department of Health and Human Services
Public Health Service
Agency for Health Care Policy and Research

The Cost-Effectiveness of AHCPR's Smoking Cessation Guideline

Final Report

Submitted by Jerry Cromwell, Ph.D., William J. Bartosch, M.P.A., and Janet B. Mitchell, Ph.D., with Health Economics Research, Inc., 300 Fifth Avenue, 6th Floor, Waltham, Massachusetts 02154.

This report was prepared under Contract No. 282-95-2002 from the Agency for Health Care Policy and Research, DHHS, to Health Economics Research, Inc. The statements contained in this report are solely those of the authors and do not necessarily reflect the views or policies of the Agency for Health Care Policy and Research.

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1.0 Introduction and Review of Findings

1.1 Purpose and Brief Summary of *Guideline*

Tobacco use has been cited as the chief avoidable cause of death in the United States, responsible for more than 420,000 deaths annually from an assortment of attributable diseases, including lung cancer, heart disease, stroke, and pulmonary disease (CDC, 1990). Despite its adverse health consequences, physicians and other practitioners fail to assess and counsel smokers consistently and effectively (AHCPR, 1996). Recognizing these facts, AHCPR commissioned a panel of smoking cessation experts to develop a *Guideline* for clinicians and behavioralists encouraging smokers to quit.

Over the course of several meetings and extensive quantitative analysis of published smoking cessation interventions, the AHCPR panel developed a thorough *Guideline* that made many recommendations in terms of screening for tobacco use, advising patients to quit and assessing their smoking status, and the kinds of interventions that appeared most efficacious. The recommendations were based on rigorous logistic regression meta-analyses of various cessation interventions, ranging from self-help materials to multi-session group counseling lasting several hours or more. Recommendations were targeted specifically to primary care clinicians, cessation specialists, and insurers and purchasers of health care services.

The *Guideline* describes a sequential process beginning with initial screening in a clinician's office or during a hospital admission. Patients are recommended to be screened each time they see a physician or other practitioner concerning their smoking status. If they continue to smoke, they should be advised to quit. If they are not ready at the time, the physician is to provide a motivational talk. If they would like to try and quit, the patient is recommended to undertake one of four counseling interventions:

1. Minimal counseling with the clinician for less than 3 minutes with one follow-up visit within 2 weeks;
2. Brief counseling with the clinician for 3-10 minutes with one follow-up 10-minute visit within 2 weeks;
3. Full counseling for over 10 minutes with the clinician with two 10-minute follow-up visits; or
4. Referral to intensive counseling with smoking cessation specialists for 5-7 sessions of individual or group therapy.

For all interventions, the patient would be encouraged to use nicotine replacement in the form of the transdermal patch or nicotine gum.

1.2 Cost-Effectiveness Analysis of the *Guideline*

It is valuable to policymakers to assess the costs of each of the AHCPR guidelines relative to their clinical effectiveness. This is especially true of the *Smoking Cessation Guideline.* Many of the other guidelines are procedure-oriented, treating a focused population with a given condition. Hence, it is possible through the use of claims to accurately measure current costs of treating the illness under a small set of alternative interventions. Each guideline is designed to reflect best practice. Costing the guidelines informs the policymaker whether best practice will cost more or less.

Evaluating the *Smoking Cessation Guideline* is more challenging in some important respects. First, no claims data exist to quantify current practice. Most counseling services are an integral part of physician-patient contacts with no separate billing. Other services, such as nicotine replacement and intensive counseling, are generally not covered by insurance and, hence, do not produce a claims trail. Moreover, many different approaches to stopping smoking exist. Variation within approach, e.g., length of physician counseling session, also complicates the definition of "current practice." Then there is hypnotism, acupuncture, and other nontraditional forms of care that add to the costing efforts.

Finally, and most telling, smoking cessation programs are more closely related to prevention than procedure-oriented interventions. Acute interventions usually result in immediate relief and measurable improvements in health status. Smoking cessation programs, by contrast, focus on quit rates, which may be analogous to a patient's "surviving the operation." The latter is only meaningful if the operation substantially improves health status. Similarly, quitting smoking is of little interest by itself. More relevant is the long-run quit rate and the expected gains in health status. This raises another difference between prevention and procedure-oriented guidelines. Smoking cessation interventions

will have quite delayed benefits in terms of extra years of life of higher quality. Health status improvements to quitting smoking, while noticeable in the short-run, are only a small part of the long-run gains. Quit rates must be translated into long-run gains in health status, then discounted to account for the delayed benefit stream.

1.3 Brief Description of Cost-Effectiveness Methods

Neither the costs nor the effectiveness measures used in this study were based on individual patients undergoing a prospective clinical trial. Rather, the various recommended interventions were costed based on estimated resource inputs found in the *Guideline* report. Similarly, estimates of effectiveness were also taken from the *Guideline*.

Costing was done, first, by estimating the per minute cost of counselors, both physicians and specialists, then multiplying by the panel's estimated time involvements in each intervention component, i.e., screening, advice, motivation, counseling. Nicotine replacement costs were based on wholesale prices per unit times the number of units recommended in the *Guideline*. Surveys of local pharmacies found no significant net mark-up in patch or gum costs over wholesale prices. Because of the significant costs patients incur in traveling to the counseling site, some scenarios impute a cost of patient travel time based on median earnings of U.S. workers. When such costs are included, a broader societal perspective is taken, versus a slightly narrower one involving cessation providers alone. Excluding patient travel costs would also be more relevant to insurers if they covered the costs of the program.

Three measures of effectiveness were evaluated:

1. Marginal quit rates;
2. Years of life (discounted) saved; and
3. Quality-adjusted years of life (discounted) saved.

Marginal quit rates were derived by taking the odds ratios published in the *Guideline* for the various interventions and applying them to the underlying quit rate among smokers nationally. Years of life saved were based on a recent study of survival probabilities for various age and gender groups (Fiscella and Franks, 1996). These authors also made quality adjustment to years of life based on the *Healthy People 2000* years of life measure.

Two general methodological approaches were taken. Under one approach, all smokers were assumed to undertake a particular intervention. This answers the "what if?" question: What would be the cost-effectiveness if all smokers could be encouraged to undertake one of the interventions recommended by the *Guideline* panel? When the resulting cost-effectiveness ratios are compared across cessation interventions, this informs policymakers which interventions appear to be the most cost effective given universal implementation.

Under the second scenario, panel experts were queried regarding the likelihood of patients choosing one of the four counseling interventions with or without nicotine replacement. These probabilities were used to weight the costs and quit rates of the interventions. The result was a combined global cost-effectiveness ratio for the *Guideline* as a whole. It answers the question: How much would the *Guideline* cost per life-year saved if adopted by practitioners, given the expected preferences of smokers for different interventions?

The *Guideline* recognizes two loci of patient intake: the office and the hospital. Interventions in each of these sites were analyzed separately. Then, the results of the two sites were integrated into a single combined cost-effectiveness ratio, assuming that the counseling intervention is undertaken only once during the year. All the screening, advice, and motivation costs incurred repetitively during several annual office visits were included. In addition, the screening costs of the hospitalized population were added, plus the direct intervention costs of counseling and nicotine replacement for hospitalized patients. Direct intervention costs of hospitalized patients were debited from those incurred by ambulatory patients. This avoids double counting such costs.

Sensitivity analysis was performed on many of the key assumptions, including the marginal quit rates, the discount rate to years of life saved, the time involved in counseling, and the likelihood that patients would undertake a particular intervention.

1.4 Summary of Principal Findings

Table 1-1 shows cost-effectiveness ratios for 15 smoking cessation interventions that are described in the *Guideline*. These results were derived by assuming that *all* smokers would make at least one quit attempt during the year using a particular intervention. Cost per quitter among the counseling interventions without pharmacotherapy ranged from a low of $1,689 for group intensive counseling to a high of $5,572 for minimal counseling. Cost per quality-adjusted life-year was slightly lower, ranging from $1,433 for group intensive counseling to $4,726 for minimal counseling.

Table 1-1. Cost-Effectiveness of Smoking Cessation, by Intervention

Intervention	Cost per Quitter	Cost per Quality-Adjusted Life-Year (5% Discount)
Without Nicotine Replacement		
Minimal Counseling	$5,572	$4,726
Brief Counseling	4,739	4,019
Full Counseling	2,357	1,999
Individual Intensive Counseling	2,881	2,444
Group Intensive Counseling	1,689	1,433
With Transdermal Nicotine		
Minimal Counseling	3,856	3,271
Brief Counseling	3,413	2,895
Full Counseling	2,231	1,892
Individual Intensive Counseling	2,365	2,006
Group Intensive Counseling	1,891	1,604
With Nicotine Gum		
Minimal Counseling	7,292	6,185
Brief Counseling	6,004	5,093
Full Counseling	3,487	2,958
Individual Intensive Counseling	3,636	3,084
Group Intensive Counseling	2,950	2,502

Notes: Assumes that all patients who smoke attempt to quit at least once during the year. Quitters discounted by 35 percent to account for relapse.

As the amount of clinician time increases, intervention costs and the number of quitters both increase, while the cost per quitter *decreases* (except for individual intensive counseling). Group intensive counseling is a particularly low-cost intervention even though it involves the greatest amount of patient-clinician time (seven 1-hour sessions). This is because it not only generates a large number of new quitters because of its intensity of contact, but intervention costs are also shared across groups of 10 patients, lowering the cost per quitter even further.

Adding pharmacotherapy increases the costs of each intervention but also increases their marginal effectiveness substantially. When using transdermal nicotine (the patch) as adjunct therapy to each of the counseling interventions, the cost per quitter ranged from $1,891 for group intensive counseling to $3,856 for minimal counseling. This translated to $1,604 and $3,271 per quality-adjusted life-year. Nicotine gum with counseling is also more effective than counseling alone, although it does not generate as many new quitters as the patch. The cost per quitter for counseling with nicotine gum ranged from $2,950 for group intensive counseling to $7,292 for minimal counseling. The cost per quality-adjusted life-year ranged from $2,502 to $6,185.

In actual practice, patients and providers vary in their intervention preferences, and it is highly unlikely that all smokers would choose the same intervention. While group intensive counseling costs less per quitter than any of the other interventions, very few patients would actually choose this treatment option. Table 1-2 shows the cost-effectiveness of the combined *Smoking Cessation Guideline*, derived by weighing each of the individual interventions by the likelihood of a smoker choosing it. Based on the *Guideline* and the likely cessation intervention preferences of patients, it would cost $8.1 billion annually to provide all smokers with the intervention of their choice. This would result in 2.63 million new quitters at an average cost of $3,069 per quitter. The cost per life-year saved (discounted at 5 percent) would be $2,875. Adjusting for quality decreases the cost per life-year saved to $2,603.

Smoking cessation is cost effective relative to other medical interventions. Annual mammographies for women aged 40-49 are estimated to be $61,744 while hypertension screening for men age 40 is

Table 1-2. Cost-Effectiveness of Combined Guideline Smoking Cessation Interventions

Intervention	Cost	Number of Quitters[a]	Life-Years Saved[b]	Quality Life-Years Saved[c]
		(thousands)		
Without Nicotine Replacement				
Minimal Counseling	$103,715	19	20	22
Brief Counseling	279,282	59	63	69
Full Counseling	347,299	147	157	174
Intensive Counseling	37,772	13	14	15
Group Counseling	22,143	13	14	15
With Transdermal Nicotine				
Minimal Counseling	1,279,074	332	354	391
Brief Counseling	2,271,158	665	710	785
Full Counseling	2,120,791	951	1,015	1,121
Intensive Counseling	194,835	82	88	97
Group Counseling	155,761	82	88	97
With Nicotine Gum				
Minimal Counseling	263,540	36	39	43
Brief Counseling	470,864	78	84	92
Full Counseling	451,644	130	138	153
Intensive Counseling	41,404	11	12	13
Group Counseling	33,589	11	12	13
Combined Interventions[d]	8,072, 870	2,630	2,808	3,101
Cost Per Quitter		$3,069		
Cost Per Life-Year Saved			$2,875	
Cost Per Quality-Adjusted Life-Years Saved				$2,603

[a]Number of quitters discounted by 35 percent to account for relapse.
[b]Life-years saved (discounted 5%) derived by using 1.07 adjustment factor to the number of quitters.
[c]Quality-adjusted life-years saved (discounted 5%) derived by using 1.18 adjustment factor to the number of quitters.
[d]Derived by weighing the individual interventions by the likelihood of smokers choosing each intervention.

reported to be $23,335. A few medical interventions (e.g., one-time cervical screening for women over 64, $2,053; polio immunization for children <$0); exhibit lower cost-effectiveness ratios, but most acute interventions (e.g., coronary artery bypass surgery, $12,350; angioplasty for men aged 55 with severe angina, $7,395) are considerably more costly than the *Smoking Cessation Guideline*.

1.5 Organization of Report

The report is presented below in five chapters. Chapter 2 reviews three relevant literatures: cost-of-illness due to smoking; costs and effectiveness of cessation programs; and the cost-effectiveness of alternative medical interventions. It is not enough to compare cost-effectiveness ratios among the various cessation interventions. Policymakers need to know how effective each of the interventions might be relative to interventions in treating other diseases. Chapter 3 then provides a stylized description of the *Smoking Cessation Guideline*. It is stylized in the sense that minor recommendations having little impact on the cost-effectiveness analysis are not modeled. Also, decisions had to be made regarding issues such as lengths of counseling and sequencing of patients, and the like that are not fully described in the *Guideline* itself. This chapter also discusses special populations and exclusions, such as smokeless tobacco and alternative therapies (e.g., hypnosis). Chapter 4 provides an extensive discussion of the cost-effectiveness methods employed. It presents the challenges to costing the *Guideline*, the interventions actually analyzed, and how all of the key parameters were calibrated.

Chapter 5 contains all of the findings. It begins with a summary of the key simulation parameters. Then, the number of quitters and years of life saved for each intervention are given, followed by a decomposition of the costs associated with each intervention. Cost-effectiveness ratios are presented by intervention and globally using each of the three effectiveness measures, and results of sensitivity analyses are summarized. Chapter 6 concludes with a comparison of the major cost-effectiveness ratios under the *Guideline* with a selected number of cost-effectiveness ratios from other medical interventions.

Freeman *et al.* (1976), Kristein (1977), Luce and Schweitzer (1978), Forbes and Thompson (1983), Office of Technology Assessment (1985), and Vogt and Schweitzer (1985)) have examined the societal costs of smoking, but their results cannot be compared because they consider different costs, diseases, and categories of smokers. Rice's group estimated the economic costs of smoking by applying attributable risk to the direct and indirect costs of malignant neoplasms and diseases of the circulatory and respiratory systems. They calculated that the total cost of smoking in 1984 was $53.7 billion. The authors then compared their results to those of Luce and Schweitzer (1978) and OTA (1985). The costs of smoking estimated by Luce and Schweitzer was $52.8 billion (in 1984 dollars) while OTA arrived at $62.2 billion.

More recent medical care cost estimates were performed by Rice, other researchers at the University of California Berkeley, and CDC (1994). Using data from the 1987 National Medical Expenditures Survey (NMES-2), a longitudinal survey of the civilian, noninstitutionalized population, researchers determined smoking-attributable health care expenditures for conditions including heart disease, emphysema, arteriosclerosis, stroke, and cancer. Costs were adjusted for 1992 by applying attributable percentages to national health care expenditures reported by HCFA. The total smoking-attributed medical expenditures were $21.9 billion, accounting for 7.1 percent of total NMES-2 reported expenditures. The authors recognized these were conservative estimates because they did not include all of the direct medical costs attributable to smoking such as burns resulting from fire, perinatal care for low-birth-weight infants, and costs attributable to treating illnesses caused by environmental tobacco smoke. In addition, the indirect costs of morbidity and mortality were not included.

2.3.3 Incidence-Based COI Literature

Oster *et al.* (1984) performed an incidence-based study of the economic costs of smoking and benefits of quitting for individual smokers examining the direct and indirect costs associated with three major smoking-related diseases: lung cancer, coronary heart disease, and emphysema. Costs varied with disease, age, and smoking intensity (light, moderate, or heavy). The total expected lifetime costs for the three illnesses ranged from $1,758 among 75-79 year-old men who were light smokers to $61,304 among 35-39 year-old men who were heavy smokers. The economic costs for women ranged from $1,046 among 75-79 year-old light smokers to $20,901 among 35-39 year-old heavy smokers. Using estimates of excess mortality due to smoking for the three diseases, the authors calculated the economic benefits of quitting. Their findings demonstrated that benefits vary according to age, gender, and disease. They reported that the economic benefits resulting for reduced risk of lung cancer, coronary heart disease, and emphysema ranged from $582 among 75-79 year-old light smokers to $40,829 among 35-39 year-old heavy smokers. The economic benefits to women ranged from $404 among 75-79 year-old light smokers to $13,594 among 35-59 year-old heavy smokers. So as individuals grow older, the economic benefits of quitting diminish because fewer smoking-related medical costs are incurred by the elderly—especially after discounting. And heavy smokers, who typically have higher lifetime medical expenditures, can realize greater economic benefits from quitting than light or moderate smokers.

While Oster *et al.* clearly established that there are significant costs associated with smoking and benefits that can be realized from quitting, the authors did not explore all of the health care costs associated with extending an individual's life through smoking cessation. It is clear that refraining from smoking prevents smoking-related illnesses and increases life expectancy. However, whether the medical expenditures incurred by smokers over their lifetimes are greater than those of nonsmokers is a more complex issue. This is because nonsmokers not only live longer, but they also incur medical expenses during these additional years of life. Whether the medical costs associated with treating smoking-related illnesses over a smoker's relatively shorter lifetime outweigh the medical costs associated with providing a nonsmoker with medical care over a longer lifetime has been debated in a handful of studies found in the literature. The conclusions of these analyses vary considerably according to their estimates of smoking versus non-smoking-related medical costs and their use of discounting.

One such analysis was performed by Leu and Schaub (1983), who studied the cost-of-illness of smoking for Swiss men over the age of 35. They found that the lifetime medical expenditures of nonsmokers exceeded those of smokers due to the costs associated with caring for nonsmokers during their elderly years. The authors assumed that the average smoker had 8 percent more physician visits and 10 percent more hospital visits per year than nonsmokers. They found that the expected lifetime

medical expenditures for the average male smoker at age 35 was 67,900 Swiss francs while the cost for a nonsmoker was 72,700 Swiss francs, indicating that the lifetime medical expenditures of nonsmokers actually exceed those of smokers.

A similar conclusion was drawn by Lippiatt (1990), who used estimates of the cost of smoking and benefits of quitting calculated by Oster *et al.* to calculate the lifetime medical expenditures of smokers versus quitters. To determine the cost of smoking, Lippiatt deducted the average annual per capita medical costs for nonsmokers over the age of 65 for every reduced year of life. This accounts for the fact that smokers, who die prematurely, would have otherwise incurred non-smoking-related medical expenditures in their later years of life. Conversely, average annual per capita medical costs were deducted for every added year of life among people who quit. This adjustment recognized that smoking-related medical expenditures are offset by non-smoking-related health costs incurred during additional years of life saved. Annual per capita medical expenditures for nonsmokers were estimated using per capita expenditures for the total population, the proportion of nonsmokers in the population, and the difference in average medical expenditures of smokers versus nonsmokers as estimated by Leu and Schaub. Lippiatt estimated that, for each additional year of life that it saves, smoking cessation *increased* medical costs by $280.

Hodgson's (1992) study of the lifetime medical expenditures of smoking disputed these earlier findings, claiming that the lifetime medical expenditures of nonsmokers exceed those of smokers. He noted that Leu and Schaub (1983) failed to discount lifetime medical expenditures, thus overstating the expenditures of nonsmokers that are incurred later in life. Furthermore, he argued that Leu and Schaub based their costs on low estimates of the rates of excess medical care use. He cited findings of 2.6-fold excess utilization of physicians' services by smokers compared to nonsmokers and excess use of hospital care over 7.7 times higher. Hodgson also pointed out that Lippiatt's study used underestimates of the cost of smoking and overestimates of the lifetime medical expenditures of nonsmokers. The Oster *et al.* estimates upon which Lippiatt's study were based only consider the costs and benefits associated with lung cancer, coronary heart disease, and emphysema. However, these illnesses are only a portion of all smoking-related diseases and account for less than half of the total short-term hospital days required for all diseases associated with smoking (Graham, 1988). Smoking is also a major agent for chronic bronchitis, cerebrovascular disease, peripheral artery occlusive disease, cancers of the oral cavity, larynx, and esophagus, and bladder. It is also a contributing factor in cancers of the pancreas and kidney, and is associated with stomach and cervical cancers. In addition, Lippiatt relied on Leu and Schaub's (1993) estimate of the average medical expenditures of smokers versus nonsmokers, which underestimates the difference in lifetime medical expenditures between smokers and nonsmokers.

Hodgson's own estimates were markedly different from these earlier findings. Using a life-cycle model, he calculated excess medical expenditures due to smoking totaling $185 billion ($2,324 per smoker) in the first 5 years from his baseline. Hodgson calculated average lifetime medical expenditures using several data sources including: the National Nursing Home Survey for hospital and physician utilization, National Health and Nutrition Examination Survey Epidemiological Follow-up Study for nursing-home care, the American Cancer Society's Cancer Prevention Study II for mortality, the National Medical Care Utilization and Expenditure Survey, and Medicare data files for medical care charges. Medical care expenditures of smokers were compared to individuals who never smoked, broken down by gender and age. Lifetime medical expenditures of moderate male smokers were estimated at $32,891, which was 21 percent higher than never smokers. And heavy smokers were estimated to cost $40,187, which was 47 percent higher than never smokers.

Hodgson's estimates of lifetime medical expenditures employed a discount rate of 3 percent. This adjustment served to place a higher value on the excess medical expenditures incurred by smokers earlier in life than on those health care costs incurred by never smokers because they live longer than never smokers. He determined that the expected medical expenditures of smokers exceed those of never smokers at all ages between 17 and 74. After age 75, the expected medical expenditures of never smokers is greater than those of smokers. This is because, while smokers above the age of 75 have higher medical expenditures than nonsmokers, few actually survive that long. Therefore the *expected* expenditures that would be incurred are less per smoker than nonsmoker. For both men and women, the cumulative excess medical expenditures of smokers rise steadily from between ages 35 and 75. After age 75, these excess cumulative expenditures begin to fall but remain positive through the smoker's lifetime (calculated through age 95).

The fact that smokers have a shorter life expectancy than nonsmokers yet incur greater lifetime medical expenditures leads to variations in the sources of health care financing between smokers and nonsmokers. Hodgson estimated that 50 percent of smokers' lifetime medical expenditures are supported with private insurance, while only 43.7 percent of medical expenditures of never smokers are supported through private insurance. However, because nonsmokers have a longer life expectancy than smokers, a greater proportion of their medical expenses are covered by Medicare, 25.1 percent, while smokers only depend on Medicare for 20.7 percent of their health care costs.

Similarly, one may speculate as to the impact of smoking on the Social Security system. If large number of smokers quit, would there be a corresponding increase in pressure on Social Security as former smokers live longer (primarily, nonproductive years) and qualify for additional years of Social Security benefits? Schelling (1986) recognizes such a possibility and considers that, in the long run, institutions may adapt to account for a healthy population that is living longer, allowing them to be capable and willing to work at older ages than had previously been possible. This would increase society's productive base, offsetting the social costs of the growing elderly population. In the absence of such a transition, however, a population's increased life expectancy should be a welcome trend regardless of the burden that it places on the young, working population.

2.4 Cost-of-Cessation Literature

Table 2-1 lists the significant cost-effectiveness studies in the literature. Differences in intervention, population of interest, study design, and results are identified.

2.4.1 General Methodological Issues

Perspective of Costing. Perspective shapes any study by deciding which costs are important for the potential decision or policymaker. A study's perspective is significant because it often results in excluding some costs while including others. There are four common perspectives for health related studies. A *societal* perspective broadly includes all resources used and considers the welfare of society regardless of when the costs are incurred or who must pay for them. A *payer's* perspective, such as an insurer or government, includes the charges for which the third party is responsible. The *provider's* perspective examines the costs to the particular institution providing health care. Lastly, a *patient's,* or individual's, perspective includes both out-of-pocket costs (i.e., co-payments or deductibles) and time.

We analyzed each of the cost categories defined in the studies to see which costs were consistently included for a particular perspective (Table 2-2). Four cost categories are most relevant for determining perspective: personnel, materials, overhead, and patient time. Personnel includes the wages of physicians, nurses, health educators, and administrative assistants. Materials include both the costs of printed materials and pharmaceuticals. Overhead refers to the overhead costs regardless of a clinical or nonclinical treatment setting. Patient time were the only measure of patient costs identified in the studies.

The societal perspective is best illustrated by Altman *et al.* (1987). The authors provide a thorough analysis of costs, including personnel, materials, overhead, and patient time. Other studies are more vague about perspective. In a study by Marks *et al.* (1990) of a smoking cessation program for pregnant women, patient time is not considered a cost, but personnel, materials, and practice overhead are. The inclusion of these costs implies that the perspective is that of a hospital or organization where the decisionmaker would be responsible not only for personnel and materials, but also overhead. Moreover, in their concluding remarks, they comment that, "based on this analysis and those documenting the health benefits and effectiveness of cessation programs, we conclude that physician third-party payers, managed-care organizations, and public health programs should offer this preventive service to all pregnant women who smoke." This study clearly took the organizational, payer, and hospital perspective.

A problem arises when a study includes a cost that conflicts with the stated, or implied, perspective of the study. Hughes *et al.* (1991) test whether patients who must pay for the cost of nicotine gum have better outcomes. By concluding that it is cost-effective for "prepaid or health insurance plans to reimburse patients for nicotine gum prescriptions," he implies that his perspective is that of a payer, hospital, or organization. In his inventory of costs, however, he includes patient time as a cost at $10/hr. and comments that he did not include the costs for evaluation and promotion because "the typical medical practice would not likely spend money for these activities." While excluding these costs would not alter the authors' conclusion, patients' costs are not incurred by the payer and

Table 2-1. Smoking Cessation Programs

Author	Year	Intervention	Population	Study Design	Result
Davis, et al.	1984	Four alternatives: 1. ALA leaflet 2. leaflet and maintenance manual 3. cessation manual 4. cessation and maintenance manual	Community (n=1237)	CEA/ randomized experiment	Cost per quitter: 1. $921 2. $497 3. $669 4. $396
Oster, et al.	1986	Counseling and nicotine gum	Routine office visit by patient (n=250)	CEA/ meta-analysis	Cost per life-year saved: Men: $4,113 - $6,465 Women: $6,880 - $9,473
Altman, et al.	1987	Three alternatives: 1. class 2. contest 3. self-help kit	Community (n=1140)	CEA/ quasi-experimental	Cost per quitter: 1. $235-$399 2. $129-$235 3. $ 22-$144
Windsor, et al.	1988	Three alternatives: 1. information and advice 2. advice plus smoking cessation manual 3. advice, manual, and manual for smoking women	Pregnant women (n=309)	CEA/ randomized experiment	Cost per quitter: 1. $104 2. $119 3. $51
Cummings, et al.	1989	Physician counseling (includes self-help booklet)	routine office visit (n=3290)	CEA/ meta-analysis	Cost per life-year saved: Men: $705 - $988 Women: $1,204 - $2,058
Ershoff, et al.	1990	Self-help printed materials	Pregnant women in large HMO (n=323)	CBA/ randomized clinical trial	Benefit cost ratio: 3.17:1
Marks, et al.	1990	Health educator or nurse managed counseling program (includes self-help materials)	Pregnant women (n=783,510)	CEA using published effectiveness research	Cost per neonatal year of life saved: $2,934
Hughes, et al.	1991	Physician counseling and nicotine gum (includes self-help book) Three costs to patient for gum: 1. free 2. $6 3. $20	Routine office visit in rural family practice (n=106)	CBA/CEA randomized experiment	Cost per quitter: 1. $725 2. $1,656 3. $735
Krumholz, et al.	1993	Nurse-managed smoking cessation program (includes self-help materials)	Post-acute myocardial infarction (AMI) patient (n=2426)	CEA using published effectiveness research	Cost per life-year saved: $220
Fiscella and Franks	1996	Physician counseling and nicotine patch and gum	Brief office visit	CEA simulation using published effectiveness research Developed own QALY adjustment to life-years saved	Cost per QALY-adjusted life-year saved from use of patch: male, age 45 = $4,671 Cost per quitter = $7,332 Cost per QALY-adjusted life-year saved from use of gum: male, age 45 = $10,000

Table 2-2. Comparison of Cost Factors

Study	Personnel	Materials	Overhead	Patient Time
Davis, et al.	♦	♦		
Oster, et al.	♦	♦		
Altman, et al.	♦	♦	♦	♦
Windsor, et al.	♦	♦		
Cummings, et al.	♦	♦		
Ershoff, et al.	♦	♦	♦	
Marks, et al.	♦	♦	♦	
Hughes, et al.	♦	♦		♦
Krumholz, et al.	♦	♦		

would be excluded from studies using a payer perspective.

In addition to including costs that do not belong to a perspective, a study can also exclude costs as well. Cummings *et al.* (1989) investigated the cost-effectiveness of counseling smokers to quit during a routine office visit, stating early on that "we assumed a societal perspective in our analysis." In the cost analysis, however, patient costs are ignored. The authors reconcile this omission by stating that the patient counseling session occurs within the context of a routine office visit. Even so, physician time is calculated as a percentage of time in the routine office visit and the patient time can be done similarly. Moreover, during sensitivity analysis, a follow-up visit dedicated solely to smoking cessation counseling is considered, and yet, patient time is again not included. One explanation for the exclusion of these costs may be that they are considered incidental, and therefore unlikely to affect the cost-effectiveness ratios. This may or may not be true.

One study included costs more relevant to the development and evaluation of the intervention than the cost of the intervention alone. Davis *et al.* (1984) report on self-help smoking cessation materials offered through the American Lung Association. Because the study solely evaluates self-administered smoking cessation programs, costs should be minimal, including the cost of materials and patient time. Instead, the study includes the costs of patient recruitment, interviewer wages, staff wages for training interviewers (though not telephone utility bills). Interviewers "were specifically advised that their task was to collect data and not to encourage the participant in their efforts to quit smoking." Unfortunately, patient time, which seems important in this self-help study, is not included, and there is no reference to the amount of time necessary to read the printed materials.

In some studies, it is reasonable to exclude certain costs. Ershoff *et al.* (1990) studied an intervention in an HMO for pregnant women, partially funded by the HMO. The study included the costs of personnel, materials, and overhead, but excluded the cost of patient time, which is consistent for a study taking the organizational perspective. Oster *et al.* (1986), in evaluating the cost-effectiveness of a nicotine gum therapy in a routine office visit, includes only personnel and materials as a cost. From a payer, hospital, or organizational perspective, it might appear inappropriate to exclude overhead costs. One explanation is that overhead charges would have been included in the physician's charge for a routine office visit. Similarly, Krumholz *et al.* (1993) in their evaluation of a nurse-managed smoking cessation program for treating smokers with acute myocardial infarction, exclude both overhead and patient time. These are legitimate exclusions because the patients are hospitalized so they presumably cannot work and do not utilize resources in excess of the those that place them in hospitalization.

Defining and Measuring Costs. Commonly the most expensive cost factor in the studies was personnel (Table 2-3). The hourly wage assigned to personnel, on the average, increased according to education level, ranging from $9.62/hr. to $150/hr. Physicians had the highest hourly wage, nurses had the next highest, health educators and individuals with bachelor degrees less, and administrative support the lowest.

The wage for each education level, however, was not uniform across studies. Physicians' imputed hourly wages ranged from $150/hr. (Hughes *et al.*, 1991) to $50 (Oster *et al.*, 1986). Moreover, because

Table 2-3. Variation in Hourly Personnel Costs by Degree

Study	Personnel Degree	Hourly Rate
Krumholz	R.N.	$30
Davis	B.A.	$9.62
Cummings	M.D.	$30
Windsor	B.A.	$12
Oster	M.D.	$50
Ershoff	B.A. or R.N.	$33.00
Hughes	M.D.	$150
Marks	B.A./M.A./R.N.	$15
Altman	N/A	N/A
Mean		$37

N/A = Not Applicable

physicians do not usually charge by the hour, but by the type of office visit, Cummings reported an office visit charge to be $30, but reasoned that only one-third of the time would be devoted to the smoking cessation advice.

Nurses' hourly wage rates were more similar. Krumholz *et al.* (1993) and Ershoff *et al.* (1990) both report hourly wages at approximately $30/hr. The duties assigned to the Ershoff wage rate of $30/hr. can also be performed by a B.A. trained individual. Marks *et al.* (1990) also averages the personnel wage for B.A., M.A., and R.N. trained personnel, but comes to a lower figure of $15/hr.

Length of Interactions. Personnel costs account for the greatest share of intervention costs. Another variable factor is the length of the interaction between personnel and program participants. Table 2-4 describes the nature of the interaction between personnel and participants. It lists the intervention type, personnel type, and length of interaction (initial, follow-up, and total) incorporated into each analysis.

Physicians spent less time with patients than other personnel types. The physician time in the Oster and Cummings studies was 5 and 4 minutes, respectively, and 10 minutes in Hughes *et al.* (1991). Cummings allotted an additional 12 minutes for a follow-up visit and Hughes an additional 5-10 minutes. Overall, the amount of time for physician counseling was between 5 and 20 minutes.

The counseling time by physicians is dwarfed by the counseling offered in nurse-managed smoking cessation programs. Marks *et al.* reported 75 minutes and Krumholz *et al.* reported 180 minutes. Moreover, Windsor *et al.* (1989), a study that relied primarily on printed materials and advice provided by nurses or bachelor-degreed health educators, involved minimal counseling and follow-up support for between 10-15 minutes varying with the intervention type.

Table 2-4. Comparison of Intervention Length and Personnel

Study	Intervention Type	Personnel	Length of Time (Minutes)		
			Initial	Follow-up	Total
Marks	counseling	R.N., H.E.*	15	2x30 min.	75
Ershoff	printed materials	H.E.	45	n/a	45
		H.E.	48	n/a	48
Oster	counseling/nicotine gum	M.D.	5	n/a	5
Cummings	counseling	M.D.	4	12	16
Windsor	advice, printed materials	B.A. or R.N.	5	2,3	10
		B.A. or R.N.	10	2,3	15
		B.A. or R.N.	10	2,3	15
Altman	class	H.E.	60	7x60+	540
Davis	printed materials	n/a	n/a	n/a	n/a
Krumholz	counseling/materials	R.N.	unspecified	7x??	180
Hughes	counseling/nicotine gum	M.D.	10	5,10	15-20

* = health educator
n/a = not applicable

Studies with the greatest interaction between personnel and participants employed health educators, which might include both bachelor and masters' trained health professionals. These professionals were involved in explaining the use of printed materials (Ershoff *et al.*) and teaching a health care class (Altman *et al.*). Depending on whether the participant received the additional 3 minutes of time hearing about the self-help materials, participants received either 45 or 48 minutes of personnel time. Participants enrolled in the smoking cessation class in Altman *et al.* received about 9 hours of time.

The intensive smoking cessation option outlined in the *Guideline* (see Chapter 3) recommends more patient-provider interaction than the less intensive physician interventions. However, these intensive inventions may involve less costly professionals or counseling in a group setting, which may offset (in whole or in part) the marginal increase in patient-provider interaction. The challenge of our cost-effectiveness analysis was to understand the dynamics of these varying costs relative to any marginal changes in effectiveness that they may encourage.

Discounting. Because most of the costs associated with providing smoking cessation interventions are direct medical costs that occur over a short period of time, these costs are largely unaffected by discounting. However, smoking cessation outcomes, which are normally measured in years-of-life-saved, occur over an extended period of time. Weinstein and Stason (1976) argued that if years-of-life-saved are not discounted, then there is no incentive to save lives in the present and health care spending is deferred. In other words, in the absence of discounting, it makes sense to invest money elsewhere to increase per capita incomes that could be used to support greater health care spending in the future. Discounting current years-of-life-saved recognizes that *effects*, like costs, are more valuable in the present than at some future time.

Only four of the cost-effectiveness studies reviewed employed discounting: Cummings *et al.* (1989), Krumholz (1993), Fiscella and Franks (1996), and Oster *et al.* (1986). The study by Cumming *et al.* drew from discounted life expectancy estimates calculated by Oster *et al.* Both Krumholz *et al.* and Oster *et al.* employed a discount rate of 5 percent to estimate life expectancy and tested their results using sensitivity analysis. For example, Oster *et al.* estimated that the average man between 40 and 44 years of age who quits smoking saves 4.6 years of life. The 5 percent discounted effect, however, is only 1.07 years saved. Men between 65 and 69 years of age save an undiscounted 1.32 years of life due to quitting. Discounted, this figure becomes .66 years.

Oster *et al.* tested the sensitivity of their 5 percent discount rate by applying rates of 3 and 7 percent. Table 2-5 shows these cost-effectiveness results using nicotine gum. It is not surprising that at the lower discount rates, the cost per year of life saved is substantially lower. Thus, discounting both costs and life-years saved can greatly effect the final results of a cost-effectiveness analysis.

Table 2-5. Cost of Nicotine Gum per Life-Year Saved Evaluated at Different Discount Rates

Discount Rate	Range of Cost per Year of Life Saved	
	Men	Women
3%	$2,516 - $4,995	$4,249 - $7,114
5%	$4,748 - $6,465	$8,996 - $9,473
7%	$6,141 - $8,214	$10,299 - $16,317

Source: Oster, G; Huse, D.; Delea, T; and Colditz, G.: "Cost-Effectiveness of Nicotine Gum as an Adjunct to Physician's Advice Against Cigarette Smoking." *Journal of the American Medical Association.* 256(10):1986, p. 1316.

Fiscella and Franks (1996) cite a recent panel of experts who recommend that 3 percent be used to discount life-years saved.

2.5 Cost-Effectiveness Literature of Comparable Medical Interventions

To assess the cost-effectiveness (CE) of the *Smoking Cessation Guideline*, other benchmark CE ratios are needed. Given methodological variations across cost-effectiveness analyses, comparisons among different studies are difficult to make. Inconsistency in perspectives, cost categories identified, the reliability of effectiveness findings, the populations studied, and the discount rate employed frequently occur among studies making resulting cost-effectiveness ratios impossible to compare without adjustments to the original methodology. Some analysts, however, have attempted to compare disparate interventions by calculating a series of cost-effectiveness ratios using a methodologically consistent approach.

Table 2-6 presents the results of three literature reviews. The first review by Eddy (1992) includes the cost-effectiveness results of a series of screening

Table 2-6. Comparisons of Cost-Effectiveness Ratios

Author	Intervention	Cost per Year of Life Saved
Eddy (1992)	Cervical cancer screening	$1,429 - $667
	Colorectal cancer screening	$1,429 - $667
	Mammography	$3,333 - $1,429
	Hypertension screening	$3,333- $1,429
	Cholesterol screening	$3,333 - $10,000
	Anti-tobacco education program	$143
Russell (1984)		
OTA (1981)	Influenza vaccine (all ages)	$2,700
Cretin (1977)	Cholesterol screening for boys screened at age 10	5,700-11,200
Willems et al. (1980)	Pneumococcal vaccine (all ages)	$6,700
Weinstein and Stason (1976)	Hypertension screening and treatment	$11,800
Tengs et al. (1994)	**Smoking Cessation**	
Marks et al. (1990)	Advice for pregnant smokers	≤$0
Cumming et al. (1989)	Advice for men age 35-54	$989 - $1,050
Cumming et al. (1989)	Advice for women age 35-54	$1,386 - $2,888
Oster et al. (1986)	Nicotine gum and advice for men 35-69	$7,460
Kristein (1977)	Advice for heavy smokers	$9,799
Oster et al. (1986)	Nicotine gum and advice for women 35-69	$11,473
	Other Selected Interventions	
White et al. (1985)	Measles, mumps, and rubella immunization for children	≤$0
Knox (1988)	Mammography every 3 years for women 50-65	$2,706
England et al. (1989)	Colorectal cancer screening for people age 40+	$4,524
Bryers et al. (1978)	Hypertension screening for men 45-54	$5,153
Moskowitz and Fox (1979)	Annual mammography and breast exam for women 35-49	$10,477

Notes: Costs calculated by Tengs et al. are expressed in 1993 dollars. Costs that are calculated by Russell are in 1981 dollars. Tengs et al. and Russell employed a discount rate of 5 percent. OTA (1981), Willems et al., (1980), and Weinstein and Stason (1976) results represent life-years adjusted for health status. Tengs' estimates were calculated by dividing the net marginal costs of the intervention by the net margin years of life saved. Therefore, some results are less than zero.
Sources: Eddy, D.M. David Eddy ranks the test. Harvard Health Letter. July 1992, pp. 10-11. Russell, L.B. The economics of prevention. Health Policy. 4(1984), p. 93. Tengs, T.; Adams, M; Pliskin, J.; Safran, D.; Siegel, J. Weinstein, M.; and Graham, J. Five-Hundred Life Saving Interventions and Their Cost-Effectiveness. An unpublished report developed by the Harvard Center for Risk Analysis supported by research grant SES-9110225 from the National Science Foundation.

tests. He assumed that the tests were performed using the methods and intervals that were most cost-effective and that the individuals targeted for the intervention did not have any risk factors. Cervical cancer and colorectal screening were found to be the most cost-effective screening tests ($667-$1,429 per year of life saved) while mammography and hypertension screening (both between $1,429 and $3,333) were placed in a slightly less, but still excellent, cost-effective tier of screening tests. Cholesterol screening ($3,333-$10,000) was deemed more costly than the other screening tests for each year of life that it saves. Eddy then attempted to put the cost-effectiveness of these screening tests into perspective by considering a smoking education program that costs $1,000 to get a single smoker to quit. He determined that this program would cost $143 for each year of life that it saves, making it a far more cost effective intervention than any of the screening tests that he examined.

Russell (1984) compared cost-effectiveness ratios from four different studies. These studies were chosen because they used similar methods, each examining only medical care costs. Results were adjusted to 1981 dollars. She found that influenza vaccination was relatively more cost effective than pneumococcal vaccination ($2,700 versus $6,700 per year of life saved). Hypertension screening was more costly than both of these interventions per year of life saved ($11,200). Cholesterol screening cost

from $5,700-$11,200 per year of life. However, this result was based on *healthy* years of life saved, making it difficult to compare to the other interventions.

Tengs *et al.* (1994) recalculated a series of cost-effective ratios, expressed in cost per life-year saved, for 587 interventions. A few selected interventions are listed in Table 2-6. Note the variation in smoking cessation studies. Differences in gender, age, smoking intensity, and cessation method led to varying cost-effectiveness ratios. The results ranged from less than $0 per year of life saved (i.e., it generated savings due to lower net medical costs over one's lifetime) for advice to pregnant women to $11,473 per year of life saved for nicotine gum and advice to women between ages 35 and 69. Other interventions that Tengs *et al.* reviewed exhibited similar variations. While measles, mumps, and rubella immunization for children all exhibited negative net costs per life-year saved, annual mammographies and breast exams for women ages 35 to 49 cost $10,477 per year of life saved. The latter interventions proved to be more costly than most smoking cessation interventions.

3.0 Description of AHCPR's *Smoking Cessation Guideline*

The *Guideline* presents recommendations based on a series of meta-analyses that draw from published literature in the area of smoking cessation and identify variations in effectiveness among different interventions for selected populations. Recommendations are directed at three target audiences: (1) primary care clinicians, (2) tobacco cessation specialists/programs, and (3) health care administrators, insurers, and purchasers. Our analysis addresses the first two sets of recommendations.

Following the presentation of the model smoking cessation interventions, the *Guideline* presents research evidence pertaining to individual interventions and special issues (e.g. gender, pregnancy, hospitalized smoker). Based on the results of the meta-analyses in these areas, the *Guideline* Panel rated the strength of the research evidence and used these assessments to develop their sets of recommendations.

3.1 Overview of Stylized Approach

The *Smoking Cessation Guideline* is different from practically all the other AHCPR guidelines. Many previous guidelines have been procedure oriented with a focused population faced with a given condition, e.g., poor vision, ischemic heart disease. The *Smoking Cessation Guideline* does focus on smokers, but they are an addicted group that must be treated primarily using psychological and pharmacotherapy interventions. Hence, unlike, say, cataract surgery where the eye responds fairly uniformly to treatment, smoking cessation interventions have a wide variety of outcomes with relatively modest success rates.

Another difference is the rather vague notion of "current practice." In other guidelines, researchers have had a wealth of claims data available in order to track the services and procedures currently performed on patients. No such claims trail exists for smoking cessation. This makes costing the *Guideline* against "current practice" almost impossible. Further complicating the definition is the multidimensional aspect of "current practice." Counseling is a key intervention performed by a variety of physicians and other clinical professionals. Who conducts the counseling may change the intervention in material ways. The duration of counseling has been found to be important in achieving better outcomes; yet, the length of treatment varies widely across patients and providers in unknown ways.

Smoking cessation is more closely related to disease prevention than procedure-oriented interventions. Acute interventions usually result in immediate relief and measurable improvements in health status. Smoking cessation programs focus on quit rates, which may be analogous to a patient's "surviving the operation." The latter is only meaningful if the operation substantially improves health status. Similarly, quitting smoking is of little interest by itself. More relevant is the long-run quit rate and the expected gains in health status. Significantly delayed health benefits raise several issues to greater prominence than in other guidelines. What discount rate to use? If benefits are postponed 20-30 years, the choice makes a big difference. What changes in health status are associated with quitting? With most other interventions, causality is more demonstrable, although the cessation literature is fairly comprehensive on this point.

3.2 Major Intervention Strategies

The primary care clinician recommendations are designed to "change clinical culture and practice patterns so as to ensure that every patient who smokes is offered cessation treatment." The *Guideline* suggests that this should be accomplished by providing a brief smoking cessation message for all smokers at an initial clinical visit. The following five steps are recommended.

1) Screen every patient to determine smoking-status;
2) Advise all smokers to quit;
3) Determine those smokers willing to quit;
4) Assist smokers to successfully quit by setting a quit date, offering nicotine replacement (when appropriate), providing self-help materials, and giving advice on successful quitting; as well as
5) Scheduling a follow-up counseling visit (either in person or via telephone).

Smoking cessation specialists/programs offer more intensive interventions. However, the *Guideline* recognizes that only a minority of smokers will wish to participate in these programs and that resources may not be available for all willing smokers. Intensive interventions begin with screening and advice from a primary care clinician. However, rather than assisting the smoker with his/her quit

attempt, the primary care clinician refers the patient to a smoking cessation specialist for a series of individual or group counseling sessions. The *Guideline* recommends that patients be provided the option of intensive counseling pending the availability of resources. The following suggestions were made for smoking cessation specialists:

- Assess whether smokers are motivated to quit via an intensive cessation program;
- Use multiple types of providers;
- Provide sessions that are at least 20-30 minutes in length;
- Provide 4-7 sessions over a period of 2-8 weeks;
- Provide individual or group counseling that includes problems-solving and/or skill training as well as in-treatment support; and
- Offer transdermal nicotine replacement (except in special circumstances).

3.2.1 Decision Flow Chart

Figure 3-1 depicts the recommendations in the *Guideline* outlining the different smoking interventions delivered by primary care clinicians and smoking cessation specialists. Patients enter the flow chart via an office visit to their primary care clinician or admission to a hospital. All patients are screened to determine their smoking status. Patients who do not smoke are either provided with relapse prevention or primary prevention to ensure that they maintain their nonsmoking status. Every patient that smokes is advised to quit. Those who are unwilling to make a quit attempt after receiving this initial advice are provided with a brief motivational message further encouraging them to undergo an intervention. Smokers who are still unwilling to quit after receiving a motivational message exit the flow chart and do not re-enter until their next visit their primary care clinician or hospital admission.

For those patients who are willing to quit after being advised by their primary care clinician, there are four different intervention options. The *Guideline* has determined that all of these interventions are effective: (1) clinician minimal visit, (2) clinician brief visit (3) clinician full counseling, and (4) behavioralist intervention. The first three of these interventions are provided by the primary care clinician in an office setting. They only differ in the length of time that the patient is counseled: less than 3 minutes, 3-10 minutes, or greater than 10 minutes. Each of these interventions involves follow-up time with the clinician. Minimal and brief counseling involve one follow-up visit within 2 weeks of the intervention. Minimal follow-up is only 3 minutes long, whereas brief follow-up involves 10 minutes of clinician time. The full counseling intervention involves the greatest amount of clinician time and includes two follow-up visits each 10 minutes long. The first follow-up visit is provided in the second week after the intervention, and the second follow-up visit provided in the fourth week after the initial intervention. Patients who choose the fourth intervention, behavioralist intensive counseling, are referred to a smoking cessation specialist for a series of individual or group intensive counseling sessions. Smokers receiving individual intensive counseling are provided with five 30-minute sessions, and smokers receiving group intensive counseling attend seven 1-hour sessions along with nine other smokers.

All smokers[1] willing to make a quit attempt are provided the option of using pharmacotherapy. Patients willing to use pharmacotherapy, may choose either transdermal nicotine (the patch) or nicotine gum. For light smokers, those who smoke 10-15 cigarettes per day or less, the *Guideline* recommends that the clinician consider lowering the starting dosage of the preferred treatment.

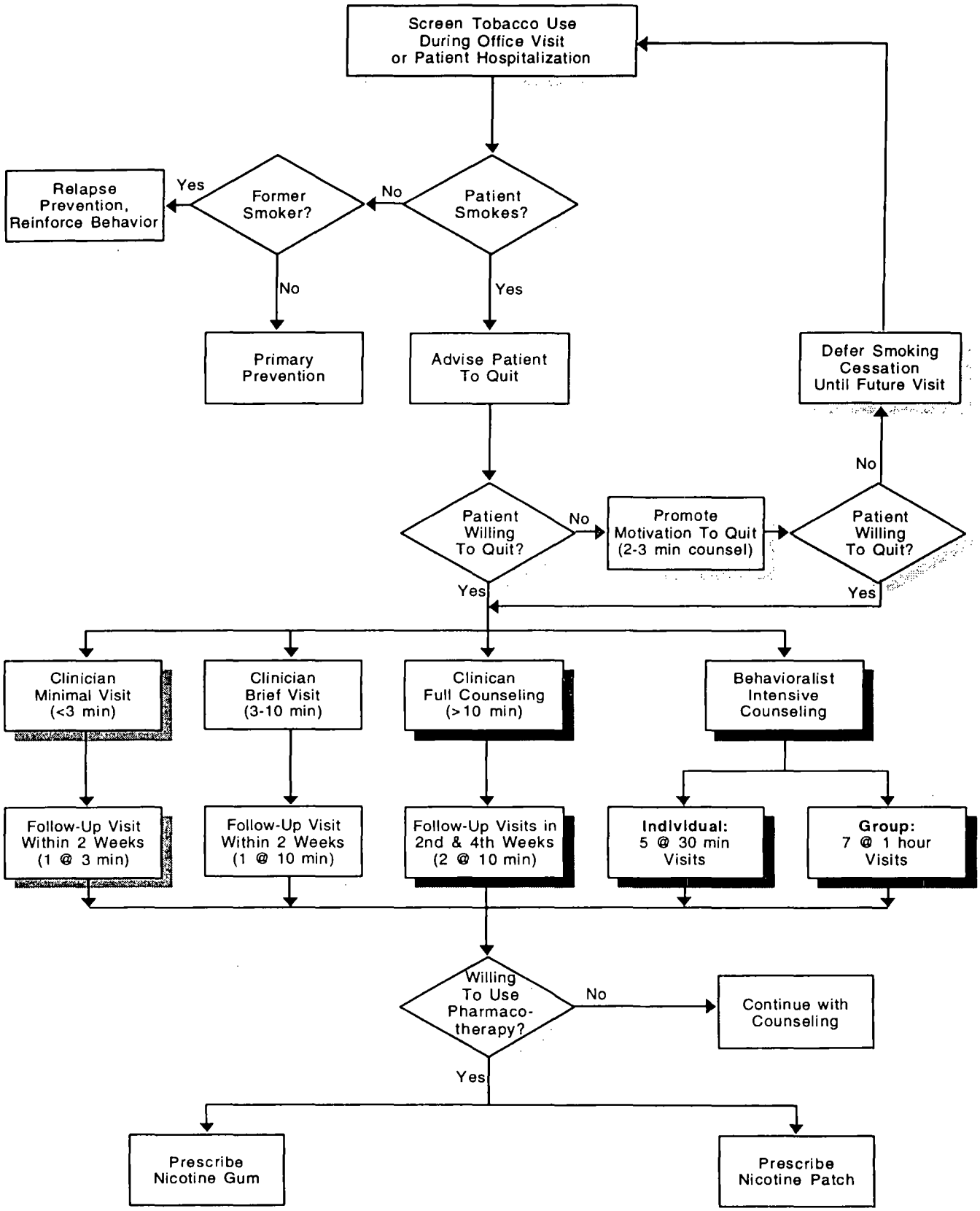
After completing their intervention, smokers making a quit attempt re-enter the *Guideline* during their next visit to their primary care clinicians or period of hospitalization. Their smoking status is determined, and those that have successfully quit are provided relapse prevention. Unsuccessful quitters are encouraged to make another quit attempt.

3.2.2 Detailed Description of Interventions

The *Guideline* addresses seven intervention dimensions: 1) provider, 2) format, 3) intensity of person-to-person contact, 4) content of intervention, 5) self-help, 6) duration of intervention, and 7) pharmacological aides. Meta-analyses were performed in each of these areas, and recommendations were made based on the results. Within most dimensions, several variations of the intervention were deemed effective. The panel, however, chose not to focus on comparing interventions, but instead identified all of the interventions that were considered effective and recognized that "the selection or use of a particular intervention technique or strategy is usually a function of practical influences: time available,

[1]The *Guideline* recommends the pregnant women receive pharmacotherapy only if the increased likelihood of smoking cessation, with its potential benefits, outweigh the risk of nicotine replacement and potential concomitant smoking.

Figure 3-1. AHCPR *Smoking Cessation Guideline*



training of the provider, patient preference, etc." The panel suggested that providers choose the appropriate intervention given these constraints.

Following is a summary of the recommendations made by the panel in the seven smoking cessation dimensions:

Provider

- Selection of provider should be based on factors such as training, time constraints, access to smokers, etc., rather than as a member of a specific professional discipline, e.g., physician.
- All care personnel and clinicians should repeatedly and consistently deliver smoking cessation interventions to their patients. Smoking cessation interventions should be delivered by as many types of providers as is feasible given available resources.

Format

- Smoking cessation interventions should include either individual or group counseling/contact.

Self-Help Intervention

- When feasible, smokers should be provided with access to support via telephone hotline/helpline.
- Multiple types of self-help materials should be made available to smokers.

Intensity of Person-to-Person Contact

- Every smoker should be offered at least a brief (3-10 minutes) or minimal intervention (3 minutes or less) whether or not the smoker is referred to an intensive intervention.

Content of Smoking Cessation Intervention

- Smoking cessation interventions should help smokers recognize and cope with problems encountered in quitting and provide social support as part of this treatment.
- Smoking cessation interventions that use some type of aversive smoking procedure may be used with smokers who desire such treatment or who have been unsuccessful using other interventions.
- Due to insufficient evidence to support the effectiveness of interventions that involve negative affect, cue exposure, hypnosis, or acupuncture, the panel chose not to make recommendations concerning these intervention types.

Duration of Treatment and Number of Treatment Sessions

- Smoking cessation interventions should last as many weeks as is feasible given available resources.
- Clinicians should strive to meet at least four times with quitting smokers if resources permit.

Smoking Cessation Pharmacotherapy

- In the absence of medical contraindications or other special circumstances, patients should be offered nicotine replacement therapy for smoking cessation.
- If nicotine replacement is being prescribed for light smokers (10-15 cigarettes per day or less), physicians should consider lowering the starting dose.
- Both transdermal nicotine (the patch) and nicotine gum are considered effective therapies. However, the patch is preferred for routine clinical use because it is associated with fewer compliance problems and requires less clinical time and effort to train patients in effective use.
- Due to limited research evidence concerning the use of nicotine nasal spray, Clonidine, antidepressants, anxiolytics/benzodiazepines, and silver acetate, recommendations were not made concerning these pharmacotherapies.

3.3 Special Populations

The panel examined a number of special populations/issues and developed recommendations that addressed differences in gender, race, and ethnicity. The *Guideline* also considers interventions for pregnant women, children and adolescents, and hospitalized smokers as well as smokers who were concerned about weight gain during their quit attempt. Finally, the available evidence concerning appropriate cessation techniques for smokeless tobacco use was reviewed and recommendations were made.

3.3.1 Gender, Race, and Ethnicity

Many of the special populations that the *Guideline* considers were not incorporated into our cost-effectiveness analysis because the *Guideline* recommendations do not affect intervention costs or variations in their effects are unknown. A smoker's gender, age, race, ethnicity, presence of psychiatric comorbidities, and concern about gaining weight do not change whether or not he/she receives an intervention or the type of intervention provided, with the exception of tailoring messages. So we assumed that these special population considerations would not affect the intervention's cost. While concern about weight gain may influence a smoker to use nicotine gum, we assumed that this was accounted for in the intervention probabilities that we incorporated into our analysis. We did, however, consider gender and age differences in the years of life that an intervention might save.

3.3.2 Pregnant Women

The *Guideline* recommends that pregnant women who smoke should be offered nonpharmacological interventions that are at least as intensive as those provided to nonsmokers. It also recommends that nicotine replacement therapy should only be used if the risk of continued smoking outweighs the risk of the pharmacotherapy and potential concomitant smoking. While nonpharmacological interventions are recommended for pregnant women, we did not attempt to adjust for lower utilization of transdermal nicotine or the nicotine gum among this population.

3.3.3 Children and Adolescents

Our analysis focused on interventions for the adult smoking populations. While there is no evidence to suggest that children and adolescents would not benefit for the interventions outlined in the *Guideline*, we assumed that this population is not screened, advised, or provided smoking cessation interventions. Because little research evidence existing concerning smoking cessation among the adolescent population, we question whether these young smokers can be easily identified through a standard office screening process and whether they would experience the same willingness to quit as the general population. Also, the effects of smoking cessation interventions among adolescents may vary from the general population. Therefore, we chose to exclude them from our cost-effectiveness analysis.

3.3.4 Hospitalized Patients

One special population that our analysis addresses is hospitalized smokers. The *Guideline* recommends that every hospitalized patient be screened for smoking, assisted with quitting, and provided with advice and assistance on remaining abstinent after discharge. To account for this special population, we assumed that smokers are identified either through the course of an office visit to a primary care clinician or during hospitalization. This is reflected in the intervention flowchart, which begins with two distinct groups of patients: office versus hospitalized. According to the *Guideline*, hospitalized patients should be provided with the same treatments listed as effective elsewhere in the *Guideline*, including nicotine replacement therapy. Therefore, we assumed that hospitalized patients follow the same intervention track as patients identified during an office visit. Hospitalized patients may or may not have seen a physician in the office prior to the hospitalization. If not, as might be the case with heart attack victims, they are new candidates for the *Guideline*. During the hospitalization, they will be encouraged to quit and likely will have much higher quit rates due to a greater willingness to try and quit. They also should have higher costs as a result of trying harder. For hospitalized patients already screened previously in the office, they, too, should have higher costs because they will be counseled yet again to quit during their acute admission. They may enjoy fewer years of extra life, however, because they will likely be older on average.

3.4 Exclusions

There are a number of smoking cessation interventions for which the *Guideline* panel did not make recommendations. Failure to recommend a technique usually resulted from a lack or research and did not necessarily imply that the treatment was ineffective.

3.4.1 Smokeless Tobacco

While the *Guideline* recommends the same psychosocial interventions for users of smokeless tobacco as cigarette smokers, there is little research evidence addressing pharmacological therapies for this population. Our analysis focuses on smoking cessation. Therefore, we did not address the cost effectiveness of any interventions directed to smokeless tobacco users.

3.4.2 Alternative Therapies

The Panel examined the research evidence for the efficacy of Clonidine, antidepressants, anxiolytics/benzodiazepines, and silver acetate as smoking cessation pharmacotherapy. The *Guideline* does not recommend any of these treatment. The Panel chose not to recommend Clonidine because five of the seven studies reviewed did not include adequate follow-up time and three of the studies did not meet the meta-analytic selection criteria. The Panel also indicated concern regarding side effects and the tendency for as many as 25 percent of patients to discontinue use because of them. The Panel came to no conclusion regarding the use of antidepressants or anxiolytics/benzodiazepines. Because research evidence is lacking, they chose not to recommend these therapies. Finally, based on three randomized trials, the Panel found that the use of silver acetate as either a primary or an adjunctive treatment for smoking cessation was not supported.

3.4.3 Primary and Relapse Prevention

The *Guideline* considers follow-up provided to patients after their smoking cessation intervention and the necessary steps taken to motivate patients to quit and avoid relapse. The *Guideline* suggests that all patients who receive an intervention be assessed for abstinence at the completion of treatment. Those patients who abstain from smoking should receive relapse prevention, which consists of reinforcing the patient's decision to quit, reviewing the benefits of quitting, and assisting the patients in resolving any residual problems arising from quitting (e.g., weight gain, depression). The *Guideline* also recommends that those patients who relapse be assessed for their willingness to quit. Those willing to quit should receive a smoking cessation intervention, while those unwilling to quit should receive an intervention designed to promote willingness to quit that consists of reviewing the risk and rewards of quitting in a manner that is relevant to the patient.

Our cost-effectiveness analysis of the *Guideline* does not include the costs of providing primary prevention to nonsmokers. We also excluded the cost of providing relapse prevention. While patients may be advised to quit and receive motivational messages from their health care providers multiple times in a single year, we assumed that they would only make one quit attempt. Our analysis assumes that smokers who make a quit attempt and fail will wait at least a year before undergoing another smoking cessation intervention.

4.0 Cost-Effectiveness Methodology

4.1 Challenges in Costing the *Guideline*

In this chapter, we describe some of the aspects of the *Smoking Cessation Guideline* that make it uniquely challenging from a costing perspective.

4.1.1 Converting Cessation Rates into Life-Years Saved

The *Guideline* uses smoking cessation rates, or quit rates, as its sole outcome of interest. The panel relied on meta-analyses, which were based on randomized controlled trials with follow-up for at least 5 months after the designated quit day. Evidence tables presenting the results of these analyses indicate both the odds ratio and success rate demonstrated by varying interventions.

From the perspective of *Guideline* development, the use of quit rates as the outcome of interest is most appropriate as it provides the information necessary to determine if a given intervention is effective and how well it works relative to some baseline (usually no intervention). From an economic perspective, however, the rate of smoking cessation is of limited use because it is an intermediate outcome. The value of smoking cessation is found in the diseases averted, years of life saved, and improved health functioning. So in order for quit rates to be used for the purpose of comparative economic analysis, they need to be converted into measures that demonstrate the improvement in health realized through quitting. Not only will this more clearly illustrate the benefits of smoking cessation, but it will also allow one to compare smoking cessation to other health-related interventions that use similar measures of effectiveness.

4.1.2 Willingness to Undertake Interventions

Several of the *Guideline*'s recommendations allow discretion on the part of patients or physicians concerning the smoking cessation intervention. Issues such as the willingness or preference of patients for certain interventions make it difficult to ascertain the exact number of individuals who would be provided with certain interventions. For example, the *Guideline* recommends that clinicians screen all patients to determine their smoking status. This activity would be performed on all patients regardless of their smoking status or interest in quitting. Then, the entire population of smoking patients would be advised to quit. However, only a portion of willing smokers would be provided with further assistance under the *Guideline*'s model intervention. Costing the *Guideline* requires identifying the probability that a given patient will receive a particular service or combination of services (e.g., screening and advice versus screening, advice, and counseling). Probabilities of patients willing to try and quit using various interventions were based on expert *Guideline* panel opinion, usually from their own research.

4.1.3 Overlapping Interventions

The model interventions for primary care clinicians and smoking cessation specialists incorporate a number of dimensions, making it difficult to determine the combined intervention effect. The *Guideline* suggests that primary clinicians screen patients to determine smoking status, advise smoking patients to quit, provide self-help materials, provide brief or minimal counseling to willing patients, offer nicotine replacement when appropriate, and provide follow-up. These recommendations are based on separate meta-analyses examining different provider types, intervention formats, self-help materials, intensity of person-to-person contact, and nicotine replacement. While these individual meta-analyses provide the necessary evidence to support the individual *Guideline* recommendations, any synergistic or offsetting effects resulting from the combination of multiple dimensions is unknown. For example, the length of counseling is strongly related to the number follow-up visits. Simply adding the individual effects will greatly overstate the quit rates applicable to longer counseling sessions. Where significant correlation is found, our strategy was to use the simple average effect of one of the dimensions. For example, quit rates under full counseling were not augmented by the marginal effects of more follow-up visits under the assumption they were already being reflected in the full counseling quit rate.

4.1.4 A Single Versus Multiple Guideline Intervention Costing

As with many of AHCPR's *Guidelines*, the *Guideline* for smoking cessation involves several interventions.[2] This suggests two costing alternatives. Under one approach, each intervention would be costed separately, assuming that all willing patients undertake the intervention. The resulting cost-effectiveness ratios would have a "what if" interpretation, answering the question: *What would be the cost per quitter and per life-year saved if all willing smokers went through the specific intervention?* Such a comparison is valuable in determining the relative costliness per quitter or life-year saved of each intervention under optimal conditions.

Realistically, though, smokers have very definite preferences in terms of the type and intensity of smoking cessation program they are willing to undertake. Some who have never tried to quit may be interested only in a minimal counseling session with their physician while others who have failed with minimal interventions may be ready for more extensive interventions, including the use of nicotine replacement. This suggests a second approach that uses preference probabilities to derive an overall cost-effectiveness ratio for the entire *Guideline*. Each of the interventions is weighted in terms of the likelihood of smokers being willing to undertake them. Ratios can be presented on an all-or-nothing basis for each intervention or weighted to produce an overall *Guideline* cost-effectiveness ratio. For example, if only 10 percent of smokers would be willing to undertake intensive counseling, the final number of quitters would be much lower than if 50 percent were willing to try this intervention. While varying probabilities are not assumed to affect the average cost of the counseling costs themselves, which are on a per participant basis, they do affect the up-front screening, advice, and motivation costs when expressed on a per quitter basis. Low willingness rates raise these costs per quitter and make some less popular interventions less cost effective unless the model assumes patients and physicians choose among a set of interventions.

Thus, our approach involves both a "what if" scenario, at one extreme, where all smokers undertake an intervention, and a second scenario that takes into consideration the differential likelihood of patients undergoing various interventions. The product is a set of cost-effectiveness ratios plus an overall global cost-effectiveness ratio for the *Guideline* as a whole.

4.1.5 Smoker-Specific Versus Population Costs

The limited number of smoking cessation cost studies in the literature (e.g., Cummings, 1989; Oster, 1984, 1986, 1988) perform cost-effectiveness analyses of counseling and pharmacotherapy on a hypothetical sample of smokers. Their results answer the question: What would be the cost per quitter or life-year saved if all (or a sample of) smokers underwent the intervention. It is not always clear whether the quit rates used in these studies involve "all comers" or just patients who "want-to-quit." Presumably quit rates based on all comers would be much lower given that most smokers are unwilling to try and quit during any one visit with their physician. Moreover, the studies are vague regarding the preliminary screening, advice, and motivation interactions with patients before the actual intervention takes place. AHCPR's *Smoking Cessation Guideline*, by contrast, is very explicit in identifying all of these activities (plus relapse prevention) in addition to various counseling and pharmacotherapy interventions. If the cost-effectiveness analysis is limited to just the direct intervention counseling, the results in terms of cost per quitter or life-year saved will be biased downwards. This is because the *Guideline* recommends screening and other costs to be incurred on both nonsmokers and smokers who are unwilling to quit at the time of their visit and who do not receive the intervention.

For example, intensive intervention with behavioralists will involve several visits. However, most patients are unwilling to undergo such an intervention. Hence, the additional gains in terms of quit rates, while relatively high, apply only to a small portion of the patient population. Yet, screening costs are being incurred on all patients and advice and motivation costs are incurred on smokers. When put on a per quitter basis, these costs will be much higher for an intervention that most smokers are unwilling to undertake.

The issue of up-front screening and advice/motivation costs is what distinguishes costing the *Guideline* from more traditional, narrowly defined, costings of direct interventions alone. The *Guideline* recommends that very minor costs be incurred on every patient every time he/she sees a

[2]It differs in the important respect that most other *Guidelines* first classify patients by severity of illness before recommending more or less expensive interventions.

physician during the year. These costs add up when summed over 600 million office visits and over 32 million hospitalizations. The research question is how sensitive these costs are to the gains in quit rates and the relative willingness of smokers to undertake the various interventions.

4.1.6 Office Versus Hospital Intake

The *Guideline* recognizes two locations of patient-physician contact: the office and the hospital. While the length and nature of the interventions are quite similar in each setting, the types of personnel involved and some of the willingness probabilities can be quite different.

The question of redundancy also must be addressed. Practically all hospitalized patients will also see a physician one or more times in the office before and after their spell of illness. We costed each location separately, producing different cost-effectiveness ratios for the same type of intervention. A more sophisticated model then considered the overlap in sites. Hospital- and physician-based interventions were integrated into a single model, which was designed to avoid double counting the cost and effects.

A third issue concerns the sensitivity of the quit rates and life-years saved to the locus of initial patient-physician contact. Asymptomatic patients seeing the physician in the office for a routine checkup are likely to be less willing to try and quit on such a visit. Moreover, the expected gains in life-years from quitting are also likely to be less than if a patient has been hospitalized for an acute illness. Expert panel opinion and studies support a differential willing-to-quit rate by location, but we are unable to account for possible differences in life-years saved among to two populations. The problem is one of catching smokers at different points in their life cycle of smoking-related problems. The overall life-years saved figures would apply to asymptomatic smokers considering quitting during an office visit. Hospitalized smokers, on the contrary, are part of the group of all smokers who have definitely incurred a smoking-related illness (assuming that is what the admission is for). Were we able to separate the two groups of smokers into "healthy ambulatory" and "unhealthy hospitalized," we could apply two different life expectancy rates, but the lack of data made this approach infeasible. In any event, the cost per life-year saved under the *Guideline* for hospitalized patients should be considered an overestimate, assuming these patients have more to gain from quitting than asymptomatic smokers.

4.1.7 Voluntary Compliance

By their very nature, guidelines do not imply mandatory compliance. The willingness of patients to undertake a smoking cessation intervention is strictly voluntary. Moreover, unlike other medical interventions where people see a direct and immediate benefit, e.g., open heart surgery, vaccination, most smokers do not recognize the correlations between their smoking and numerous medical problems later in life. In costing the *Guideline*, we must assume that every smoker who is willing to quit undertakes a given intervention in order to construct alternative cost-effectiveness ratios. An intervention with twice the cost-effectiveness ratio is interpreted to be half as efficient at saving life-years. This answers the important policy question: What if all smokers chose to undertake a given intervention?

But willingness to quit varies systematically by intervention. Smokers are less willing to undertake interventions that involve more follow-up visits. Thus, in order to produce an overall cost-effectiveness ratio that better mirrors smokers' preferences, we apply unequal probabilities of undertaking various interventions—again, based on expert opinion and the literature. This scenario answers the question: Given the expected choices of smokers regarding interventions, what is the *Guideline*'s average cost-effectiveness?

4.1.8 Lack of Claims Data

Knowledge about current physician practice regarding smoking cessation is primarily limited to patient and physician survey results. According to the National Center for Health Statistics, in 1987, only 33.6 percent of former smokers and 49.5 percent of current smokers reported that they were ever advised by their doctor to quit (NCHS, 1989). Slightly higher rates have been reported by physicians. Wells *et al.* (1986) used data from the Physician Practice Survey to evaluate the practices of general and subspecialty internists in counseling their patients about smoking. They indicated that only 3 percent of all internists reported that they never counsel patients about smoking. However, those internists that did counsel were more oriented toward tertiary care with only 52 percent reporting that they counsel more than 75 percent of all smokers as opposed to 82 percent who reported counseling more than 75 percent of smokers with chronic lung disease.

Beyond surveys that provide some estimate of the proportion of smokers who have received advice or

counseling from physicians, there are few data available to provide more detailed information about the level and types of smoking cessation activities under current practice. Physicians Current Procedural Terminology (CPT) codes, which physicians use to report a detailed description of the services that they provide, do not have a designation for smoking cessation interventions. These services might be reported under the codes relating to counseling and/or risk factor reduction interventions for new and established patients, services that are provided to healthy individuals for the purpose of promoting health and preventing illness or injury. However, while these codes consider length of visit and whether the intervention was provided in an individual or group counseling setting, distinctions are not made between different types of preventive issues (e.g., smoking, diet, exercise, sexual practices). Therefore, it is impossible to isolate those preventive health services that are specifically intended to help individuals quit *smoking*. Furthermore, smoking cessation advice provided to individuals with symptoms or established illnesses would not be included.

Equally limiting for the purpose of costing the *Smoking Cessation Guideline* is the International Classification of Diseases (ICD-9). These are codes used to identify episodes of illness on claims and are particularly reliable for acute conditions where the episode of illness begins with hospitalization (Mitchell, 1995). Interestingly, there is a ICD-9 code for *tobacco use disorder*, which is considered a nonspecific principal diagnosis code that may trigger a PRO review. These data, however, are unlikely to identify smokers who receive smoking cessation counseling during the course of a periodic examination or individuals who have developed a smoking-related illness such as emphysema and who are provided help to quit smoking but for whom the related illnesses is the principal diagnosis rather than the smoking cessation intervention.

Drug utilization data are available for both transdermal nicotine and nicotine gum. Currently, the patch is available under four different brand names, and one drug manufacturer has FDA approval to provide nicotine gum. However, claims data will likely include only a fraction of all smokers who receive nicotine replacement therapy. Fiore *et al.* (1992) reported that an early response of third-party payers was to withhold reimbursement for transdermal nicotine replacement therapies. While research evidence demonstrating the effectiveness of the nicotine patch may increase the number of third-party payers covering the cost of these prescriptions, a large portion of the costs are probably still borne completely by patients and would not appear in claims databases.

4.1.9 Specifying Resource Use

The *Guideline* Panel avoided choosing among multiple effective interventions recognizing that the selection of certain smoking cessation strategies may be a function of practical matters such as time available, training of providers, patient preference, and available financial resources. For example, intensive interventions require more time and resources than less intensive options, yet they are generally more effective. In this case, the *Guideline* recognizes the expense of the interventions by recommending that they be used pending the availability of resources. While this approach allows providers to choose from among a range of effective interventions considering fiscal constraints, it is unclear which providers will be financially capable and willing to provide certain interventions.

4.1.10 Differential Relapse Rates by Intervention

A final challenge to costing the *Guideline* involves relapse rates. All cessation programs experience relapses, but the rates likely vary by intervention. The meta-analyses upon which the effectiveness measures are based rely on 5- or 12-month abstinence rates. Regrettably, some patients relapse after these periods.

Lacking data on different relapse rates by intervention, we assume constant 35 percent rates, then test the assumption through sensitivity analysis. The basic relapse rate is based on the National Health and Nutrition Examination Survey published in CDC (1990).

4.2 Summary of Approach

4.2.1 Stylized Interventions

The *Smoking Cessation Guideline* addresses a number of issues and strategies for encouraging smokers to quit. Not all of the recommendations can be evaluated, either because of time and resources or due to the lack of valid cost and/or outcomes information. For example, the *Guideline* presents several alternative formats (e.g., individual versus group counseling) and self-help materials (e.g., videos versus pamphlets). While these can be costed, we lack the information necessary on quit rates to distinguish their effects from the broad underlying

effect of counseling. The *Guideline* also offers recommendations regarding dosages for nicotine replacement, such as 4 mg gum versus 2 mg gum for highly dependent smokers. Again, we do not have information on quit rates of varying dosages in order to calculate cost-effectiveness ratios. Without differing quit rates, the less intensive, less costly intervention will always have the higher cost-effectiveness ratio.

Furthermore, the *Guideline* meta-analyses and panel evaluations have concluded that not enough evidence exists to establish the effectiveness of a number of other interventions. This includes the use of Clonidine, antidepressants, anxiolytics/ benzodiazepines, and silver nitrate, as well as acupuncture. Consequently, these interventions will not be included in the cost analysis.

For the above reasons, a narrower set of stylized interventions will be the focus of the cost-effectiveness analysis. They are stylized in the sense that not all recommendations are presented and evaluated. The actual *Guideline* interventions are richer in detail than what we are able to analyze. The major intervention strategies can be stratified according to

- Setting
  - Physician's office
  - Hospital
- Length of physician visit contact
  - Minimal (<3 minutes)
  - Brief (3-10 minutes)
  - Counseling (>10 minutes)
- Follow-up visits with physician
  - One 3-minute visit
  - One 10-minute visit
  - Two 10-minute visits
- Intensive counseling
  - Individual (5 @ 30-minute sessions)
  - Group (7 @ 1-hour sessions)
- Nicotine Replacement
  - None
  - Patch
  - Gum

While these strata generate many possible combinations, not all were recommended by the *Guideline* panel. First, for smokers in the physician's office, the minimal visit would have a 3-minute follow-up visit and no pharmacotherapy. The brief visit is linked with one 10-minute follow-up visit while two follow-up visits are recommended with an initial full counseling visit greater than 10 minutes. Nicotine replacement is recommended with either brief or counseling visits. Patients may also choose intensive counseling, which can be either individual or group counseling for different numbers and session lengths. Again, pharmacotherapy is recommended but not required.

4.2.2 Interventions by Primary Care Clinicians

Thus, we performed a cost-effectiveness analysis examining a series of smoking cessation interventions outlined in the *Guideline*. This involved estimating the costs and benefits of the following smoking cessation activities:

- Screen all patients on every office visit to determine smoking status;
- Advise smoking patients to quit;
- Promote motivation to quit among unwilling patients;
- Assess individual and environmental factors of willing patients;
- Counsel willing patients for 3, 7, or 15 minutes on initial visit;
- Provide willing patients with self-help education materials;
- Offer nicotine replacement to willing smokers; and
- Provide one or two follow-up visits.

Follow-Up Counseling. The panel recommended follow-up counseling (either through face-to-face contact or via telephone) within a 2-week period following the quit date (preferably within the first week) and a second follow-up visit within a month after the quit date. Consistent with the *Guideline*'s recommendations for primary care clinicians, this stylized intervention implies additional costs beyond physician counseling.

Nicotine Replacement. Two adjuvant interventions will incorporate nicotine replacement therapy. The *Guideline* recommends such therapy for all willing patients without medical contraindications. Costing interventions that include nicotine replacement therapy will require estimates of patient willingness to use either therapy, their costs, and their marginal quit rates. We derive assumptions of transdermal nicotine replacement and nicotine gum compliance based on the literature and the panel's expert opinion (see Section 4.4.1). The cost of transdermal nicotine patches and nicotine gum are estimated using reported wholesale prices and a nonrandom survey of pharmacies and expert panel recommendations.

The *Guideline* presents results of a series of meta-analyses examining the effectiveness of transdermal nicotine replacement and nicotine gum interventions. Based on the results of six nicotine patch meta-analyses, the *Guideline* reports that transdermal

nicotine replacement approximately doubles smoking cessation rates over those experienced among placebo group participants. The panel reviewed four meta-analyses of nicotine gum use and concluded that nicotine gum improved quit rate by approximately 60 percent relative to control groups. See Section 4.4.2 for marginal quit rates.

4.2.3 Intensive Interventions by Smoking Cessation Specialists

The *Guideline* recommends that clinicians refer willing patients to smoking cessation specialists for intensive interventions. Recognizing that only a minority of patients will choose such an alternative, we assumed that a portion of the patients who are screened and advised by primary care clinicians will select to receive an intensive intervention. This involved estimating the costs to perform the following smoking cessation activities:

- Screen all patients to determine smoking status;
- Advise smoking patients to quit;
- Promote motivation to quit among unwilling patients;
- Assess individual and environmental factors for willing patients; and
- Refer willing patients to behavioralists for four to seven sessions lasting 20-30 minutes each conducted over a period of 2-8 weeks.

The first three activities are provided in an office or hospital setting by a nurse and physician. The costs and assumptions associated with these activities will parallel those previously mentioned. The remaining two activities, the assessment of individual and environmental factors and the provision of counseling, will be conducted by a smoking cessation specialist during the patient's first counseling session. The *Guideline* recommends that multiple providers be used. One strategy would be to have a health care clinician deliver messages about the health risks of smoking and benefits of quitting while a nonmedical clinician would deliver psychosocial or behavioral interventions. We will assume that the providers who assess and counsel patients under the intensive intervention are primarily nonmedical behaviorialists, although we include a portion of physician time to assist in assessing patients and/or prescribing pharmacotherapy.

Quit rates under this scenario will be based on the *Guideline*'s meta-analyses. Similar to the other scenarios, we will assume that 35 percent of those smokers who quit as a result of intensive counseling will relapse and will not benefit from additional years of life saved. As with the less intensive intervention, the smoking specialist scenario will apply a 5 percent discount rate to life-years saved. The *Guideline* also recommends that individuals who receive intensive counseling also receive nicotine replacement and nicotine gum for willing patients. The same costs as under the primary care scenarios will be used, as well as the same effectiveness odds ratios for pharmacotherapy. However, because intensive counseling, alone, is more effective, the use of pharmacotherapy as adjuvant therapy produces a higher marginal quit rate than it does when used with less intensive physician counseling.

4.3 Mathematical Cost-Effective Models

Constructing a cost-effectiveness ratio for an intervention can be decomposed into four components, i.e.,

$$CE_i = \frac{CS + CADV + CMOT + DC_i}{\Delta Q_i\,(YRS/Q)}$$

$$CE_i = \frac{CS}{\Delta Q_i\,(YRS/Q)} + \frac{CADV}{\Delta Q_i\,(YRS/Q)} + \frac{CMOT}{\Delta Q_i\,(YRS/Q)} + \frac{DC_i}{\Delta Q_i\,(YRS/Q)}, \quad (4\text{-}1)$$

where CE_i = the marginal cost-effectiveness of the ith smoking intervention, CS = total screening costs, $CADV$ = total costs of advising smokers to quit on each visit, $CMOT$ = total costs of motivating smokers to quit who are unwilling to try on the current visit, DC_i = total direct costs for the ith intervention, ΔQ_i = the underlying increase in the number of quitters due to the intervention, and (YRS/Q) = the expected number of life-years gained for a quitter (usually discounted). The first component of equation (4-1) is the screening costs of the U.S. patient population per gain in the number of quitters or, if one wishes, per life-year saved. The second and third components are the *Guideline* costs of giving advice to smokers and motivating unwilling smokers to try and quit, also expressed on a per quitter or life-year saved basis for the ith intervention. The fourth component is the

direct costs incurred in helping smokers quit, again expressed per quitter or per life-year saved.

Initial screening costs apply to all patients seen in the physician's office or hospital, and are derived as the following product:

$$CS = \left[\frac{CS}{V}\right] \cdot \left[\frac{V}{POP}\right] \cdot POP \quad , \qquad (4\text{-}2)$$

where CS/V = screening costs per visit, V/POP = visits per capita, and POP = potentially screenable population (i.e., adult population).

The number of quitters in the denominator of the first (and all) components of equation (4-1) can be decomposed by setting

$$\Delta Q_i = POP \cdot pb[S] \cdot pb[W_i] \cdot \Delta QR_i \quad , \qquad (4\text{-}3)$$

where $pb[S]$ = the probability of a patient being a smoker, $pb[W_i]$ = the probability of a smoker being willing to undertake the ith intervention, and ΔQR_i = marginal quit rate due to the intervention, equal to the difference in the ratio of quitters to smokers between the ith intervention and the baseline quit rate. Inserting equations (4-2) and (4-3) into the first component of the cost-effectiveness formula (4-1) gives

$$\frac{CS}{\Delta Q_i} = \frac{[CS/V] \cdot [V/POP]}{pb[S] \cdot pb[W_i] \cdot \Delta QR_i} \quad , \qquad (4\text{-}4)$$

ignoring for the time being the factor that converts quit rates into life-years saved. The numerator of equation (4-4) is a constant per capita outlay unrelated to the type of intervention. Under the *Guideline*, all patients are screened as to smoking status on every visit. The denominator rises or falls, however, with either the assumed willingness to undergo an intervention or the gain in the quit rate from a particular intervention. Thus, interventions that are more attractive to smokers wanting to quit or that are more effective in promoting abstinence will lower the up-front screening costs per new quitter. Previous cost-effectiveness analyses ignore this cost component by assuming smokers are already identified.

The second component of equation (4-1) concerning advice can be expressed as

$$\frac{CADV}{\Delta Q_i} = \frac{CADV/POP}{pb[W_i] \cdot \Delta QR_i} \quad . \qquad (4\text{-}5)$$

It differs from screening in excluding the probability that a patient smokes from the denominator. This is because advice costs are being given only to smokers.

The third component can be expressed as

$$\frac{CMOT}{\Delta Q_i} = \frac{CMOT/POP}{\Delta QR_i} \cdot \frac{pb[NW_i]}{pb[W_i]} \quad . \qquad (4\text{-}6)$$

Per capita costs for motivation apply only to smokers who are unwilling to try the ith intervention on a particular visit. For any given intervention, motivational costs per quitter vary inversely with the odds of being willing to try to quit. For example, if 50 percent of smokers are willing to try to quit using the ith intervention, then motivational costs per quitter are simply equal to per capita costs divided by the marginal quit rate. If only 25 percent are willing to try an intervention, then motivational costs per quitter are three times per capita motivational costs divided by the marginal quit rate. If all patients are assumed to be willing to try to quit without motivation (highly unrealistic), no motivational costs are incurred. Hence, motivational costs are fairly sensitive to the attractiveness of an intervention.

Finally, the cost-effectiveness of the direct intervention alone is

$$\frac{CC_i}{\Delta Q_i} = \frac{CC_i / pb[S] \cdot POP \cdot pb[W_i]}{\Delta QR_i} \quad . \qquad (4\text{-}7)$$

The numerator is the direct intervention costs per smoker participating in the ith intervention while the denominator is simply the marginal quit rate. Assuming the cost per participant is constant (i.e., all direct intervention costs are variable), then direct costs per quitter fall as marginal quit rates rise.

The overall cost-effectiveness per quitter for a given intervention is simply the sum of per quitter costs for the four components.

Interventions incorporating nicotine replacement and/or intensive counseling by nonphysicians would be analyzed using the same general formula (4-1). Intervention costs per participant and marginal quit rates would vary, as would the assumed willingness of smokers to undergo the specific intervention.

Equations (4-4 through 4-7) focus on the cost-effectiveness of various interventions in encouraging smokers to quit. Each component would also be expressed in terms of life-years saved by multiplying the denominator by average life-years gained per quitter.

Producing a single cost-effectiveness ratio for the entire *Guideline* requires access to decision

probabilities. The population probability (Pb_i) for a patient undertaking the ith intervention is equal to

$$Pb_i = pb[S] \cdot pb[WQ] \cdot pb[W_i] \cdot (1 - pb[Rx]):$$
without nicotine replacement (4-8)

$$= pb[S] \cdot pb[WQ] \cdot pb[W_i] \cdot pb[Rx] \cdot pb[PCH]:$$
with patch (4-9)

$$= pb[S] \cdot pb[WQ] \cdot pb[W_i] \cdot pb[Rx] \cdot pb[GUM]:$$
with gum (4-10)

where $pb[WQ]$ = the likelihood a patient is willing to try and quit, $pb[Rx]$ = the likelihood a willing patient will also be willing to try pharmacotherapy, and $pb[PCH]$, $pb[GUM]$ = the likelihood a pharmacotherapy patient will use the patch or gum.

For example, if 25 percent of patients smoke, if 25 percent are willing to try and quit, if 40 percent of willing smokers prefer intervention i, and 75 percent are also willing to use pharmacotherapy, then the joint probability of a patient being enrolled in the ith intervention without pharmacotherapy is 1.875 percent. That is, slightly less than 2 percent of all of a physician's patient visits would result in enrollment in the ith counseling intervention without pharmacotherapy.

These probabilities are used to weight both the direct costs (DC_i) of various interventions (they exclude screening and up-front costs) as well as determine the number of quitters. That is,

$$CC = \sum_i CC_i = \sum_i POP \cdot Pb_i \cdot DC_i \quad , \quad (4\text{-}11)$$

where CC = total direct costs attributable to all interventions in the *Guideline*, and $POP \cdot Pb_i$ = number of smokers undertaking the ith intervention. The expected number of quitters across all interventions is derived in similar fashion:

$$E[\Delta Q_i] = \sum_i E[\Delta Q_i] = \sum_i POP \cdot Pb_i \cdot \Delta QR_i \quad , \quad (4\text{-}12)$$

where $E[\Delta Q]$ = the expected number of quitters across all interventions. Thus, the number of quitters can be considered a weighted sum of marginal quit rates of the various interventions. If all smokers are assumed willing to try at least one of the interventions, i.e., $pb[WQ] = 1$, then the sum of the weights adds to the total number of smokers in the population. Consequently, interventions with either higher marginal quit rates or a greater willingness of smokers to try them will contribute more to total quitters.

4.4 Calibration of Key Parameters

The interventions were costed using a spreadsheet that listed the probabilities of persons undergoing certain intervention modules, the unit costs of intervention components, the number of recommended units of service (e.g., counseling minutes), and the cost per unit. Initial screening, for example, is done on everyone at every visit. Hence, this component has a probability of one. It is done by a nonphysician and is assumed to take a minute.

Effectiveness data in the form of quit rates are included in the spreadsheet as well under each intervention. Both the underlying baseline quit rate and the estimated quit rate of patients undergoing a given intervention are included in order to derive the marginal gain in quit rate due specifically to the intervention. Another table converts quit rates into years of life saved at different age groups. The *Guideline* does not differentiate interventions by patient age. Assuming the quit rates apply uniformly to all age groups, it is possible to generate a range of cost-effectiveness ratios depending solely upon the age of the patient. An overall cost-effectiveness ratio for the entire population is based on the distribution of smokers by age group. For example, if the marginal quit rate for an intervention is 10 percentage points and 1 million smokers undertake the intervention, then 100,000 new quitters are generated. If quitting smoking adds 2 years (discounted) to the average smoker's life, then 200,000 life-years becomes the denominator of the C/E ratio.

Estimates of the total number of office and hospital visits and admissions are used to factor up the per contact costs to a national cost estimate.

4.4.1 Decision Probabilities

Table 4-1 gives the probabilities used in constructing cost-effectiveness ratios under different scenarios. The top panel gives the univariate probabilities of each event while the bottom panel gives the joint probability of 10 possible combinations of visit counseling and the use of the patch or gum.

The likelihood of a patient being a smoker (25 percent) comes from National Survey data (NCHS, 1994). For nearly all scenarios, 100 percent of smokers are assumed to be willing to quit versus the more realistic alternative of only 25 percent (based on expert opinion and Goldstein *et al.*, unpublished;

Table 4-1. Decision Probabilities for the *Smoking Cessation Guideline*

	Probabilities (Percent)	
	Baseline	Sensitivity
Probability of Smoking, *pb[S]*	25	
Probability of Willing to Quit, *pb[WQ]*	100	25
Willing Smoker Probability of Visit Type, *pb[Wi]*		
Minimal Visit	25	
Brief Visit	40	
Counseling	30	
Intensive Counseling	5	
Probability of Using Any Pharmacotherapy, *pb[Rx]*	75	
Pharmacotherapy Using Patch, *pb[PCH]*	83	
Pharmacotherapy Using Gum, *pb[GUM]*	17	
Relapse Rate (>6 months)	35	10

	Conditional Probabilities (Percent)			
Type of Intervention	**Alone**	**With Patch**	**With Gum**	**Total**
Minimal	6.25	-	-	6.25
Brief	2.50	6.22	1.28	10.00
Counseling	1.875	4.66	0.96	7.50
Intensive Counseling	0.313	0.78	0.16	1.25
Total	10.94	11.66	2.40	25.00

Sources: *pb[S]*: Health U.S. 1994, Table 64. Data from National Health Interview Survey. Other probabilities: Expert panel opinion and literature (see text).

Velicer *et al.*, 1995). A 25 percent willing-to-try rate is somewhat higher than the 16-18 percent found in the literature. The higher rate was based on the expected success of the *Guideline*'s motivational intervention in converting some smokers who might have been contemplating quitting in the near future. The likelihood of willing smokers' choosing one of four counseling interventions is also based on expert panel opinion. It is weighted heavily towards a brief or full counseling visit with one or two follow-up visits. Generally, very few patients are willing to undertake intensive counseling with five to seven sessions of 30 minutes (individual) to an hour (group) that involves traveling to another site to see nonphysicians. Liechtenstein and Hollis (1992), for example, report that 11.3 percent of Kaiser Portland smokers actually attended the first meeting of a multi-session smoking cessation program versus the 53.2 percent who said they were initially willing to try the program. Only 8.9 percent actually completed the nine-session program (which claimed to have a 35 percent quit rate). We have assumed only 5 percent of smokers screened and advised by physicians in the office would undertake intensive counseling under the assumption they would have to pay a $100 or more (plus transportation and time costs). The Kaiser program was free.

Concerning nicotine replacement, Oster *et al.* (1986) assumed that 25 percent of patients who are offered a prescription for nicotine gum will actually use it. They based this estimate on clinical trials (Jamrozik *et al.*, 1984; Russell *et al.*, 1983) in which 50 percent of all smokers accepted an offer of nicotine gum in a primary care setting when it was offered free of charge. Oster *et al.* assumed that this rate would be lower if patients had to purchase the gum themselves and tested their assumption using sensitivity analysis. By contrast, expert panel opinion estimated that three-quarters of smokers would be willing to try pharmacotherapy. Of these, it was believed they would prefer the patch over the gum by at least a 5-to-1 ratio. These probabilities, instead of earlier estimates from Oster's group, were used given they were based on more current information.

To recognize that not all quitters stay abstinent, a 35 percent relapse rate is applied as well to the marginal quit rates. The *Guideline* meta-analyses were based on an abstinence rate for at least 5 months. Hence, the 35 percent relapse rate is

assumed for patients who resume smoking after being abstinent roughly half a year. The limited literature on relapse rates shows a wide range of assumed relapse rates. Oster *et al.* (1986) assumed no relapse after 1 year in their baseline study of nicotine gum, while Cummings, Rubin, and Oster (1989) assumed a 10 percent relapse rate. The very recent cost-effectiveness analysis of the nicotine patch by Fiscella and Franks (1996) assumed a 35 percent lifetime relapse from smoking cessation. The rate was based on the National Health and Nutrition Examination Surveys I and II (CDC, 1990). Sensitivity at a less conservative 10 percent rate is also used in some variants.

The probabilities are all set equal to 1.0 (except for the likelihood of being a smoker) when evaluating the cost-effectiveness of individual interventions. This approach answers the "what if" question necessary in comparing cost-effectiveness ratios across interventions. The actual joint probabilities are used (in the bottom panel) when determining the expected outlays, number of quitters, and life-years saved for each intervention under a naturally occurring choice set. As one can see, the likelihood of an adult opting for intensive counseling using nicotine gum is very low: 0.16% [= (0.25) (1.0) (0.05) (0.75) (0.17)].

It should be kept in mind, though, that the conditional probabilities apply to the entire adult population. The rates should be multiplied by 4 when considering the likelihood of a smoker choosing a particular intervention. For example, assuming all smokers were willing to try and quit, roughly 19 percent would be expected to choose full counseling with the patch. Another 44 percent would not use nicotine replacement at all.

An alternative set of joint probabilities for the various intervention combinations can be derived by setting the willing-to-quit probability to 25 percent. As explained below, this would be appropriate if one assumed that the marginal quit rates were based on only a willing-to-quit population of smokers.

4.4.2 Quit Rates

The *Guideline* uses smoking quit rates as its effectiveness indicator. Primarily employing a modified intent-to-treat analysis technique, the researchers supporting the *Guideline* panel calculated percentages of individuals who successfully quit smoking under different interventions, drawing from peer-reviewed, published literature that provided at least 5 months of follow-up data. Meta-analyses evaluated basic treatment characteristics such as counseling format, duration of treatment, and use of pharmacotherapy. Studies that included the same intervention were grouped together, screened to ensure methodological rigor, and analyzed using either fixed or random effects logistic models. The *Guideline* converts the logistic regression coefficients generated from the meta-analyses into odds ratios.

By way of example, one of the *Guideline*'s meta-analyses compares quit rates by the extent of person-to-person contact. The estimated odds ratios in the *Guideline* report compare the success of each counseling intervention to no intervention, i.e., no contact. For example, the odds of a person quitting as a result of a minimal (<3 minute) counseling visit relative to no intervention was 1.2. Therefore, someone would be approximately 20 percent more likely to quit smoking if they received one minimal counseling visit versus trying to quit on their own.

For the 56 studies included in the meta-analysis, the baseline no intervention quit rate was 8.8 percent versus 10.7 percent for minimal counseling, 12.1 percent for brief counseling and 18.7 percent for counseling greater than 10 minutes, all excluding pharmacotherapy (see Table 4-2). The baseline and intervention quit rates for the study of intensive counseling (based on four to seven sessions) were 10.4 and 22.6 percent, respectively. Absolute quit rates for each intervention were converted into marginal quit rates by subtracting the underlying baseline quit rate. Marginal quit rates, net of the baseline rate, are the relevant statistics given the marginal increases in practice care costs generated by the various smoking interventions, although they need to be rebased for reasons given below.

Other quit rates were developed for adjuvant pharmacotherapy. Because the logistic coefficients from the meta-analyses produced unreasonably high marginal quit rates for nicotine patch and gum, due in part to small clinical trial samples testing these interventions, simple odds ratios from meta-analyses of the patch or gum were used instead. For transdermal replacement, the odds ratios ranged from 2.1 to 2.6 over counseling alone (see Table 16, p. 54, of the *Guideline*). Similarly, odds ratios for gum use ranged from 1.4-1.6. These odds ratios were converted to quit rates under varying lengths of physician contact. For example, the brief visit quit rate was 12.1 percent, implying an odds ratio of 0.138 [= 0.121/(1 - 0.121)]. Multiplying this ratio by the most conservative 2.1 odds ratio gives a brief counseling-with-patch odds ratio of 0.29, which converts back to an overall quit rate of 22.5 percent [= 0.29/(1 + 0.29)]. The marginal quit rate for brief

Table 4-2. Smoking Cessation Quit Rates

Type of Visit	Baseline (percent)	Odds Ratio	Intervention[a] (percent)	Marginal Quit Rate (percent)	Rebased Marginal Quit Rate[b] (percent)
Minimal (<3 minutes)	8.8	1.2	10.7	1.9	0.94
With Patch	8.8	2.1	19.6	10.8	6.70
With Gum	8.8	1.5	14.8	6.0	3.68
Brief (3-10 minutes)	8.8	1.4	12.1	3.3	1.86
With Patch	8.8	2.1	22.5	13.7	8.40
With Gum	8.8	1.5	17.1	8.3	4.95
Counseling (>10 minutes)	8.8	2.4	18.7	9.9	6.20
With Patch	8.8	2.1	32.6	23.8	16.00
With Gum	8.8	1.5	25.7	16.9	10.90
Intensive Counseling (4-7 visits @ 20-30 minutes)	10.4	2.5	22.6	12.2	6.62
With Patch	10.4	2.1	38.0	27.6	16.64
With Gum	10.4	1.5	30.5	20.1	11.50

[a]Quit rates using patch and gum derived by applying marginal odds ratios reprinted in guideline to quit rates without nicotine replacement (see Chapter 4 on methods).
[b]Derived by adjusting 5% underlying quit rate for at least 3 months in U.S. by odds ratios (see text).
Source: USDHHS, Clinical Practice Guideline Number 18: Smoking Cessation, PHS/AHCPR, No. 96-0692, April 1996.

counseling with patch is 13.7 percentage points (= 22.5 percent - 8.8 percent), as shown in Table 4-2.

The very high baseline quit rates in the meta-analyses are due to (a) some studies including only want-to-quit subjects, and (b) minimal cessation interventions (e.g., self-help materials) offered some control subjects. In order to apply the results of the meta-analyses to the entire U.S. smoking population, the odds ratios derived from the analyses were applied to the underlying 3-month-or-more quit rate in the U.S. (CDC, 1996). This rate was reported (by C. Husten at CDC) to be 5 percent (versus 5.7 percent for smokers quitting for at least 1 month). For example, the rebased marginal quit rate for brief counseling using the patch of 8.4 percent was derived by converting the 5 percent underlying quit rate into an odds ratio (= 0.0526), multiplying by the product of the two odds ratios (1.4 x 2.1 = 2.94), converting the result back into a percentage (= 0.1339 = 0.155/1.155), and subtracting off the original 5 percent. Finally, a 35 percent relapse rate is applied to derive an estimate of expected permanent quitters beyond 5 months. Thus, in determining the estimated number of permanent quitters under this intervention, 5.46 percent was used instead of 8.4 percent (or the 13.7 percentage point difference derived from the meta-analyses based on an 8.8 percentage point baseline).

Average and marginal quit rates are easily converted into an estimate of the total number of quitters by multiplying by the number of smokers involved in a given intervention. Approximately 25 percent of the adult population smokes, or slightly less than 50 million persons. If every smoker were to undergo minimal counseling, then the expected number of quitters would be 470,000 persons (= 50 million times 0.0094). With just brief counseling, about 930,000 persons (= 50 million times 1.86 percent) would be expected to quit versus 4.2 million (= 50 million times 8.4 percent) if they all used the patch as well.

Using quit rates to develop cost-effectiveness ratios allows one to compare alternative smoking cessation interventions, but they cannot be compared with other medical interventions whose cost-effective ratios are based on life-years saved, e.g., treatment of hypertension. In the next section, we describe the data and methods used to convert quit rates into life-years saved.

4.4.3 Life-Years Saved by Demographic Characteristic

Fortunately, the adverse effects of smoking have been well documented allowing researchers to link quit rates to health effects. Smokers have higher death rates than nonsmokers at all ages over 35

(Hodgson, 1992). They also are at higher risk for lung cancer, coronary heart disease, and emphysema, which is almost never observed among nonsmokers (Oster, 1984). The Office of Technology Assessment (1985) estimates that in 1982, 32 percent of all cancer deaths, 13 percent of all cardiovascular deaths, and 88 percent of all chronic lung disease deaths were due to smoking. In addition, smoking is a major agent for many other medical conditions including chronic bronchitis, cerebrovascular disease, and cancers of the oral cavity, larynx, and esophagus.

Hammond (1966) found that men aged 50-69 who were light smokers returned to a nonsmoker's level of risk of lung cancer within 5 years after quitting. He also reported that former light smokers demonstrated a decrease in coronary heart disease mortality within 1 year after quitting with the decline in risk complete after 10 years. Former heavy smokers returned to the nonsmoker risk levels 15 years after they quit smoking.

Table 4-3 shows the years of life gained as a result of smoking cessation for both men and women in different age groups. The data come from Fiscella and Franks (1996), who performed a cost-effectiveness analysis of nicotine patch and gum as an adjunct to smoking cessation counseling from a physician. The authors translated quit rates into years-of-life-saved using life expectancy data for smokers and never smokers taken from Rogers and Powell-Griner (1991). Fiscella and Franks extrapolated mortality rates for smokers versus never smokers using a 20-year phase-in period based on mortality ratios of long-term quitters to never smokers derived from the American Cancer Society's 25-State Cancer Prevention Study II (CDC, 1990).

The unadjusted life-years saved are highest for young female smokers, averaging over 6.5 years. Young males average roughly 2 years less due to shorter expected lifetimes in general. Discounting by 3 and 5 percent has a pronounced effect on the expected years saved. This is due to the fact that most years are gained near the end of life 20-30 years after quitting smoking. Indeed, undiscounted life-years saved for males, aged 18-19, is nearly 5-fold larger than if discounted at 5 percent.

Table 4-3. Estimates of Years of Life Saved per Smoker by Age and Gender

Age at Quitting	Years of Life Saved per Smoker			Quality-Adjusted Years of Life Saved per Smoker		
	Undiscounted	3% Discount	5% Discount	Undiscounted	3% Discount	5% Discount
Men						
25-29	4.73	1.31	0.95	6.55	2.34	1.32
30-34	4.47	1.39	1.03	6.09	2.38	1.40
35-39	4.09	1.43	1.06	5.48	2.34	1.44
40-44	3.59	1.40	1.08	4.75	2.20	1.41
45-49	3.03	1.30	1.00	3.96	1.98	1.32
50-54	2.35	1.11	0.89	3.08	1.67	1.16
55-59	1.76	0.91	0.74	2.31	1.35	0.97
60-64	1.23	0.70	0.59	1.62	1.01	0.77
65-69	0.76	0.47	0.40	1.04	0.69	0.54
Women						
25-29	6.71	1.43	1.01	6.60	1.94	1.01
30-34	6.66	1.63	1.13	6.34	2.04	1.10
35-39	6.44	1.80	1.29	5.93	2.08	1.17
40-44	6.00	1.90	1.32	5.38	2.06	1.19
45-49	5.56	1.95	1.39	4.77	1.97	1.19
50-54	4.94	1.92	1.38	4.08	1.81	1.13
55-59	4.28	1.85	1.33	3.39	1.62	1.05
60-64	3.53	1.69	1.24	2.67	1.39	0.94
65-69	2.67	1.41	1.07	1.93	1.08	0.77

Sources: Fiscella, K. and P. Franks, Cost-Effectiveness of the Transdermal Nicotine Patch as an Adjunct to Physicians' Smoking Cessation Counseling, Journal of the American Medical Association, 275(16), April 24, 1996, and unpublished data by Fiscella and Franks. Estimates were derived from the American Cancer Society's Cancer Prevention Study II and adjusted for quality of life using the Healthy People 2000 Years of Healthy Life (YHL) measure.

Fiscella and Franks made a quality-of-life adjustment to the raw years-of-life saved figures. They used a years-of-healthy-life index constructed from questions on the annual National Health Interview Survey (CDC, 1995). Self-reported health status assesses health on a 0-1 continuum using two health domains: self-rated health and role limitations.

Adjusting for quality of life, like discounting, has pronounced effects on the gains to quitting smoking, especially for males. Not only can young males expect to gain over 4.5 years of life generally, they can add another 38 percent in terms of better health functioning by avoiding chronic lung and heart problems, etc. Morbidity gains to women are much less, in part because their early health gains are less from quitting. As with the undiscounted life-years saved, the value of quality-adjusted life-years is quite sensitive to the discount used. In their work, Fiscella and Franks (1996) discount their estimates of QALY's saved by 3 percent, a rate recently recommended by the Panel on Cost-Effectiveness in Health and Medicine (Gold *et al.*, 1996).

By multiplying the number of quitters by the discounted life-years saved per quitter, one can calculate total life-years saved and convert cost per quitter to cost per life-year saved. Cost-effectiveness ratios can then be compared among alternative smoking cessation interventions and other medical interventions derived from the literature.

4.4.4 Resource Utilization and Costs

The amount of counseling that smokers willing to make a quit attempt receive depends largely on patient and/or physician preference. We modeled five possible intervention scenarios that a patient may following after receiving advice from a physician. They include 1) minimal counseling, 2) brief counseling, 3) full counseling, 4) individual intensive counseling, and 5) group intensive counseling. The level of provider time and number of sessions vary among these five options. The first three interventions involve primary care clinicians, who we assume are physicians, while intensive counseling, both individual and group, is performed by smoking cessation specialists.

Time Inputs. The assumptions that we made concerning the providers and length of time required for each intervention scenario are outlined in Table 4-4. They were provided by the *Guideline* panel chairman, Dr. Fiore. The *Guideline* recommends that health professionals screen all patients for smoking status during office visits or hospitalization. We assumed that this task is performed by a registered nurse, and that it requires 1 minute of provider time. Furthermore, we assumed that adults 18 years and older are screened for their smoking status at each office visits, an average of approximately three visits per patient each year.

Following the identification of a smoker, initial smoking cessation advice is provided by physicians in either an office or hospital setting. This task involves delivering a clear, strong, and personalized message urging every smoker to quit. We assumed that this would take 1 minute of physician advice time and that all smokers would be advised to quit at each of their office visits or during the course of hospitalization. Patients unwilling to quit after receiving initial advice are provided with a motivational intervention that involves an additional minute of physician time. We assumed that 75 percent of all smokers would require a motivational intervention at each of their annual office visits or during the course of hospitalization.

Minimal, brief, and full counseling interventions are provided to smokers willing to make a cessation attempt. These are delivered by primary care clinicians and involve increasing amounts of physician time. Among these three scenarios, full counseling involves the greatest amount of physician time, 15 minutes during an initial visit and two 10-minute follow-up visits. An extra 3 minutes was allocated to the minimal, brief, and full counseling interventions when nicotine replacement is used.

The individual intensive and group intensive interventions begin with screening and advising tasks performed by primary care clinicians. Patients are then referred to a smoking cessation specialist. We assumed that smokers undergoing an individual intensive intervention receive five counseling sessions that are each 30 minutes long. The first session involves 10 minutes of physician time for the purpose of assessing the patient and prescribing pharmacotherapy and an additional 20 minutes of R.N. time. The remaining time is divided between a registered nurse with health education experience and a psychologist (three 30-minute visits for the former and two 30-minute visits for the latter). Across the five sessions, there is a total of 10 minutes of physician time, 80 minutes of R.N. time, and 60 minutes of psychologist time. We assumed that group intensive counseling is delivered to groups of 10 patients and that the patients undergo seven sessions that are each 1 hour long. Under this scenario, a physician is also available for a portion of the first session (in this case, 20 minutes of the first). The remaining time for the first group session and sessions 2 through 7 involves a

Table 4-4. Resource Utilization Assumptions

Type of Intervention	Intervention Time (Minutes)		
	Minimal	Brief	Counseling
Interventions for Primary Care Clinicians			
Screening			
Registered Nurse	1	1	1
Advice			
Physician Alone	1	1	1
Initial Counseling			
Physician Alone	3	7	15
Physician with Patch/Gum	6	10	15
Follow-up Counseling			
First Follow-up MD Visit	3-6	10	10
Second Follow-up MD Visit			10

Type of Intervention	Intervention Time (Minutes)[a]	
	Individual Intensive[b]	Group Intensive[c]
Intensive Interventions for Smoking Cessation Specialists		
Screening		
Registered Nurse	1	1
Advice		
Physician Alone	1	1
Counseling Sessions		
Physician	10	20
Registered Nurse	80	400
Psychologist	60	400

[a]Patients referred to a smoking cessation specialist are first screened in an office or hospital setting and advised to quit by a primary care clinician.
[b]Counseling time for Individual Intensive patients is distributed over five 30-minute sessions.
[c]Counseling time for Group Intensive patients is distributed over seven 1-hour sessions.

registered nurse, who provides health education, and a psychologist. These two professionals jointly provide services, and each contributes a total of 400 minutes of time across all sessions.

Input Costs. Physicians are the most costly provider among primary care clinicians. Their costs include not only a return to their own time input but any overhead costs associated with maintaining their practice. We used Medicare claims data to estimate the cost of physician time in both the office and hospital settings (see top panel of Table 4-5). Other studies (Cummings, 1989) have used physician charges, but very few patients or insurers pay full charges today. Medicare rates were used assuming they more accurately reflect the physician's true marginal price of providing an office visit. Assuming that patients are provided with a smoking cessation intervention during a routine office visit or during the course of hospitalization, we searched Medicare data for Current Procedural Terminology (CPT) codes identifying total costs incurred and total patient encounters for relevant visit codes. To determine the per minute cost of physician time for the initial intervention, we used Evaluation and Management codes for new patients receiving services in an office or other outpatient setting. Per patient Medicare payments for 10, 20, 30, 45, and 60 minute visits were calculated and adjusted for medical services inflation through 1995. Then a per minute payment was calculated for each office code, and a weighted average taken across all time intervals to account for differences in patients with respect to length of office visits. We estimated that the Medicare effective physician payment per minute for an initial visit is $1.97. Using the same methodology, we estimated that the average per minute cost of physician time for follow-up office visits is $2.20.

We used Evaluation and Management CPT codes for subsequent hospital care to estimate initial physician advice and counseling costs in a hospital setting, i.e., $1.92 per minute. We assumed that

Table 4-5. Cost Estimates of Physician Time

CPT Code	Medicare Payments	Patient Encounters	Minutes per Visit	1994 Cost per Visit	1994 Cost per Minute	1995 Cost per Minute
New Patient: Evaluation and Management, Office or Other Outpatient						
99201	$22,356,671	853,648	10	$26.19	$2.62	$2.75
99202	120,603,240	3,011,825	20	40.04	2.00	2.10
99203	198,088,091	3,717,946	30	53.28	1.78	1.87
99204	194,207,390	2,445,577	45	79.41	1.76	1.85
99205	154,541,514	1,583,820	60	97.58	1.63	1.71
			1995 Weighted Average Physician Cost per Minute:			$1.97
Established Patient: Evaluation and Management, Follow-up and/or Periodic Reevaluation						
99211	$111,513,773	8,392,042	5	$13.29	$2.66	$2.80
99212	695,309,442	31,592,741	10	22.01	2.20	2.31
99213	2,605,981,622	83,419,519	15	31.24	2.08	2.19
99214	1,470,776,427	30,568,970	25	48.11	1.92	2.02
99215	501,549,210	6,769,614	40	74.09	1.85	1.94
			1995 Weighted Average Physician Cost per Minute:			$2.20
Established Patient: Subsequent Hospital Care						
99231	$929,300,584	30,942,535	15	$30.03	$2.00	$2.10
99232	1,545,432,134	35,888,843	25	43.06	1.72	1.81
99233	719,801,417	11,998,762	35	59.99	1.71	1.80
			1995 Weighted Average Physician Cost per Minute:			$1.92

Note: 1995 costs were derived using the Consumer Price Index (CPI) for all urban consumers, medical care services, to adjust 1994 costs.
Source: 1994 Medicare Claims data.

hospitalized patients would receive follow-up after discharge in an office setting or on an outpatient basis. Therefore, we used the same $2.20 per minute average follow-up rate that was used for patients whose initial visit was in a physician's office setting.

We used Bureau of Labor Statistics (BLS) estimates of mean weekly earnings to calculate the per minute cost of R.N. and psychologist time (see Table 4-6). In 1995, the average weekly earnings of registered nurses and psychologists were $729 and $698, respectively. Assuming that these professionals work an average of 40 hours each week, the per minute labor cost of R.N.s is $0.30, and for psychologists, the per minute labor cost is $0.29.

Recognizing that there are also overhead costs associated with services that these professionals provide, we increased their salaries by a factor of two. Note that our physician cost estimate did not require this sort of adjustment because the Medicare claims that we used are based on office/hospital visit payments rather than physicians' salaries.

Educational Materials. The *Guideline* recommends that patients receive educational materials during the course of their smoking cessation intervention. While physicians and hospitals often receive self-help pamphlets from government agencies or anti-smoking groups free of charge, there is a cost associated with these materials that is incurred by society-at-large. For each intervention scenario, we assumed that patients would receive two educational pamphlets during their counseling session at a total cost of $2.00 per patient undergoing the intervention.

Nicotine Replacement. The *Guideline* recommends that every smoker be offered nicotine replacement therapy except in special circumstances, e.g., pregnant women. All of the smoking cessation scenarios were analyzed considering the cost-effectiveness of including the patch and/or gum as part of the intervention. We used the *Guideline* recommendations to determine the amount and dosages that each patient should receive.

Both the patch and nicotine gum are prescription drugs, although recently they have been made

Table 4-6. Cost Estimates of Nonphysician Time

Occupation	1995 Mean Weekly Earnings	Mean Hourly Earnings	Earnings per Minute	Total Cost per Minute
Registered Nurses	$729	$18.23	$0.30	$0.60
Licensed Practice Nurses	463	11.58	0.19	0.38
Nurses' Aids	335	8.38	0.14	0.28
Psychologists	698	17.45	0.29	0.58
Physician Assistants	741	18.53	0.31	0.62

Note: Total cost per minute for nonphysician time was doubled to account for overhead and support costs.
Source: Bureau of Labor Statistics (BLS) Current Population Survey, 1995 estimates of weekly earnings.

available over the counter.[3] Transdermal nicotine is sold under four different brand names: Nicoderm, Habitrol, Prostep, and Nicotrol. A complete smoking cessation intervention using the patch requires that patients use different dosages over a period of 8 weeks. We used the Average Wholesale Price (AWP) as an estimate of the cost of nicotine replacement (Mosby, 1995).

It is difficult to determine the exact price of any pharmacotherapy because prices vary with geographic region and by pharmacy. AWPs are benchmark prices that reflect what a retailer might pay without any special discounts. However, most pharmacies receive discounts off the AWP between 10 and 18 percent (HCFA, 1992). The price that consumers pay for drugs includes the discounted AWP cost to retailers plus any dispensing costs and net profits. Coincidentally, the AWPs for nicotine replacement are reflective of actual prices that consumers pay. This was determined by a random survey of Boston-area pharmacies. The retail prices for nicotine replacement varied from AWPs by less than 3 percent among chain drug stores and between 6 and 18 percent among more expensive independent pharmacies.

Table 4-7 gives the 1995 AWP for transdermal nicotine applied to the nicotine replacement recommendations detailed in the *Guideline* for each brand name. The average cost of an 8-week supply of the patch is $219.23.

Nicotine gum is available under one brand name, Nicorette, in 2mg or 4mg doses. Both doses come in boxes of 96, and the AWP per box is $38.85 and $63.29, respectively. We assumed that patients use nicotine gum for the first 3 months of their quit attempt and that they chew an average of 10 pieces per day. This intervention requires a single patient to purchase 10 boxes of gum. Therefore, the cost of a complete treatment of 2mg gum is $388.50 and 4mg gum is $632.90.

Only a portion of patients willing to undergo an intervention successfully quit. Unsuccessful quitters would not purchase an 8-week supply of nicotine replacement therapy or a full 90-day supply of gum. Instead, we assumed that they would only purchase a 4-week supply of the patch or gum. For transdermal nicotine, the average cost for the first month of patches is $114.38. And a 4-week supply of nicotine gum requires approximately three boxes of gum, which costs $116.55 for 2mg gum or $189.87 for 4 mg gum.

4.5 Resources by Intervention Activity

Table 4-8 outlines smoking cessation interventions for primary care clinicians employing our resource utilization and cost assumptions. Minimal, brief, and full counseling inventions all have the same cost per participant for screening ($0.60), advice ($1.97), and motivation ($1.97). However, the per participant intervention cost of each scenario increases with the intensity of counseling provided. The estimated cost of a single minimal intervention without pharmacotherapy is $14.51. The brief intervention assumes longer initial physician visit and follow-up time, with a per participant cost of $37.79. The full counseling intervention, requiring 15 minutes during the initial visit plus two 10-minute follow-up visits, costs $75.55.

In calculating direct intervention costs for scenarios that employ pharmacotherapies, we assumed the 75 percent of smokers willing to quit would also be willing to use either the patch or nicotine gum. The total cost of pharmacotherapy was estimated as the sum of the cost of successful

[3]Transdermal nicotine and nicotine gum are now available over the counter at presumably lower cost. Because all of the meta-analyses of effectiveness are based on the gum available only by prescription, no price reduction was made.

Table 4-7. Nicotine Replacement Therapy Costs

Brand	Duration of Treatment	Dosage	Average Wholesale Price per Box	Number per Box	Boxes per Treatment	Cost of Treatment
Transdermal Nicotine						
Nicoderm	4 weeks	21 mg/24 hours	$57.18	14	2	114.36
	then 2 weeks	14 mg/24 hours	52.50	14	1	52.50
	then 2 weeks	7 mg/24 hours	48.60	14	1	48.60
					Total	$215.46
Habitrol	4 weeks	21 mg/24 hours	115.96	30	1	115.96
	then 2 weeks	14 mg/24 hours	110.17	30	0.5	55.09
	then 2 weeks	7 mg/24 hours	104.37	30	0.5	52.19
					Total	$223.23
Prostep	4 weeks	22 mg/24 hours	30.76	7	4	123.04
	then 4 weeks	11 mg/24 hours	28.35	7	4	113.40
					Total	$236.44
Nicotrol	4 weeks	15 mg/16 hours	52.08	14	2	104.16
	then 2 weeks	10 mg/16 hours	49.56	14	1	49.56
	then 2 weeks	6 mg/16 hours	48.05	14	1	48.05
					Total	$201.77
				Average Cost of Complete Treatment		$219.23
				Average Cost of Partial Treatment (First Month)		$114.38
Nicotine Gum						
Nicorette	90 days	2 mg	$38.85	96	10	$388.50
Nicorette	90 days	4 mg	63.29	96	10	$632.90
				Cost of Partial Treatment, 2 mg		$116.55
				Cost of Partial Treatment, 4 mg		$189.87

Sources: Physicians GenRx (Mosby Publishing, 1995); Guideline Recommendations on Usage.

and failed treatments. The average total cost of successful pharmacotherapy was calculated as the cost of a single successful treatment (using the full recommended dosage) times the number of successful quitters (assuming a 30 percent relapse). The cost of pharmacotherapy among failed quitters was equal to the cost of just a 1-month supply of pharmacotherapy times the total number of smokers who attempted to quit but failed. Adding pharmacotherapy greatly increases intervention costs. For brief counseling, the per participant cost rises to $262.93 with the addition of a complete treatment of transdermal nicotine and to $432.20 with nicotine gum. Full counseling with a complete transdermal nicotine treatment costs $300.69, and full counseling with nicotine gum costs $469.96. These costs, however, are much lower for patients who fail to quit because they do not require a complete treatment nicotine replacement.

The participant costs of intensive interventions provided by smoking cessation specialists are outlined in Table 4-9. Screening, advising, and motivation are provided by primary care clinicians in an office or hospital setting before the patient in referred to a specialist. Therefore, these costs are the same as those described in Table 4-8. The cost of educational materials and pharmacotherapy are the same under these scenarios as well. Intensive interventions are divided into five sessions for individual counseling and seven sessions for group counseling. While the group counseling sessions are longer than individual counseling sessions (1 hour as opposed to 30 minutes), its per participant costs are much lower because the cost for each group session is distributed across 10 patients. The participant cost of an individual intensive counseling intervention without pharmacotherapy is $104.50 per patient while it is only $53.14 per patient for a group intervention. Adding a complete treatment of transdermal nicotine increases patient costs to $323.73 and $272.37, respectively. A complete, successful intensive intervention with gum costs

$493 when provided through individual counseling and $441.64 when provided in a group context. Again, among the scenarios that employ pharmacotherapy, costs are substantially less among patients who fail than among successful quitters because of the differential costs of nicotine replacement.

Table 4-8. Smoking Cessation Costs: Interventions for Primary Care Clinicians

Treatment	Minimal			Brief			Counseling		
	Alone	With Patch	With Gum	Alone	With Patch	With Gum	Alone	With Patch	With Gum
Screening									
Number of Minutes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Cost per Minute	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Cost of Screening Visit	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Advice									
Number of Minutes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Cost per Minute	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97
Cost of Advice Visit	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97
Motivation									
Number of Minutes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Cost per Minute	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97
Cost of Motivational Visit	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97
Intervention									
Initial Physician Counseling									
Number of Minutes	3.00	6.00	6.00	7.00	10.00	10.00	15.00	18.00	18.00
Cost per Minute	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97
Cost of Initial Physician Counseling	5.91	13.82	13.82	13.79	19.70	19.70	29.55	35.46	35.46
Physician Follow-up									
Number of Minutes	3.00	6.00	6.00	10.00	10.00	10.00	20.00	20.00	20.00
Cost per Minute	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20
Cost of Physician Follow-up	6.60	13.20	13.20	22.00	22.00	22.00	44.00	44.00	44.00
Educational Materials	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Complete Pharmacotherapy	0.00	219.23	388.50	0.00	219.23	388.50	0.00	219.23	388.50
Partial Pharmacotherapy	0.00	114.38	116.55	0.00	114.38	116.55	0.00	114.38	116.55
Cost of Successful Intervention	14.51	246.25	415.52	37.79	262.93	432.20	75.55	300.69	469.96
Cost of Failed Intervention	14.51	141.40	193.57	37.79	158.08	160.25	75.55	195.84	198.01

Table 4-9. Smoking Cessation Costs: Interventions for Specialists

Treatment	Individual Intensive Counseling			Group (10 Patients) Intensive Counseling		
	Alone	With Patch	With Gum	Alone	With Patch	With Gum
Screening						
Number of Minutes	1.00	1.00	1.00	1.00	1.00	1.00
Cost per Minute	0.60	0.60	0.60	0.60	0.60	0.60
Cost of Screening Visit	0.60	0.60	0.60	0.60	0.60	0.60
Advice						
Number of Minutes	1.00	1.00	1.00	1.00	1.00	1.00
Cost per Minute	1.97	1.97	1.97	1.97	1.97	1.97
Cost of Advice Visit	1.97	1.97	1.97	1.97	1.97	1.97
Motivation						
Number of Minutes	1.00	1.00	1.00	1.00	1.00	1.00
Cost per Minute	1.97	1.97	1.97	1.97	1.97	1.97
Cost of Motivational Visit	1.97	1.97	1.97	1.97	1.97	1.97
Intervention						
Session 1	31.70	31.70	31.70	8.66	8.66	8.66
Session 2	18.00	18.00	18.00	7.08	7.08	7.08
Session 3	18.00	18.00	18.00	7.08	7.08	7.08
Session 4	17.40	17.40	17.40	7.08	7.08	7.08
Session 5	17.40	17.40	17.40	7.08	7.08	7.08
Session 6	0.00	0.00	0.00	7.08	7.08	7.08
Session 7	0.00	0.00	0.00	7.08	7.08	7.08
Educational Materials	2.00	2.00	2.00	2.00	2.00	2.00
Complete Pharmacotherapy	0.00	219.23	388.50	0.00	219.23	388.50
Partial Pharmacotherapy	0.00	114.38	116.55	0.00	114.38	116.55
Cost of Successful Intervention	104.50	323.73	493.00	53.14	272.37	441.64
Cost of Failed Intervention	104.50	218.88	221.05	53.14	167.52	169.69

5.0 Cost-effectiveness of the *Smoking Cessation Guideline*

5.1 Introduction

This chapter presents the findings regarding the costs and effectiveness of several smoking cessation interventions recommended in the AHCPR *Guideline*. Section 5.2 provides a summary of the basic parameters used in simulating costs and constructing cost-effectiveness ratios. The parameters include the number of adult smokers, total physician office visits, total hospital admissions, the likelihood of a patient being a smoker, etc. Section 5.3 then summarizes the estimates of the expected number of quitters under 12 intervention strategies by extent of patient-physician contact and the use of nicotine replacement. Section 5.4 provides the cost-effectiveness results for the same interventions. Each intervention scenario assumes the marginal quit rates apply to all comers (i.e., all smokers). We examine interventions provided to smokers who visit a physician's office and smokers who are hospitalized. Section 5.5 presents overall cost-effectiveness results for the *Guideline* as a whole. This section weights the cost-effectiveness ratios of the individual interventions by the likelihood that a patient will undertake the intervention. These models examine interventions initiated in a physician's office, intervention provided to hospitalized patients, and a combination of the physician visits and inpatient hospital interventions. Finally, Section 5.6 summarizes results of sensitivity analyses including willingness to quit, patient opportunity costs, relapse rate, format preference, and screening volume.

5.2 Summary of Basic Parameters

Each of the smoking cessation scenarios that we modeled is based on a common set of basic parameters that are listed in Table 5-1. The U.S. resident population over the age of 18 is estimated by the U.S. Bureau of the Census for January 1, 1996. The probability of smoking is based on the findings of the CDC's National Health Interview Survey, which found that, in 1993, 25 percent of the U.S. adult population smoked cigarettes. We assumed that the proportion of the population who smoked remained constant between 1993 and 1996, producing approximately 48,745,000 adult smokers in 1996.

Our estimate of the number of physician office visits per year is based on the CDC's National Ambulatory Medical Care Survey. This study found that there was a total of 606,877,000 office visits in the U.S. in 1992 among the population aged 15 years and older. We assumed the same number of office visits for our study. We estimated that adults in the U.S. experience an average of 3.11 physician office visits per year.

Hospital admissions were based on the American Hospital Association's (AHA) 1993 survey of hospitals. We used the estimate for short-term hospital admissions, which includes all patients except newborns. Psychiatric admissions were deducted from the total assuming that smoking cessation interventions would not be provided to these patients. We estimated that the total number of hospital admissions was 32,315,795.

Table 5-1. Summary of Basic Parameters

Population	
Population (18 years and older)[a]	194,980,000
Probability of Smoking[b]	25%
Number of Smokers	48,745,000
Utilization	
Total Office Visits per Year[c]	606,877,000
Office Visits per Capita	3.11
Office Visits to Smokers	158,580,925
Short-Term Hospital Admissions[d]	32,315,795
Short-Term Hospital Admissions to Smokers	8,653,757
Unique Smoker Admissions	6,966,275

Notes: Hospital admissions exclude newborns and admissions to psychiatric facilities.

Sources:

[a]U.S. Bureau of the Census, U.S. Resident Population estimates. January 1, 1996.

[b]Health, United States, 1994. Table 64, Cigarette Smoking by Persons 18 Years of Age and Older, 1993. Based on data from the CDC's *National Health Interview Survey.*

[c]Health, United States, 1994. Table 79, Office Visits to Physicians, 1992. Based on data from the CDC's *National Ambulatory Medical Care Survey.*

[d]AHA Hospital Statistics, 1994-1995. Table 2A, Utilization, Personnel and Finances in Short-Term Hospitals. Based on *1993 AHA Hospital Survey.*

Smokers have higher physician office and hospital utilization than people who have never smoked. Rice *et al.* (1986) found that, on average, smokers experienced about 6 percent more physician office visits and spent 27 percent more days in the hospital than never smokers. To determine the number of physician office visits among smokers, we estimated the average number of physician visits per smoker versus nonsmoker. If the ratio of the average number of physician visits among smokers versus nonsmokers is 1.06, and the number of visits per capita is 3.11, then the average smoker would experience 3.25 visits. Nonsmokers would have an average of 3.06 visits. We estimated that 606,877,000 physician office visits were made by smokers.

Using National Health Interview Survey (NHIS) estimates of the number of short-term hospital episodes by age and gender, we calculated that there were 29,051,900 admissions among the adult population ages 18 years or older. Therefore, there were approximately 0.149 admissions per adult resident. We assumed that because smokers experience 27 percent more hospital days per year than nonsmokers, they would also be 27 percent more likely to be admitted to the hospital. We calculated that 18.8 percent of smokers would experience an inpatient stay, while only 13.9 percent of nonsmokers would be admitted. These estimates generated 8,653,757 smoker admissions. However, according to NHIS estimates, among the general population, only 80.5 percent of admissions are unique hospital admissions; the remaining 19.5 percent are readmissions. We calculated that the total number of unique smoker admissions that would be eligible for an intervention is 6,966,275.

5.3 Number of Expected Quitters and Life-Years Saved by Intervention

Table 5-2 provides a summary of the expected number of quitters and quality-adjusted life-years saved from following the *Guideline*. The first two columns give the results for the overall *Guideline* while the second two columns report numbers only for hospitalized smokers. The number of quitters in each row was derived by multiplying the marginal quit rates, adjusted for a 35 percent relapse rate, times the roughly 48 million smokers in the United States, under the assumption that all smokers would go through a given intervention once during the year. For example, if all smokers were to undertake minimal counseling alone, 298,000 would be expected to quit over-and-above the baseline expected number of quitters (1.56 million = 0.05 x 48 million x 0.65). A second set of figures is presented for the hospital-specific component of the *Guideline*. The number of quitters is derived by applying the same marginal quit rates from the literature to the estimated number of smokers that were hospitalized in 1995.

The number of quitters is converted into two measures of life-years saved: one discounted by 5 percent, and a second adjusted for quality-of-life years saved and discounted by 5 percent. The estimated years of life saved per quitter is given in the notes at the bottom of the table. For example, quitters can expect to save 1.18 quality-adjusted years of life, discounted at 5 percent annually. Not adjusting for quality-of-life improvements and discounting by 5 percent annually reduces the gain to 1.07 life-years.

Finally, a set of figures is provided at the bottom of the table that combines the results from each of the interventions. It does so by applying choice probabilities to each of the interventions. Hence, the number of quitters is based on a weighted average of the number of quitters in each intervention, the weights being the likelihood a patient would undergo a particular intervention.

According to Table 5-2, if all smokers were to undertake the minimal counseling intervention (assumed to be 3 minutes with the physician) with a 3-minute follow-up telephone call within 2 weeks, 298,000 smokers could be expected to be permanent quitters. If they were successful in quitting, a total of 351,400 quality-adjusted life-years would be saved (discounted at 5 percent). The total number of quitters and life-years saved rise with the intensity and duration of the cessation intervention. Intensive counseling with behavioral specialists and using the nicotine patch would generate the most quitters, 5.27 million, for a total of over 6.2 million quality-adjusted life-years saved.

Clearly, the use of nicotine replacement adds considerably to the effectiveness of any counseling intervention. With minimal counseling, the increase in the number of quitters is over 7-fold. Combined with intensive counseling, the impact of the patch is a 2.5-fold gain in quitters over the number expected from just intensive counseling alone. The large difference in the marginal effectiveness of the patch is due to the difference in marginal gain over the underlying 5 percent quit rate. For any counseling intervention, the nicotine patch slightly more than doubles the quit rate. Once the constant 5 percent underlying quit rate is subtracted, however, the

Table 5-2. Expected Annual Number of Quitters and Life-Years Saved by Smoking Cessation Intervention, Assuming All Smokers Attempt To Quit Once During the Year

Treatment	Overall Guideline: Office and Hospital			Hospital Only		
	Number of Quitters[a]	Quality Life-Years Saved[b]	Life-Years Saved[c]	Number of Quitters[a]	Quality Life-Years Saved[b]	Life-Years Saved[c]
Minimal Counseling	298	351.4	318.7	43	50.2	45.5
With Patch	2,123	2,504.0	2,271.4	303	358.0	324.6
With Gum	1,156	1,364.6	1,237.4	165	195.0	176.8
Brief Counseling	589	659.4	630.6	84	99.4	90.1
With Patch	2,662	3,140.5	2,847.8	380	448.8	407.0
With Gum	1,568	1,850.7	1,678.2	224	264.5	239.8
Full Counseling	1,964	2,318.0	2,101.9	281	331.3	300.4
With Patch	5,069	5,982.0	5,424.3	724	854.9	775.2
With Gum	3,454	4,075.2	3,695.3	494	582.4	528.1
Intensive Counseling	2,097	2,475.0	2,244.3	300	353.7	320.7
With Patch	5,272	6,221.3	5,614.3	753	889.1	806.2
With Gum	3,644	4,299.6	3,898.7	521	614.5	557.2
Combined Intervention[d]	2,630	3,103.7	2,814.4	376	443.6	402.2

[a]Number of quitters (in thousands).
[b]Quality-adjusted life-years saved (discounted 5%), in thousands, derived using 1.18 adjustment factor to number of quitters.
[c]Life-years (discounted 5%), in thousands, derived using 1.07 adjustment factor to the number of quitters.
[d]Derived by weighting the individual interventions by the likelihood of smokers choosing each intervention.
Source: Marginal quit rates: AHCPR Guideline. Life-years saved per quitter: Fiscella and Franks (1996).

relative impacts become far larger for the shorter counseling sessions.

Quality-adjusted life-years saved ranges from a low of 351,400 under the overall *Guideline* to over 6.2 million for full and intensive counseling using the patch. Life-years saved also discounted at 5 percent and not adjusted for quality improvements are slightly less than the number based on quality adjustments.

Summing across all the interventions suggests that roughly 2.63 million new quitters could be expected under the *Guideline*, assuming patients choose the various interventions in proportions expected by the panel experts and the literature. If realized, these new quitters could expect to enjoy 3.1 million more quality-adjusted life-years, discounted at 5 percent. The new quitters would slightly more than double the underlying 5 percent quit rate in the United States.

5.4 Cost-Effectiveness Results: Individual Interventions

Cost-effectiveness ratios were developed for each intervention scenario assuming that the entire population of smokers over the age of 18 would be willing to quit. We performed three separate analyses. First, we examined patients visiting their primary care clinician. Second, we analyzed the cost-effectiveness of providing smoking cessation interventions to hospitalized patients. Finally, we combined office visit patients and hospitalized patients into a single analysis.

5.4.1 Cost-Effectiveness Ratios for Office Visit Patients

Table 5-3 presents the cost-effectiveness results of each of the intervention scenarios. We assumed that

Table 5-3. Cost-Effectiveness of Smoking Cessation Provided in Physicians' Offices by Intervention, All Comers

Treatment	Minimal			Brief			Counseling			Individual Intensive Counseling			Group (10 Patients) Intensive Counseling		
	Alone	With Patch	With Gum	Alone	With Patch	With Gum	Alone	With Patch	With Gum	Alone	With Patch	With Gum	Alone	With Patch	With Gum
Total Screening Cost[a]	364,126	364,126	364,126	364,126	364,126	364,126	364,126	364,126	364,126	364,126	364,126	364,126	364,126	364,126	364,126
Total Advising Cost[a]	312,404	312,404	312,404	312,404	312,404	312,404	312,404	312,404	312,404	312,404	312,404	312,404	312,404	312,404	312,404
Total Motivation Cost[a]	234,303	234,303	234,303	234,303	234,303	234,303	234,303	234,303	234,303	234,303	234,303	234,303	234,303	234,303	234,303
Direct Intervention															
Total Direct Cost[a]	707,290	7,234,974	7,482,171	1,842,074	8,134,926	8,467,568	3,682,685	10,363,967	11,096,924	5,093,853	11,519,762	12,299,546	2,590,309	9,016,218	9,796,002
Cost per Capita	3.63	37.11	38.37	9.45	41.72	43.43	18.89	53.15	56.91	26.13	59.08	63.08	13.29	46.24	50.24
Cost per Smoker	14.51	148.42	153.50	37.79	166.89	173.71	75.55	212.62	227.65	104.50	236.33	252.32	53.14	184.97	200.96
Cost per Quitter	2,374.80	3,408.15	6,469.81	3,125.72	3,056.55	5,398.96	1,874.69	2,044.38	3,213.16	2,428.54	2,184.98	3,375.58	1,234.95	1,710.12	2,688.48
Aggregate Statistics															
Total Intervention Cost[a]	1,618,124	8,145,808	8,393,005	2,752,907	9,045,760	9,378,402	4,593,519	11,274,801	12,007,757	6,004,686	12,430,596	13,210,380	3,501,143	9,927,052	10,706,836
Marginal Quit Rate	0.0094	0.067	0.0365	0.0186	0.084	0.0495	0.062	0.16	0.109	0.0662	0.1664	0.115	0.0662	0.1664	0.115
Total Quitters	297,832	2,122,845	1,156,475	589,327	2,661,477	1,568,370	1,964,424	5,069,480	3,453,583	2,097,497	5,272,259	3,643,689	2,097,497	5,272,259	3,643,689
Total Cost per Quitter	5,433.01	3,837.21	7,257.40	4,671.27	3,398.77	5,979.71	2,338.35	2,224.05	3,476.90	2,862.79	2,357.74	3,625.55	1,669.20	1,882.88	2,938.46
Total Cost per Capita	8.30	41.78	43.05	14.12	46.39	48.10	23.56	57.83	61.58	30.80	63.75	67.75	17.96	50.91	54.91
Total Cost per Smoker	33.20	167.11	172.18	56.48	185.57	192.40	94.24	231.30	246.34	123.19	255.01	271.01	71.83	203.65	219.65
Cost per Life-Year Saved															
Undiscounted	1,168.66	825.40	1,561.09	1,004.81	731.09	1,286.25	502.99	478.40	747.89	615.79	507.16	779.87	359.05	405.01	632.07
3% Discount	3,716.64	2,624.98	4,964.68	3,195.55	2,325.05	4,090.63	1,599.63	1,521.44	2,378.49	1,958.39	1,612.89	2,480.19	1,141.88	1,288.05	2,010.16
5% Discount	5,083.10	3,590.08	6,789.99	4,370.42	3,179.88	5,594.59	2,187.75	2,080.82	3,252.97	2,678.41	2,205.89	3,392.05	1,561.70	1,761.62	2,749.21
Cost per Quality-Adjusted Life-Year Saved															
Undiscounted	1,065.45	752.50	1,423.23	916.07	666.52	1,172.66	458.57	436.15	681.84	561.41	462.37	711.00	327.34	369.25	576.25
3% Discount	2,731.75	1,929.38	3,649.07	2,348.75	1,708.93	3,006.64	1,175.74	1,118.27	1,748.21	1,439.43	1,185.49	1,822.95	839.28	946.73	1,477.48
5% Discount	4,568.38	3,226.54	6,102.43	3,927.87	2,857.88	5,028.07	1,966.22	1,870.11	2,923.57	2,407.19	1,982.52	3,048.57	1,403.56	1,583.23	2,470.82

[a]Costs are reported in thousands.

Note: Quitters were discounted at 35 percent to account for relapse.

all smokers visiting a physician's office during a period of 1 year would attempt to quit. The costs associated with screening all patients and advising and motivating all smokers to quit remain constant across all of the intervention scenarios. Only the intervention-specific direct costs and their corresponding quit rates vary.

The estimated total cost of providing the minimal intervention alone to all smokers is $1,618,124,000. Given a marginal quit rate of 0.9 percent and assuming that 35 percent of the quitters will relapse, the scenario generates a cost of $5,433.01 per quitter. Spread across the entire U.S. adult population, the minimal intervention scenario costs $8.30 per capita, or $33.20 per adult smoker. The direct intervention costs, which exclude the cost of screening, advising, and motivating patients, is $707,290,000. The cost per quitter of this portion of the minimal scenario is $2,374.80. This intervention costs $5,083.10 per year of life saved (discounted at 5 percent). When we adjust for quality of life, the cost drops to $4,568.38.

The remaining intervention scenarios include brief, full counseling, individual intensive counseling, and group intensive counseling. With the exception of group counseling, which provides counseling sessions to groups of 10 patients, as the amount of provider time required for an intervention increases, its costs do as well. The addition of nicotine replacement therapy increases intervention costs even further. The most costly intervention is individual intensive counseling with nicotine gum. It would cost over $13 billion to provide this intervention to all smokers, assuming they were willing. The cost of this intervention about 8 times greater than the total cost of the minimal intervention alone.

However, costs alone are of limited use in making economic decisions. Just as intervention costs increase with intensity, the marginal number of quitters increases, too. So while individual intensive counseling with gum costs over $13 billion, it is expected to generate over 3.6 million new quitters, assuming all smokers were willing to try this intervention.

The total costs per quitter ranged from a low of $1,669.20 for group intensive counseling without pharmacotherapy to $7,257.40 for minimal counseling with nicotine gum. When the cost of advising, screening, and motivating are excluded from the total costs, the direct intervention cost-effectiveness estimates range from a low of $1,234.95 per quitter for group intensive counseling alone to a high of $6,469.81 for minimal counseling with nicotine gum. Cost per life-year saved, discounted at 5 percent, ranged from $1,561.70 for group intensive counseling alone to $6,789.99 for minimal counseling with nicotine gum.

5.4.2 Cost-Effectiveness Ratios for Hospitalized Patients

The *Guideline* recommends that hospitalized patients receive smoking cessation interventions. We performed a separate analysis examining this population assuming that all smokers admitted to a short-term hospital would be willing to undergo an intervention. Our results are summarized in Table 5-4. The number of smokers who would receive an intervention in the hospital is much smaller than the population that would encounter a physician in an office setting, 6.9 million versus 48 million, so aggregate costs are lower.

When we assume that all patients receive an intervention, costs per life-year saved are slightly higher for the nonhospitalized patients versus hospitalized patients, reflecting the large number of patients who are repeatedly screened, advised, and motivated in the office setting. Among the hospitalized patients, the total intervention costs ranged from $142,390,000 for minimal counseling alone to $1,796,631,000 for individual intensive counseling with nicotine gum. However, group counseling alone generated the lowest cost per quitter, $1,373.92. Minimal intensive counseling with gum is the most costly intervention per quitter at $6,713.43. This translates to a cost of $1,298.01 per life-year saved (discounted at 5 percent) for group counseling alone and $6,342.49 for minimal counseling with gum.

5.4.3 Cost-Effectiveness Ratios for Office Visit and Hospitalized Patients Combined

Table 5-5 combines the interventions provided to office visit patients and hospitalized patients, analyzing each intervention individually. One of the challenges to studying the cost-effectiveness of the recommendations outlined in the *Guideline* is determining any overlap between the population of hospitalized smokers and the population of smokers who visit the office of a primary care clinician. If we simply combine the costs and effects of our hospital and physician office scenarios, we would be

Table 5-4. Cost-Effectiveness of Smoking Cessation Provided to Hospitalized Patients by Intervention, All Comers

Treatment	Minimal			Brief			Counseling			Individual Intensive Counseling			Group (10 Patients) Intensive Counseling		
	Alone	With Patch	With Gum	Alone	With Patch	With Gum	Alone	With Patch	With Gum	Alone	With Patch	With Gum	Alone	With Patch	With Gum
Total Screening Cost[a]	17,431	17,431	17,431	17,431	17,431	17,431	17,431	17,431	17,431	17,431	17,431	17,431	17,431	17,431	17,431
Total Advising Cost[a]	16,615	16,615	16,615	16,615	16,615	16,615	16,615	16,615	16,615	16,615	16,615	16,615	16,615	16,615	16,615
Total Motivation Cost[a]	8,308	8,308	8,308	8,308	8,308	8,308	8,308	8,308	8,308	8,308	8,308	8,308	8,308	8,308	8,308
Direct Intervention															
Total Direct Cost[a]	100,036	1,031,879	1,067,207	260,817	1,159,100	1,206,639	521,077	1,474,872	1,579,621	724,493	1,642,836	1,754,277	369,491	1,287,835	1,399,276
Cost per Capita	0.51	5.29	5.47	1.34	5.94	6.19	2.67	7.56	8.10	3.72	8.43	9.00	1.90	6.60	7.18
Cost per Smoker	2.05	21.17	21.89	5.35	23.78	24.75	10.69	30.26	32.41	14.86	33.70	35.99	7.58	26.42	28.71
Cost per Quitter	2,350.25	3,401.26	6,457.16	3,096.77	3,047.39	5,383.42	1,856.08	2,035.73	3,200.46	2,416.92	2,180.35	3,368.89	1,232.63	1,709.20	2,687.15
Aggregate Statistics															
Total Intervention Cost[a]	142,390	1,074,233	1,109,561	303,171	1,201,454	1,248,993	563,431	1,517,226	1,621,975	766,847	1,685,190	1,796,631	411,845	1,330,189	1,441,630
Marginal Quit Rate	0.0094	0.067	0.0365	0.0186	0.084	0.0495	0.062	0.16	0.109	0.0662	0.1664	0.115	0.0662	0.1664	0.115
Total Quitters	42,564	303,381	165,275	84,222	380,359	224,140	280,741	724,493	493,561	299,759	753,472	520,729	299,759	753,472	520,729
Total Cost per Quitter	3,345.31	3,540.87	6,713.43	3,599.66	3,158.74	5,572.38	2,006.94	2,094.19	3,286.27	2,558.21	2,236.57	3,450.22	1,373.92	1,765.41	2,768.48
Total Cost per Capita	0.73	5.51	5.69	1.55	6.16	6.41	2.89	7.78	8.32	3.93	8.64	9.21	2.11	6.82	7.39
Total Cost per Smoker	2.92	22.04	22.76	6.22	24.65	25.62	11.56	31.13	33.27	15.73	34.57	36.86	8.45	27.29	29.57
Cost per Life-Year Saved															
Undiscounted	700.95	741.93	1,406.69	754.25	661.86	1,167.60	420.52	438.80	688.58	536.03	468.64	722.94	287.88	369.91	580.09
3% Discount	2,300.27	2,434.74	4,616.23	2,475.17	2,171.99	3,831.63	1,380.00	1,439.99	2,259.68	1,759.06	1,537.89	2,372.41	944.72	1,213.92	1,903.64
5% Discount	3,160.48	3,345.23	6,342.49	3,400.77	2,984.21	5,264.49	1,896.06	1,978.48	3,104.70	2,416.86	2,112.99	3,259.59	1,298.01	1,667.87	2,615.52
Cost per Quality-Adjusted Life-Year Saved															
Undiscounted	681.64	721.48	1,367.92	733.46	643.62	1,135.42	408.93	426.71	669.61	521.26	455.72	703.01	279.95	359.72	564.10
3% Discount	1,794.71	1,899.62	3,601.65	1,931.16	1,694.61	2,989.49	1,076.69	1,123.50	1,763.03	1,372.44	1,199.88	1,850.99	737.09	947.12	1,485.25
5% Discount	3,020.00	3,196.54	6,060.58	3,249.61	2,851.57	5,030.50	1,811.78	1,890.54	2,966.70	2,309.44	2,019.07	3,114.71	1,240.32	1,593.74	2,499.26

[a]Costs are reported in thousands.
Note: Quitters were discounted at 35 percent to account for relapse.

Table 5-5. Cost-Effectiveness of Smoking Cessation, Physician's Office and Hospital Combined, by Intervention, All Comers

Treatment	Minimal			Brief			Counseling			Individual Intensive Counseling			Group (10 Patients) Intensive Counseling		
	Alone	With Patch	With Gum	Alone	With Patch	With Gum	Alone	With Patch	With Gum	Alone	With Patch	With Gum	Alone	With Patch	With Gum
Total Screening Cost[a]	381,557	381,557	381,557	381,557	381,557	381,557	381,557	381,557	381,557	381,557	381,557	381,557	381,557	381,557	381,557
Total Advising Cost[a]	329,020	329,020	329,020	329,020	329,020	329,020	329,020	329,020	329,020	329,020	329,020	329,020	329,020	329,020	329,020
Total Motivation Cost[a]	242,611	242,611	242,611	242,611	242,611	242,611	242,611	242,611	242,611	242,611	242,611	242,611	242,611	242,611	242,611
Direct Intervention															
Total Direct Cost[a]	706,245	7,232,884	7,480,081	1,839,635	8,131,443	8,464,085	3,677,460	10,357,697	11,090,654	5,090,369	11,516,278	12,296,062	2,589,613	9,015,522	9,795,306
Cost per Capita	3.62	37.10	38.36	9.43	41.70	43.41	18.86	53.12	56.88	26.11	59.06	63.06	13.28	46.24	50.24
Cost per Smoker	14.49	148.38	153.45	37.74	166.82	173.64	75.44	212.49	227.52	104.43	236.26	252.25	53.13	184.95	200.95
Cost per Quitter	2,371.29	3,407.17	6,468.00	3,121.59	3,055.24	5,396.74	1,872.03	2,043.15	3,211.35	2,426.88	2,184.32	3,374.62	1,234.62	1,709.99	2,688.29
Aggregate Statistics															
Total Intervention Cost[a]	1,659,433	8,186,072	8,433,269	2,792,823	9,084,631	9,417,273	4,630,648	11,310,885	12,043,842	6,043,557	12,469,466	13,249,250	3,542,801	9,968,710	10,748,494
Marginal Quit Rate	0.0094	0.067	0.0365	0.0186	0.084	0.0495	0.062	0.16	0.109	0.0662	0.1664	0.115	0.0662	0.1664	0.115
Total Quitters	297,832	2,122,845	1,156,475	589,327	2,661,477	1,568,370	1,964,424	5,069,480	3,453,583	2,097,497	5,272,259	3,643,689	2,097,497	5,272,259	3,643,689
Total Cost per Quitter	5,571.71	3,856.18	7,292.22	4,739.00	3,413.38	6,004.50	2,357.26	2,231.17	3,487.35	2,881.32	2,365.11	3,636.22	1,689.06	1,890.79	2,949.89
Total Cost per Capita	8.51	41.98	43.25	14.32	46.59	48.30	23.75	58.01	61.77	31.00	63.95	67.95	18.17	51.13	55.13
Total Cost per Smoker	34.04	167.94	173.01	57.29	186.37	193.19	95.00	232.04	247.08	123.98	255.81	271.81	72.68	204.51	220.50
Cost per Life-Year Saved															
Undiscounted	1,194.52	826.73	1,563.38	1,016.00	731.80	1,287.31	505.37	478.34	747.65	617.73	507.06	779.57	362.12	405.37	632.43
3% Discount	3,813.97	2,639.65	4,991.70	3,243.96	2,336.54	4,110.22	1,613.60	1,527.29	2,387.17	1,972.33	1,618.97	2,489.08	1,156.20	1,294.29	2,019.27
5% Discount	5,219.19	3,612.20	6,830.84	4,439.17	3,197.42	5,624.59	2,208.11	2,090.01	3,266.70	2,699.02	2,215.47	3,406.16	1,582.19	1,771.16	2,763.25
Cost per Quality-Adjusted Life-Year Saved															
Undiscounted	1,097.81	759.79	1,436.80	933.74	672.55	1,183.08	464.46	439.61	687.12	567.71	466.00	716.45	332.80	372.55	581.22
3% Discount	2,823.66	1,954.25	3,695.58	2,401.65	1,729.85	3,042.99	1,194.62	1,130.72	1,767.33	1,460.21	1,198.60	1,842.78	855.99	958.22	1,494.96
5% Discount	4,725.52	3,270.53	6,184.73	4,019.28	2,894.98	5,092.58	1,999.25	1,892.32	2,957.71	2,443.73	2,005.91	3,083.98	1,432.54	1,603.63	2,501.89

[a]Costs are reported in thousands.

Note: Quitters were discounted at 35 percent to account for relapse.

costing multiple interventions provided individual smokers and attributing more than one successful quit attempt to them.

According to the *Guideline,* all patients are screened during office visits and during hospitalization. Therefore, a patient may be screened more than once either because he/she visited a physician's office multiple times or visited a physician's office and was hospitalized. The *Guideline* indicates that continual screening is not necessary for adults who have never smoked or not smoked for many years, and for whom this information is clearly documented in their medical record. Our analysis makes the conservative assumption that all patients would require continual screening. Similarly, we assumed that individual smokers would be advised to quit in both office and hospital settings with health care clinicians repeatedly urging them to quit. Seventy-five percent of patients visiting a physician's office and 50 percent of hospitalized patients were assumed, initially, to be unwilling to quit and would receive a motivational message. We then assumed all smokers would undertake one intervention annually.

To calculate the combined cost of direct intervention provided to patients encountered in the physician's office and those encountered in an inpatient hospital setting, we subtracted the number of unique smoker admissions from the total population of smokers. We assumed that all hospitalized smokers would receive an initial intervention during their admission and would receive follow-up in a physician's office or be referred to a smoking cessation specialist. All other smokers would receive their initial intervention during the course of an office visit to their primary care clinician. Therefore, 6,966,275 smoking cessation interventions begin in the hospital, and 41,778,725 interventions begin in a physician's office.

Table 5-5 summarizes our analysis of the individual interventions, which combines ambulatory and hospitalized patients. Note that the total costs of screening, advising, and motivation include services provided in both physicians' offices and hospitals. Therefore, the costs are slightly higher than those in Table 5-3. Total intervention costs ranged from $1.7 billion for minimal counseling alone to 13.2 billion for individual intensive counseling with nicotine gum. The total direct intervention costs ranged from $706 million for minimal counseling alone to over $12 billion for individual intensive counseling with nicotine gum. Again, group intensive counseling alone generated the lowest cost per quitter, $1,689.06, and would cost $1,582.19 per life-year saved (discounted at 5 percent). Minimal counseling with gum costs $7,292.22 per quitter, more than any other intervention. This translates to a cost of $6,830.84 per life-year saved.

5.5 Overall *Guideline* Cost-Effectiveness Ratios

While analyzing the cost-effectiveness of each intervention scenario individually allows one to identify the relative economic value of each approach, these hypothetical constructs are unlikely to ever occur in actual medical practice. In reality, smokers vary in their willingness to undergo intensive interventions and use pharmacotherapies, and one would not expect the entire population of smokers (or willing-to-quit smokers) to select or be offered the same intervention option. Furthermore, the *Guideline* recognizes that a variety of smoking cessation approaches are effective and allows for patient willingness and, to a certain degree, provider discretion to influence intervention selection.

Table 5-6 combines all of the interventions into just three models. We assumed that all smokers would be willing to quit, but that this population would be distributed across all of the intervention scenarios based on smoker preferences. Intervention probabilities were used to determine the likelihood that a smoker would choose a particular scenario (see Section 4.4.1 in Chapter 4). We assumed that only 5 percent of smokers would select an intensive intervention, whereas 25 percent would choose a minimal intervention. Another 40 percent would be willing to receive a brief intervention, and the remaining 30 percent of willing smokers opt for counseling. In addition, we assumed that 75 percent of smokers making a quit attempt would be willing to use pharmacotherapy, and among these smokers, 5 times as many patients would chose the nicotine patch as nicotine gum. These probabilities were applied to the population of adult smokers to determine the number of smokers that would go through each intervention. Then, the cost of each intervention scenario was calculated as a weighted sum, as well as the number of new quitters that each would generate.

The total cost of providing all patients who visit a physician's office with the smoking cessation intervention of their choice is $8.1 billion. Most of this cost, $7.2 billion, is attributable to the direct intervention, while the remaining cost is associated with screening, advising, and motivation efforts. We estimate that this model would result in 2,630,288

Table 5-6. Cost-Effectiveness of Smoking Cessation, Combined Interventions

	Office Visit Patients	Hospitalized Patients	Combined Patients
Total Cost	8,034,047	1,056,715	8,072,870
Total Screening Cost	364,126	17,431	381,557
Total Advising Cost	312,404	16,615	329,020
Total Motivation Cost	234,303	8,308	242,611
Total Direct Intervention Cost	7,123,213	1,014,361	7,119,682
Total Quitters (18+)	2,630,288	375,901	2,630,288
Cost per Quitter	3,054.44	2,811.15	3,069.20
Cost per Capita	41.20	5.42	41.40
Cost per Smoker	164.82	21.68	165.61
Cost per Life-Year Saved			
Undiscounted	657.02	589.03	658.01
Discounted (3%)	2,089.49	1,932.98	2,100.94
Discounted (5%)	2,857.72	2,655.83	2,875.01
Cost per Quality-Adjusted Life-Year Saved			
Undiscounted	599.00	572.80	604.73
Discounted (3%)	1,535.79	1,508.14	1,555.42
Discounted (5%)	2,568.34	2,537.78	2,603.07

Notes: Costs are reported in thousands. Quitters were discounted by 35 percent to account for relapse. The Combined Patients model adjusts office visit interventions to avoid double counting. Life-years exclude adult quitters over 69 years old.

new quitters at a cost of $3,054.44 per quitter. The average cost per years of life-year saved ranged from $657.02 (undiscounted) to $2,857.72 (discounted at 5 percent). Adjusted for quality of the life, cost per life-year saved ranged from $599.00 (undiscounted) to $2,568.34.

Because there are far fewer smoker hospital admissions per year than smoker office visits, the total cost of providing an intervention to all hospitalized smokers is also less. It would cost slightly more than $1 billion to reach all smokers who experience an inpatient stay during a period of 1 year. Under this scenario, we estimate that there would be 375,901 new quitters, and the cost per quitter would be $2,811.15. The cost per years of life saved ranges from $589.03 (undiscounted) to $2,655.83 (discounted at 5 percent). And the cost per quality-adjusted life-year saved is $572.80 (undiscounted) and $2,537.78 (discounted at 5 percent).

The third intervention scenario estimates the total cost of providing patients who visit a physician's office and patients who are hospitalized with an intervention of their choice. The costs associated with screening, advising, and motivating patients are simply added. Total direct intervention costs assume that all hospitalized patients receive an intervention, but they are not provided with additional direct interventions in the office setting. The total direct cost of reaching all adult smokers is $8.1 billion, while the total direct intervention cost is $7.1 billion. Since the total number of quitters is based on the adult smoking population, this model would generate 2,630,288 new quitters, just as the office visit model did. However, the cost per quitter is slightly more under the physician-hospital combined model, $3,069.20, because smokers receive continual screening, advice, and motivation in both the office and hospital settings. The costs per life-year saved range from $658.01 (undiscounted) to $2,875.01 (discounted at 5 percent). Adjusted for quality, the costs per life-year saved range from $604.73 to $2,603.07.

5.6 Sensitivity Analysis

A series of one-way sensitivity analyses was performed to test several of our major assumptions. Recall that the results shown in Tables 5-3 through 5-6 test the sensitivity of our results to changes in the discount rate. Both measures of effectiveness, life-years saved and QALYs saved, were calculated

at the 0, 3, and 5 percent levels. The cost per life-year saved or QALY discounted at 5 percent was over 4 times greater than the undiscounted result. In addition to testing our results at different discount rates, we varied our assumptions concerning patients' willingness to quit, patient opportunity costs, the relapse rate, format preference, and screening.

5.6.1 Willingness to Quit

Our baseline analysis assumes that all smokers are willing to make a quit attempt. However, it is highly unlikely that all smokers would actually be willing to quit even after receiving an added motivational message. Therefore, estimates were calculated assuming that only 25 percent of ambulatory patients and 50 percent of hospitalized patients would be willing to try an intervention. First, each intervention was analyzed individually assuming that it would be provided to all smokers willing to quit. Cost per quitter ranged from $2,677 for group intensive counseling with the nicotine patch to $15,509 for minimal counseling alone. Cost per year of life saved (discounted at 5 percent) ranged from $2,508 to $14,528 for same interventions. Decisions probabilities were then used to combine the interventions into a single willing-to-quit scenario. The cost per quitter was $3,844, an increase of 25 percent over the all-comers scenario, and cost per life-year saved (discounted at 5 percent) increased to $3,601.

5.6.2 Patient Opportunity Costs

Our baseline analysis excluded patient opportunity costs. For certain smoking cessation interventions, the amount of patient time involved is small. For example, minimal counseling is offered during the course of a routine office visit with follow-up provided over the telephone. Therefore, travel time and intervention time associated with smoking cessation is trivial. However, treatments that involve more direct intervention time and one or more follow-up visits can have substantial patient costs. The most extreme example is group intensive counseling, which involves seven 1-hour sessions.

We performed an analysis to test the sensitivity of our results to the inclusion of patient opportunity costs. According to the Bureau of Labor Statistics, in 1995 the median weekly salary of full-time wage and salary workers was $479. We assumed an average work week was 40 hours long and calculated an average per minute patient opportunity cost of $0.20. For each intervention, we estimated patient travel and cessation counseling time. Travel time for initial visits was excluded because patients would have incurred its costs in the absence of the smoking cessation intervention. Patient time associated with the direct intervention and travel to follow-up or intensive counseling sessions was calculated assuming that patients would travel an average of 20 minutes (round-trip) for each visit. We estimated that minimal counseling would involve no patient opportunity costs, but that group intensive counseling, which involves the greatest amount of travel and direct intervention time, would cost each participant $112 in lost time that could be spent on other activities.

As the intensity of the interventions increase, they become more sensitive to patient opportunity costs. Group intensive counseling alone experienced the greatest change in cost per quitter rising from $1,689 when patient costs were ignored to $4,292 when they were included in the analysis, a $2,603 difference. Still, minimal counseling with nicotine gum, which involves no patient opportunity costs, remained the least cost-effective intervention. While interventions that involve large amounts of patient time become less cost-effective when patient opportunity costs are incorporated, they remain more cost-effective than minimal or brief counseling, which involve little patient time. Patient opportunity costs increase the cost per quitter of the overall *Guideline* by approximately 6 percent. Adding these costs into the analysis of combined interventions changed the cost per quitter from $3,093 to $3,278, a 6 percent increase.

5.6.3 Relapse

Our baseline analysis incorporated a relatively high relapse rate of 35 percent. This was applied to all smokers who remained abstinent after the 5-month follow-up period. To test the sensitivity of our original results, we calculated cost-effectiveness ratios assuming that only 10 percent of quitters would relapse. Cost per quitter ranged from $1,220 for group intensive counseling along to $5,266 for minimal counseling with nicotine gum. This translates to $1,143 and $4,933 per life-year saved. Combining the interventions using patient preferences generated a cost of $2,217 per quitter and $2,076 per life-year saved. These costs are 28 percent less than their baseline estimates.

5.6.4 Format

The baseline analysis assumes that only 5 percent of smokers would select intensive counseling if given an intervention choice. We tested the sensitivity of this assumption using revised decisions probabilities. We assumed that 10 percent of smokers would be willing to try an intensive intervention and, like the baseline scenario, we assumed that intensive counseling was equally distributed between individual intensive and group intensive counseling. We also assumed that 2.5 percent fewer patients would choose to undergo brief counseling and 2.5 percent fewer patients would select full counseling. We did not alter our assumption concerning preference for minimal counseling. The resulting cost per quitter was $3,019, only 1.6 percent less than our baseline estimate. Cost per life-year saved (discounted at 5 percent) decreased from $2,875 to $2,828.

5.6.5 Screening

A major cost of providing smoking cessation to the entire population is the cost of screening patients to determine their smoking status. Our baseline analysis assumed that all hospitalized and ambulatory patients over the age of 18 are screened for smoking status. And patients may be screened multiple times either because they both visit their physician's office and are hospitalized in a single year or because they visit their physician more than once during the year. So while the cost of a single screening is less then $1.00, the cost of screening the entire population each time they interact with the medical system is quite large, over $381 million. We altered our screening costs assuming that smokers would be screened multiple times in a single year and that nonsmoking adults would only be screened once during a physician office visit and once if they were hospitalized. This generated a total screening cost of $197,934,112. Analyzing the interventions individually resulted in costs per quitter that ranged from $1,602 to $7,133. Costs per year of life saved ranged from $1,500 to $6,682. Incorporating our baseline decision probabilities, the combined interventions generated a cost per quitter of $2,999 and a cost per life-year saved of $2,810, each 2 percent less than our baseline estimates.

6.0 Comparison of *Guideline* Cost-Effectiveness with Alternative Medical Interventions

6.1 Goals of Comparisons

The cost-effectiveness ratios presented in the last chapter are useful in evaluating the efficiency of certain smoking cessation interventions. While valuable, they are limited without external benchmark cost-effectiveness ratios. Relative to other medical interventions, all of the cessation interventions may be cost-effective and should be promoted. Another reason for comparing cessation intervention cost-effectiveness ratios with other medical interventions is the dependence of the cessation interventionist on patient preferences. Some patients will prefer the less cost-effective cessation intervention. This raises the question of whether such an intervention should be promoted by public policymakers.

This chapter provides several preventive and acute intervention cost-effectiveness ratios for benchmarking purposes. Section 6.2 discusses the methodological challenges to making such comparisons. Section 6.3 provides tables of comparisons. The last section summarizes the implications of the comparisons for the cost-effectiveness of the AHCPR *Smoking Cessation Guideline*.

6.2 Methodological Challenges

Literally thousands of cost-effectiveness analyses of health-related interventions exist in the literature. Making comparisons, however, is complicated because of differences in study methods.

Differences in Perspective. Studies differ in their perspective, whether the perspective is that of society, payer, provider, or patient. This has direct impacts on the kinds of costs and benefits that are included. The *Guideline* cost-effectiveness analysis takes a generally societal perspective in the sense that resource costs are usually imputed rather than based on insurer claims. Claims-based analyses will often exclude uncovered services.

Inconsistent Measurement of Costs. Studies differ in how they value resources used in an intervention. These variations have already been demonstrated in Chapter 2 of this report. At the most fundamental level, studies differ in the time period used for valuing inputs. Smoking cessation studies go back to the 1970s, hence requiring adjustments for inflation. At least for physician services, we have used Medicare payment levels. These are considerably lower than charges, which are often used in other studies. We believe Medicare rates are more accurate measures of what the physician actually is willing to receive in order to provide the service.

Whether the extra costs of medical care in future years should be included is controversial. Some argue that medical costs avoided should be used to offset intervention costs early, while the extra medical costs associated with a longer life should be considered an add-on to costs. Others argue that such a definition of costs is too narrow and biases the results against life-extending interventions.

Varying Discount Rates. Results in this report and other studies indicate that the choice of discount rate is one of the most important variables in conducting a cost-effectiveness analysis of any preventive intervention that generates most of its benefits well into the future. Indeed, discounting at 5 percent vs. no discounting can reduce expected gains by a factor of 5 for younger age groups who quit smoking.

Differing Populations Affected. Smoking cessation interventions affect the entire population of smokers, who are distributed somewhat randomly across the U.S. population (although some differences exist in the characteristics of smokers, e.g., gender, education). Other interventions (e.g., mammography) affect only women, children (e.g., polio immunization), or some special group. Generally, the more targeted the group with a specific illness or high incidence of disease, the more cost effective an intervention will be. Targeting hypertension screening to younger men, for example, is less cost effective than targeting older men.

Preventive Versus Acute Interventions. Preventive interventions, including smoking cessation programs, may not be cost effective because so many persons receiving the intervention are healthy with low likelihood of contracting the illness in question. Performing cardiac angioplasty on men with severe angina, by contrast, may be cost effective simply because the intervention is targeted only to the symptomatic group. If smoking cessation could be targeted to only those who would eventually contract one of the smoking-related diseases, it would show a lower (and better) cost-effectiveness ratio.

No benchmark cost-effectiveness comparisons of different interventions can ever overcome all of these differences. Tengs, *et al.* (1994) have reviewed and made adjustments to 500 life-saving interventions for inflation (all costs are expressed in 1993 dollars), discount rate (all findings converted to 5 percent discount rate), exclusion of indirect costs, and consistent effectiveness measure (years of life saved). The studies shown below have been taken from Tengs with these adjustments, making them more comparable to the ratios derived from the *Guideline*. The one point of difference concerns the treatment of net medical costs, which Tengs' group generally tries to include. Costs avoided or incurred in future years due to smoking cessation have not been included in our cost-effectiveness analysis of the *Guideline* because they tend to be more speculative and are biased against life-extending interventions. We agree with Warner (1982) that if net social costs are to be included, they should include more than simply medical costs. The impact of excluding these costs in the cessation cost-effectiveness ratios is to bias them upwards versus other studies that include them. This is because smoking cessation is a net saver of future medical expenditures (see the discussion of Hodgson's recent study in Chapter 2). Were net medical costs to be included, the cost-effectiveness ratios for smoking cessation would be even lower.

6.3 Comparison of Cost-Effectiveness Ratios

Table 6-1 presents comparative cost-effectiveness ratios for 10 preventive and acute medical interventions along with the overall global cost-effectiveness ratios for the AHCPR *Smoking Cessation Guideline*. The interventions have been selected to show a range of cost-effectiveness across a wide variety of different medical interventions. They range from less than $0 to over $100,000. Polio immunization is a case where the net medical costs in the future dominate short-run vaccination costs. Conversely, using antihyperlipemic drug therapy in reducing the risk of coronary heart disease cost $102,033 per discounted year of life saved for men aged 35-39 with significantly elevated cholesterol levels. This high cost is due primarily to the fact that the lifelong treatment would only result in 0.60 extra years of life (Oster and Epstein, 1987).

Several well-targeted prevention strategies show very low cost-effectiveness ratios, including a one-time screening for cervical cancer for women over age 64 ($2,053), and a pneumonia vaccination for people over age 64 ($1,769). Other screening strategies targeted at younger age groups cost considerably more, including an annual mammography for women aged 40-49 ($61,744) and hypertension screening for men age 40 ($23,335). By contrast, coronary bypass surgery or angioplasty appear more cost effective, again because they are targeted to the subset of at-risk patients who actually develop ischemic heart disease.

Two cost-effectiveness ratios for the *Smoking Cessation Guideline* are given at the bottom of Table 6-1. They are based on the expected preference of smokers for one of the many cessation interventions, assuming all smokers undertake an intervention once during the year. Life-years saved have been discounted 5 percent and presented unadjusted and adjusted for quality-of-life gains. The resulting cost-effectiveness ratios are highly favorable relative to most other medical interventions. They also confirm Eddy's (1992) treatment of smoking cessation as the gold standard by which all other screening tests can be compared. They are all the more remarkable in that the *Guideline* is not targeted to any one population group. Were the *Guideline* applied only to smokers under age 30, for example, the costs per life-year saved would be much lower.

Also shown below the two average cost-effectiveness ratios is the range of cost-effectiveness across the various cessation interventions. On a discounted life-year basis, intensive group counseling would cost only $1,582 without using nicotine replacement as adjunct therapy. At the other extreme, minimal physician counseling using nicotine gum as adjunct therapy would cost $6,831 per discounted life-year saved. Although more than 5 times more costly per life-year than intensive group counseling, minimal counseling with gum is still more cost-effective than most preventive interventions except those well-targeted to high-risk groups (Tengs, 1994).

6.4 Conclusions

Summarizing the results from the last two chapters, full implementation of the *Guideline* could cost as much as $8 billion annually, including $1 billion in screening, advising, and treating hospitalized smokers. For this investment, society could expect to gain 2,630,288 new quitters over-and-above the baseline 5 percent quit rate. These quitters could expect to enjoy 5.2 million extra quality-adjusted life-years, even after discounting

Table 6-1. Comparison of Smoking Cessation Cost-Effectiveness Ratios with Other Medical Interventions

Intervention	Source	Cost-Effectiveness Ratio
Selected Interventions		
Beta-blockers for low-risk myocardial infarction survivors	Goldman, et al. (1988)	$16,897
Annual mammography & breast exam for women 40-49	Eddy, et al. (1988)	$61,744
One-time cervical cancer screening for women age 65+	Fahs, et al. (1992)	$2,053
Polio immunization for children age 0-4	Sisk, et al. (1983)	<0
Cholestyramine/low cholesterol diet (versus diet) for men aged 35-39 & 290/dL	Oster, et al. (1987)	$102,033
3-vessel coronary artery bypass graft surgery (versus medical management)	Weinstein, et al. (1980)	$12,350
Hypertension screening for asymptomatic men age 40	Littenberg, et al. (1990)	$23,335
PTCA (versus medical management) for men age 55 with severe angina	Wong, et al. (1990)	$7,395
Pneumonia vaccination for people age 65+	Sisk, et al. (1983)	$1,769
Intervention	**Effectiveness Measure**	**Cost-Effectiveness Ratio**
AHCPR *Smoking Cessation Guideline*		
Combined Cessation Interventions	5% Discounted Life-Years	$2,875 ($1,582-$6,831)
	5% Quality-Adjusted Life-Years	$2,603 ($1,433-$6,185)

by 3 percent. No analysis was done of how these years would fall within smokers' productive lifetimes, but certainly many quitters would enjoy more productive years on the job.

For approximately $2,600, society could generate an extra year of quality-adjusted life if it could entice smokers, and their health practitioners, to follow the *Guideline*. This cost could be as low as $1,555 if a 3 percent discount rate were used.

Finally, the more intensive the cessation intervention, the lower the cost per year of life saved, suggesting that greater spending on interventions yields more net benefit. While all interventions seem a reasonable societal investment, those involving more intensive counseling and the nicotine patch as adjuvant therapy are particularly meritorious.

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