9. Pregnancy and Postpartum Smoking Cessation

Introduction

For female smokers and their partners, pregnancy represents an opportunity to re-evaluate lifestyles and a variety of health behaviours, including smoking. Most women smokers in industrialized countries are aware of health warnings about the serious consequences of cigarette smoking during pregnancy for the health and well-being of the newborn child.\textsuperscript{1–3} Smoking and smoke exposure during pregnancy have important deleterious effects on the fetus and on the baby at birth and throughout his or her early development, including miscarriage, stillbirth, placental abruption, placenta previa, low birth weight, cognitive impairment, and risk of death from certain conditions such as sudden infant death syndrome (SIDS).\textsuperscript{4,5} Children living in homes where the mother and/or father continues to smoke during the postnatal and early childhood period are at greater risk for respiratory illnesses, middle-ear infections, and reduced lung growth.\textsuperscript{6–9} A 2001 study\textsuperscript{10} estimated that 27% of children in the United States 6 years of age and younger lived with smokers. Additional risks are death and injury resulting from fires caused by cigarettes, exacerbation of asthma, and accidental poisonings from ingestion of cigarettes or other tobacco products.\textsuperscript{11,12}

Birth asphyxia caused 23% of neonatal deaths worldwide in 2004, while low birth weight (primarily due to prematurity) caused 31% of neonatal deaths.\textsuperscript{13} Clearly, these two causes of death reflect not only maternal cigarette smoking but also the many other factors contributing to premature birth and asphyxia. However, studies on risks of smoking during pregnancy indicate that a significant percentage of these deaths is attributable to smoking by the mother and others in the family environment.\textsuperscript{14,15} Studies from laboratories around the world are exploring the physiological mechanisms linking smoking exposure during pregnancy to adverse neurodevelopmental effects that occur well into adulthood.\textsuperscript{9} Detrimental effects are caused by exposure to carbon monoxide (CO), tar, benzene, and heavy metals, as well as by nicotine, the addictive substance in tobacco products that affects gestation and can cross the placenta to directly affect fetal tissue. In their review of the animal and human research on smoking during pregnancy and fetal outcomes, Shea and Steiner\textsuperscript{9} concluded that these negative consequences “involve a cascade of events causing not only dysregulation of the nicotinic and muscarinic, but also the catecho-laminergic and serotoninergic neurotransmitter systems”. A deeper understanding is needed of how smoke exposure in utero affects long-term regulation of behaviour, emotions, and attention.\textsuperscript{9,15}

Because smoking during pregnancy and in the postpartum period has serious consequences for children, smoking cessation by women and their partners during the prenatal, perinatal, and postnatal periods offers multiple, significant benefits. Those benefits have been demonstrated in numerous studies showing that smoking cessation interventions significantly reduce the frequency of low birth weight, increase mean birth weight, and reduce the frequency of pre-term births.\textsuperscript{16} There is also evidence of a dose-response relationship between numbers of cigarettes smoked during pregnancy and low birth weight.\textsuperscript{17–19} Thus, a significant reduction (usually more than 50%) in smoking and the resulting decrease in exposure during pregnancy can significantly increase birth weight.\textsuperscript{20}

Over the past 20 years, numerous clinical trials and observational studies in the United States, the United Kingdom, Europe, Australia, Sweden, and other countries have demonstrated the effectiveness of smoking cessation interventions early in pregnancy.\textsuperscript{16,17,19,21–29} Other studies have highlighted the cost-effectiveness of such prenatal and perinatal interventions in terms of birth outcomes.\textsuperscript{30,31} Moreover, interventions in paediatric settings that target new mothers who continue to smoke or relapse to smoking during the postpartum period have begun to demonstrate modest success,\textsuperscript{32,33} although efficacy is not well established. Finally, intervention studies are beginning to target partners who smoke and to include fathers in family interventions.\textsuperscript{34–37} Studies of smoking cessation in the context of pregnancy and the birth of a child have yielded important information about the course and process of smoking cessation during pregnancy and the postpartum period.\textsuperscript{38,39}

This chapter outlines conceptual and practical considerations for smoking cessation with regard to pregnancy and infancy. It reviews recent literature and highlights the multiple opportunities to intervene during the entire period prior to, during, and after pregnancy. It also describes what is known about smoking cessation...
and pregnancy and discusses ways to promote effective, evidence-based strategies throughout and after pregnancy to create smoke-free families.

**Smoking During Pregnancy**

Pregnant smokers constitute a subset of a larger population of female smokers of childbearing age. Demographic characteristics of this group vary from country to country. Epidemiological data provide insights into characteristics of pregnant women who smoke and into the subpopulations at risk for the consequences of smoking during pregnancy and in the postpartum period. Age-standardized estimates from the *WHO Report on the Global Tobacco Epidemic, 2009* indicate that the current prevalence of tobacco smoking among female adults ranges from less than 1% in countries such as Algeria and Morocco and less than 5% in Armenia, Bahrain, Chad, China, the Congo, Guatemala, Thailand, and Uganda to over 20% in Belgium, Germany, Iceland, Ireland, Israel, Latvia, Spain, and Uruguay and over 30% in Bosnia and Herzegovina and Chile. The prevalence rate in the United States is 19.0%. The wide range of prevalence indicates a need for targeting by national and international smoking control agencies to maximize the impact and cost-effectiveness of their efforts.

In some subpopulations, smoking rates may be higher among younger women of childbearing years than in the general population; thus, total population rates may underestimate the true prevalence of women at risk for smoking during pregnancy in countries where subpopulations may also smoke at higher or lower rates because of their particular determinants of smoking. For example, in the United States, the prevalence of smoking during pregnancy is particularly high among Caucasian women in the lower socioeconomic strata of society. Among Afro-American, Hispanic, and Asian populations of women, cigarette smoking is generally less prevalent across all age ranges, with few exceptions. Knowledge of smoking rates and prevalence among subpopulations of women of childbearing age can inform strategies for creating targeted anti-smoking advertising and other programmes.

For effective intervention, we need to understand why rates of initiation are highest and rates of cessation lowest among certain subgroups of women smokers. First, younger smokers tend to be less worried about the long-term health effects of smoking and are more vulnerable to the advertising of the tobacco industry, which focuses on different themes depending on the age of the target population. Brands for younger women stress freedom, camaraderie, independence, and self-confidence and feature young women as smokers; brands for older women stress weight reduction, relaxation, and needs for pleasure. This is elaborated in the chapter in this monograph on global perspectives on the marketing of tobacco to women. Second, women appear to seek some unique consequences of smoking (e.g., weight and affect management) that make smoking part of their way of coping with life and increase their dependence on nicotine. Some of these factors are particularly salient for pregnant women. Third, younger women in many cultures have multiple demands and stressors related to performing the competing roles of mother, homemaker, and employee. For some women of childbearing age, smoking becomes a stress-coping strategy that can assist them in asserting independence, managing negative emotions, and providing weight management, as well as creating a particular image. Fourth, many women who smoke are influenced by support systems that encourage nicotine use, and they are often surrounded by smokers in their social networks.

Younger women who decide to smoke in the context of the current anti-smoking climate and social norms constitute a subgroup of the population that may not be affected by simple educational interventions and is therefore probably resistant to quitting. This group’s motivations for smoking need to be better understood, particularly in countries where smoking is increasing among youth and specifically among young women. Interventions are needed that are based on a better understanding of the needs and perspectives of young women to interfere with the initiation of tobacco dependence and to be effective in promoting cessation. Interventions to reach these at-risk women even before they become pregnant represent the most effective strategy to prevent smoking during pregnancy. However, the interventions will have to be potent and multifaceted and will have to include comprehensive approaches that range from protective and restrictive policy interventions to prevention and cessation efforts as outlined in the WHO Framework Convention on Tobacco Control (WHO FCTC).

There are multiple points of entry and targets of intervention for control of smoking during pregnancy. Ruggiero et al. screened a group of low-income pregnant
women (n = 1105) who were ever-smokers. Of this group, 22% quit before they became pregnant, 27% quit after becoming pregnant, and 52% were smoking on entry into prenatal care. Table 9.1 offers a view of smoking during pre-pregnancy, pregnancy, and postpartum periods and interventions to be considered. In addition to reducing risks for babies, interventions should focus on the health and well-being of the mother, the father or partner, and the extended family. It is critical to search for teachable moments throughout the lives of smokers and to use them to promote cessation.  

**Pre-Pregnancy Quitters**

Women smokers of childbearing years follow a number of different paths in managing their smoking as they anticipate becoming pregnant. Some women consider the option of stopping smoking and modifying other behaviours that increase risks to becoming and staying pregnant. This group usually consists of women who anticipate pregnancy or who have already created plans and expectations that when they become pregnant, they will stop smoking either permanently or, at the very least, for the duration of the pregnancy. This level of concern, planning, and forethought is a positive indicator for successful cessation of smoking during pregnancy but does not ensure sustained cessation. Although the actual number of women who quit smoking prior to becoming pregnant is not known, anecdotal and observational data indicate that many women stop smoking prior to becoming pregnant or while trying to become pregnant. Self-reported rates of smoking on entry to obstetric care are generally lower than overall population rates. In the early 1990s, when the smoking rate of the female population in the United States was

<table>
<thead>
<tr>
<th>Smoking Status</th>
<th>Interventions</th>
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<tbody>
<tr>
<td>Smokers (age 15–45)</td>
<td>Use policy and interventions to promote pre-pregnancy quitting.</td>
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<tr>
<td>Early-pregnancy smokers</td>
<td>Promote early first-trimester cessation.</td>
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<td></td>
<td>Offer cessation help (5 As) in obstetric care.</td>
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<tr>
<td>Early-pregnancy quitters</td>
<td>Provide support to sustain cessation during pregnancy and postpartum.</td>
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<tr>
<td></td>
<td>Promote spouse and family quitting and exposure reduction.</td>
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<tr>
<td></td>
<td>Shift motivation to include mother, not just baby.</td>
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<tr>
<td>Late-pregnancy smokers</td>
<td>Provide intensive interventions to promote cessation.</td>
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<tr>
<td></td>
<td>Support reduction even late in the pregnancy.</td>
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<tr>
<td></td>
<td>Involve the family in protecting the fetus and preparing for the baby.</td>
</tr>
<tr>
<td>Pregnancy quitters</td>
<td>Engage family and spouse smokers to quit.</td>
</tr>
<tr>
<td></td>
<td>Offer relapse prevention immediately postpartum.</td>
</tr>
<tr>
<td>Continuing smokers</td>
<td>Prevent return to pre-pregnancy levels.</td>
</tr>
<tr>
<td></td>
<td>Provide interventions during paediatric visits.</td>
</tr>
<tr>
<td></td>
<td>Promote smoke-free home policies.</td>
</tr>
<tr>
<td>Postpartum relapsers</td>
<td>Support recycling and cessation.</td>
</tr>
<tr>
<td></td>
<td>Highlight protection and smoke-free policies.</td>
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There are two challenges for designing interventions that target women who stop smoking immediately prior to becoming pregnant: promoting pre-pregnancy quitting, and supporting cessation throughout pregnancy and preventing relapse during the difficult postpartum period. Strategies to promote pre-pregnancy smoking cessation among women of childbearing age include creating and displaying media messages that highlight the links between smoking during pregnancy and fetal health; demonstrating how smoking can adversely affect fertility and how cessation can prevent loss of the fetus; and emphasizing the long-term neurodevelopmental effects of smoking on the child. Another important strategy would be to engage medical and other professionals who have regular contact with pre-pregnancy smokers to promote smoking cessation. The smoking cessation guidelines calling for 5 As (Ask, Advise, Assess, Assist, and Arrange for follow-up) should be used in office practice. Emphasis should be given to the benefits of cessation before women become pregnant. This type of message could have a particularly strong impact in more-industrialized countries where women often have careers outside the home and delay pregnancy until they are older and consequently have concerns about fertility. In countries where access to obstetric and gynaecological medical care may be limited and where childbirth may be less medicalized, other providers, such as midwives, elders, and indigenous health-care providers, should be trained to promote quitting smoking before pregnancy.

The challenge of preventing relapse must be addressed by the health-care providers who look after women during pregnancy. When women who have quit smoking prior to their pregnancy come to the first prenatal visit, they are likely to report that they do not smoke. Unless a full smoking history is obtained, these women are likely to be considered as either never-smokers or former smokers and therefore are not counselled about the need to avoid re-starting smoking, although they are highly vulnerable to doing so. This group has not been well studied, as the women are usually not identified and included in pregnancy smoking cessation studies and are not followed by researchers. However, they seem more conscious of health risks of smoking both for themselves and for their babies and are often committed to becoming smoke-free not only for the pregnancy but for their entire life. Pre-pregnancy quitters typically sustain cessation throughout the pregnancy and postpartum period. Nevertheless, depending on the strength of the smoking habit and the depth of their motivation to quit, these women are vulnerable to a return to smoking, particularly if they experience a stressful event or a shift in environmental support during or after the pregnancy. Although interventions and services for women who quit before pregnancy are clearly a lower priority than interventions and services for those who continue to smoke during pregnancy, a comprehensive approach to smoking cessation in pregnancy should recognize that these women have greater risks from smoking than never-smokers have, and they may need support to prevent postpartum relapse.

**Newly Pregnant**

**Spontaneous Quitters**

Another group of women smokers quit smoking upon learning that they are pregnant or soon after, usually during the first trimester of pregnancy. They have been called “spontaneous quitters”, and most are highly motivated to protect their babies from tobacco smoke. They quit primarily for the health and welfare of the baby and often only secondarily for themselves. These women who stop smoking “spontaneously” or without a formal intervention generally have higher socioeconomic status (SES) and educational attainment than those who do not stop. In fact, there are often dramatic differences between the spontaneous quitters and the pregnant women who continue to smoke. Race, educational level, income, and employment status are primary characteristics on which the spontaneous quitters differ from those who continue to smoke. For example, in the United States, less-educated, lower-SES, Caucasian, unemployed women who are more dependent on nicotine have the greatest risk of continued smoking during pregnancy. In addition, the strength of nicotine addiction, measured by years of smoking and level of cotinine (a specific nicotine metabolite) in the body, is a predictor of whether a woman will continue smoking or will quit. Finally, partner smoking is another important factor that influences whether a woman will quit spontaneously. Spontaneous quitting or stopping smoking for the welfare of the baby usually happens early in the pregnancy and thus offers significant protection for the fetus. Therefore, women of childbearing age who become pregnant need to be reached with warnings and messages...
about the risks of smoking and the benefits of cessation. Depending on the methods for confirming pregnancy in various societies, messages could be delivered during pregnancy testing or during any contact or conversations with extended family or other pregnancy support systems, such as midwives.

In each country, detailed information should be gathered about spontaneous quitters and the motivations that enable them to stop smoking for extended periods of time, in order to understand the cultural forces and values that will promote early-pregnancy quitting. It should be noted that pregnant women in family-oriented cultures with involvement of extended families in the pregnancy often have lower smoking rates. Cultural factors may include values and pressures that promote spontaneous quitting. Cultural sensitivity is critical in accessing the decisional factors that have the personal relevance and cultural support to tip decision-making towards change of an addictive behaviour.

Most spontaneous quitters (80% to 85%) are able to maintain cessation of smoking throughout the pregnancy. However, the majority of these women return to smoking during the postpartum period at rates that are high, considering the extended period of abstinence from cigarettes they have experienced. Their rates of return to smoking by 6 months after the birth of the baby exceed 50% and can be as high as 80%; the relapse rate may be higher among the lower-SES mothers who were able to stop smoking during the pregnancy.

In a 1996 study of return to smoking, researchers examined process-of-change variables (decisional balance, self-efficacy, and processes of change) among a group of women in Texas who quit smoking early in their pregnancies and compared them with those of women who were not pregnant but were in the process of quitting smoking. They found that many of the pregnant women were not actually quitting smoking but appeared to be simply stopping or suspending their smoking for the duration of the pregnancy. When compared with non-pregnant women who were in various stages of change in the process of quitting smoking, the pregnant women who stopped smoking in early pregnancy looked like non-pregnant women smokers who were in earlier contemplation or preparation stages of change and were not similar to the non-pregnant women in the action stage of smoking cessation. Many women who stop smoking while pregnant suspend their smoking to provide protection for the fetus and are not engaged in intentionally quitting smoking for the rest of their lives. The lack of action-oriented cessation coping activities during the period of pregnancy may explain the very high relapse rate in the first 6 months of the postpartum period.

The challenge for tobacco control is to prevent the postpartum return to smoking of these spontaneous quitters by shifting motivational considerations from an almost exclusive focus on protecting the baby to greater consideration of cessation for the health and well-being of the mother. This shift from more extrinsic to intrinsic considerations might increase specific cognitive and behavioural process activity during the last trimester of pregnancy and, most important, in the transition between pregnancy and the postpartum period. Stotts et al. found that by asking spontaneous quitters during their pregnancy about their postpartum goal related to cigarette smoking (to never smoke again, to smoke occasionally, or to return to smoking after breastfeeding) and about their self-efficacy to remain abstinent postpartum, they were able to predict the rate of return to smoking after the birth of the baby. Most smoking cessation programmes and efforts to stop smoking during pregnancy, however, do not address the needs of spontaneous quitters. The smoking status of spontaneous quitters, like that of women who are pre-pregnancy quitters, is often ignored after the initial obstetric visit. These women receive few or no services to support cessation or to prevent relapse in the postpartum period. At the very least, relapse prevention services should be offered to these women at the beginning of the postpartum period. A significant number of them resume smoking within 2 to 3 months (-45%) or 6 months (60 to 70%) postpartum or after they have stopped breastfeeding.

Women Who Continue To Smoke During Pregnancy

Women who continue to smoke during pregnancy pose a challenge different from that of women who quit spontaneously either while preparing for pregnancy or upon learning that they are pregnant. The pregnant women who continue to smoke may differ substantially in socioeconomic characteristics from both those who stop and those of childbearing age generally.
numbers of pregnant women who continue to smoke come from the subgroup of addicted smokers that includes lower-SES women smokers with fewer resources and more psychosocial problems, although this profile may vary by country. These continuing smokers may have multiple and complex problems, in addition to nicotine addiction. They tend to have more psychological and emotional problems, less social support and financial resources, more family problems, and less residential stability than those who stop smoking. Pregnancy is an additional stress producer because of the multiple problems these women already have, and smoking, for them, is a perceived stress reducer. Women who continue to smoke throughout a pregnancy also typically live in more smoke-filled home environments. Reaching pregnant women who continue to smoke with sustained, effective interventions that address the complicated context of their real-life problems has been a significant challenge.

Although difficult, it is not impossible to persuade women who continue to smoke even after they discover that they are pregnant to quit. In fact, there is ample evidence that a significant number of women can be helped to quit smoking early in pregnancy with effective, low-intensity interventions. The literature strongly supports the efficacy of 5- to 15-minute cessation counselling sessions delivered by trained providers and accompanied by pregnancy-specific self-help materials. These brief interventions are significantly more effective than simple advice in increasing cessation rates of pregnant smokers. A meta-analysis showed a summary risk ratio (weighted by the precision of each study’s risk ratio) of 1.7 (95% CI = 1.3, 2.2) for successful cessation during pregnancy, an average improvement in cessation of 70% over standard practice; the confidence interval suggests that the outcome (cessation) was at least 30% higher in the treated groups than in the untreated groups. Studies included in this meta-analysis came from the United States, the United Kingdom, Sweden, Australia, and Canada. Moreover, there was a dose-response relationship, with contact time ranging from a half hour to an hour and a half. However, more-intensive periods of contact provided no additional benefit. A brief intervention strategy was least successful with more-dependent or addicted smokers.

Similar results have been highlighted in other reviews. Lumley et al., in their Cochrane Collaboration review of interventions that promote smoking cessation in pregnancy, examined 64 trials that included 51 randomized control trials and six cluster-randomized trials with more than 28,000 participants. The smoking cessation intervention trials with cessation validated biochemically showed a significant reduction in smoking, with a relative risk (RR) of 0.94 (95% CI = 0.92, 0.95). Two trials that used reward plus social support achieved a greater smoking reduction than the others, resulting in a relative risk of 0.77 (95% CI = 0.72, 0.82).

Brief interventions early in pregnancy (less than 20 to 24 weeks) have helped women to quit smoking and thus have increased the pool of early-pregnancy quitters. Some interventions are based on the clinical practice guidelines promulgated by the Agency for Health Care Policy and Research. These guidelines include a 5-step process that should be used in all health-care settings to the extent possible (see Table 9.2). The steps can be completed in five to 10 minutes in the health-care provider’s office prior to or during pregnancy. Ask, the first step, includes checking on smoking status to determine if the pregnant woman is a never-smoker, quit before finding out she was pregnant, stopped after learning about the pregnancy, reduced her smoking during the pregnancy, or smoked about the same before the pregnancy as she does now. Assessment of readiness and motivation to quit follows firm but empathetically delivered Advice that emphasizes the fact that it would be in the best interest of the woman and the developing child for her to quit smoking. The Assist step usually connects the smoker with resources to choose from, including self-help materials specifically tailored for pregnant women and their families, nicotine replacement or other pharmacological aids (when medically appropriate), and referral to groups of other types of cessation programmes, quit lines, or other specific intervention, depending on the needs and requests of the smoker. Arranging for some type of follow-up and checking on progress over time is the critical last step in this intervention. These components have been determined to be helpful and to increase cessation among both the general population of smokers and pregnant women smokers.

These interventions are also cost effective. Windsor et al. have demonstrated the effectiveness of brief, well-executed interventions that use medical advice, videos, and self-help materials. They estimated that the cost of delivering a brief intervention on a large scale would be approximately US$ 6.00 per pregnant smoker in year 2000 dollars. According to their estimates, the cost–benefit ratio for an intervention that achieved a 15% smoking...
cessation rate, compared with the 5% cessation rate of usual practice, would be US$ 11 in savings for each US$ 1 of investment although the costs of the programme and the savings from preventing the expenses for care of low-birth-weight babies would vary by country. The evidence shows that a brief, empirically supported intervention can have low delivery costs and can yield significant benefits, not only for the child and his or her family but for the entire health-care system.3

A number of countries have implemented national programmes that are based on the demonstrated efficacy of brief interventions and that combine pregnancy interventions with policy initiatives and other types of incentives and programmes for pregnant smokers. A 2005 conference highlighted these efforts in the United Kingdom, New Zealand, and Sweden. In some programmes, midwives deliver cessation messages, often during home visits, while in others, the messages are delivered by the physician or nurse in the health-care setting. Most programmes include a variety of resources for women smokers, such as free or low-cost pharmacotherapy, access to telephone counselling through quit lines, self-help materials specifically tailored to women or more specifically to pregnant women, and, at times, more-intensive smoking cessation group or individual treatment. Comprehensive programming offers the potential for synergy of effects. However, if resources are limited, introduction of a brief health-care-provider-based intervention that can reach the majority of women smokers should be the first priority for a community or nation to reduce the risks of tobacco exposure during pregnancy.

Later-Pregnancy Continuing Smokers

Cessation is very difficult for pregnant women who continue to smoke up to the third trimester, and they are not responsive to minimal interventions. Promoting cessation is even more difficult with women who have already had a child and smoked during the first pregnancy. These multiparous smokers typically believe that the harm of smoking is exaggerated because of their personal experiences of “successful” pregnancies while smoking, even if the previous children had low birth weight. In the Birmingham Trial II study, none of the women recruited between 24 and 32 weeks of gestation quit or significantly reduced their smoking. More-dependent, heavier smokers have a greater probability of continuing to smoke, while light or moderate smokers are better able to stop earlier in a pregnancy. The type and intensity of interventions needed to assist women who continue to smoke during the last trimester of pregnancy to quit have not been established. Several studies have focused on second- and third-trimester continuing smokers and examined different types of interventions. One study evaluated an intervention consisting of motivational interviewing strategies delivered over the telephone and enhanced with personalized feedback for continuing, resistant smokers. Findings of lower cotinine levels at the end of pregnancy for the women who received the full programme of two telephone calls and a personalized feedback letter were promising. However, it was difficult to deliver the full intervention to these smokers, particularly in the last trimester. Women who continue to smoke late

Table 9.2. Agency for Health Care Policy and Research Guidelines: the 5 As

<table>
<thead>
<tr>
<th>Step 1:</th>
<th>Ask about the smoking history and current smoking pattern of women in health-care settings. Record that information so that it is accessible throughout the pregnancy.</th>
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</thead>
<tbody>
<tr>
<td>Step 2:</td>
<td>Advise each and every woman who smokes of the value of stopping and the risks of continuing in an empathetic, sensitive, clear, and personalized manner.</td>
</tr>
<tr>
<td>Step 3:</td>
<td>Assess the woman’s motivation and thoughts related to smoking cessation or reduction.</td>
</tr>
<tr>
<td>Step 4:</td>
<td>Assist the smoker in any attempts to quit, with office-based, mailed, or other materials and the offer of referral to specific services to assist her in her efforts, from quit lines to more-intensive individual or group-focused programmes.</td>
</tr>
<tr>
<td>Step 5:</td>
<td>Arrange for a follow-up contact and continued contact throughout the pregnancy and postpartum period, through telephone calls, office or home visits, or the Internet.</td>
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</tbody>
</table>
in pregnancy may need more-intensive interventions, but they are not motivated to stop smoking and are difficult to reach and engage, and they tend to believe that they are protecting the fetus in other ways.

Many pregnant women who continue to smoke throughout a pregnancy reduce the number of cigarettes smoked during that time.\textsuperscript{91,92} The data indicate that they can reduce nicotine levels significantly (50% or more) and can sustain the reductions throughout the pregnancy. Reduction of smoking during pregnancy offers some measure of protection for the child.\textsuperscript{91} Although reducing is less desirable than complete cessation and never provides as much protection, decreased exposure to the effects of smoking in utero is better for the developing fetus, especially in the later weeks of the pregnancy when significant fetal growth and development takes place. It may even be possible to gain some benefit for the fetus if the mother stops smoking right before the birthing, when needs for oxygen are high and smoking presents a greater threat. Whether it would be possible to influence continuing smokers to stop completely during the final days of pregnancy so that the actual delivery would be uncomplicated by the ingestion of smoke, nicotine, carbon monoxide, and smoking-related chemicals has not been tested. However, if cessation cannot be achieved, harm-reduction strategies such as stopping smoking for brief periods of time either during the pregnancy or at the delivery, significantly reducing the number of cigarettes smoked, and engaging in other health-protection behaviours, including taking vitamins and exercise,\textsuperscript{93} should be considered as interventions.

### Postpartum Relapse and Cessation

The most problematic change in smoking status during the first 12 months of the postpartum period is a return to smoking by women who stopped during pregnancy. Equally troubling is an increase in the number of cigarettes smoked by those who reduced their amount of smoking significantly during pregnancy. Although increasing numbers of pregnant women are stopping or reducing smoking to protect their babies, the overall yield in terms of permanent reduction in smoking prevalence among women as a result of pregnancy leaves much to be desired, because of postpartum relapse. During the postpartum period, many, if not most, spontaneous quitters and intervention-assisted quitters resume smoking. This return is delayed if women breastfeed, but estimates are that 50% to 70% of the women who stop smoking during pregnancy return to smoking regularly 6 to 12 months postpartum.\textsuperscript{61,71–73}

In the general population, relapse prevention has not been very successful for smokers who quit for short periods of time or who stop smoking for a particular event such as pregnancy. The Cochrane Collaboration review of relapse prevention interventions concluded, “We detected no benefit of brief and ‘skills-based’ relapse prevention interventions for women who have quit smoking due to pregnancy or for smokers undergoing a period of enforced abstinence.”\textsuperscript{94} These authors also concluded that at present there is insufficient evidence to support the use of relapse prevention strategies for those who quit on their own or through cessation programmes.

The return to smoking postpartum is a significant problem, since the child of the smoker will be exposed to second-hand smoke (SHS). Preventing relapse simply by focusing on skills-based or cue-management strategies delivered to women is problematic. Although the evidence is not conclusive on the effectiveness of interventions, a variety have been designed to address this problem, including approaches that target the transition period between late pregnancy and immediately postpartum; are delivered in the paediatric-care system to reach parents of newborns and young children; include innovative efforts focusing on the environment and the partner who smokes; and attempt to incorporate pharmacotherapy for smoking cessation either during the pregnancy or immediately after the birth of the child.

Few interventions recognize and utilize the critical transition from pregnancy to the postpartum period marked by the birth of the baby as the opportunity for intervening to prevent a return to smoking. However, some interventions use nurses who deliver messages in the hospital after delivery, midwives who visit homes and assist during the immediate postpartum period, and messages that are delivered during well-baby visits.\textsuperscript{37,77,95,96} Trials using these approaches have had mixed results, and even intensive, state-of-the-art motivational interventions delivered in women’s homes by midwives have not always been successful.\textsuperscript{97} One
randomized, controlled trial, Project PANDA, developed an intervention in which videos and newsletters were mailed to the women and their partners, timed to arrive at intervals during the final weeks of pregnancy and the first six weeks postpartum.63 The goal of this intervention was to prevent women who quit smoking for the pregnancy from returning to smoking at the time they were most vulnerable. Results from Project PANDA indicated significantly greater abstinence over the entire follow-up period and at the 12-month follow-up by the participants in the intervention group (55% vs 45%), supporting the idea that it is possible to decrease the return to smoking among these women. Women in the experimental condition were significantly more likely to be abstinent at almost every follow-up point than women in a standard-care control group. However, the total number of women who benefited from the intervention was small, and almost half returned to smoking. The period immediately after the birth of the child is a particularly difficult one for a new mother. The return to smoking appears to be facilitated by stress, lack of sleep, concerns about weight, and the ability to protect the baby from SHS. Interestingly, mothers who breastfeed seem to postpone the return to smoking until the baby is weaned.77 Although the early postpartum period is a difficult time, some women who stop smoking during pregnancy might be motivated to stop permanently.23,61,98,99

The shift to new-baby and paediatric care offers another opportunity to intervene with women smokers who are now new mothers. Some women who continued to smoke during pregnancy may be able to quit during the postpartum period,32 although few do so. Postpartum cessation is best related to increasing awareness of the effects of SHS on small babies or some problematic birth outcome that might be related to smoking. The 2006 US Surgeon General’s report on involuntary exposure to tobacco smoke offers a strong rationale for preventing passive smoking exposure and offers strategies to address such exposure.3 Unfortunately, however, the number of women who relapse during the postpartum period exceeds by far the number of women who smoked during pregnancy and quit postpartum.71 Much needs to be done to decrease the SHS exposure of children living in households in which family members smoke. Increasing emphasis on partners and families can be helpful in addressing the exposure issue, as well as in promoting women’s cessation of smoking.

Partner Smoking

Having a partner who smokes is probably the most important facilitator of a woman’s continued smoking during pregnancy and her return to smoking during the postpartum period.35,61,66,73 Most interventions for smoking during pregnancy concentrate on the woman and seldom offer messages about smoking in the home, and few address partner smoking. However, some interventions are beginning to use a partner’s pregnancy as an opportunity to promote quitting by men. At a minimum, these interventions encourage male partners who are smoking to support and not undermine their partner’s cessation during pregnancy and the postpartum period. One example of such an approach is Project PANDA. A secondary goal of that project was to provide an intervention to address partner smoking. Partners identified by the pregnant women were sent a set of video and print materials, similar to those sent to the pregnant smoker but tailored to the male perspective on pregnancy and child care, which tends to be more instrumental and focused on child-rearing. Materials were designed to promote cessation in light of impending fatherhood and to evoke support for the women during pregnancy; some emphasis on SHS exposure was also included. An initial evaluation of these materials indicated greater cessation among the men reported by the women in the intervention group than among those reported by the control-group women. Men appeared to read and use the materials sent to them, and the intervention appeared to make a small but significant difference in smoking; 28% of these men were not smoking at 3 months postpartum, compared with 14% of the control-group men. However, no differences were reported by the women at the 6- and 12-month follow-up visits.34 Cessation of smoking by partners or spouses is critical for protecting newborns from exposure to tobacco smoke and offers another opportunity for the development and evaluation of innovative interventions.34,35,62,99

Using Nicotine Replacement or Pharmocotherapy During Pregnancy

There is growing evidence of the effectiveness of pharmacotherapy for quitting smoking in the general population of smokers. The findings point to equivalent
efficacy for women and men.\textsuperscript{3} Since the advent of these medications, tobacco control advocates have been interested in the feasibility of using nicotine replacement therapy (NRT) or cessation medications to help pregnant women stop smoking and sustain cessation.\textsuperscript{31} To date, only a limited number of trials have examined the use of different forms of NRT or either bupropion or varenicline among pregnant women, and therefore definitive recommendations cannot be made. However, we review some of the current information about these pharmacological options below.

Both animal and human studies have demonstrated that nicotine has adverse neurodevelopmental effects on the fetus. These effects vary by dose and are found for exposure to both smoking and smokeless tobacco.\textsuperscript{14,15,100} In a review of nicotine’s effects during pregnancy, Wickstrom\textsuperscript{15} concluded that even though nicotine obtained from NRT is safer than nicotine obtained from smoking, it is the total dose of nicotine received by the fetus that determines the effect on brain development. There is a concern, moreover, that higher doses of NRT and longer-acting replacement products may lead to higher doses of nicotine than those delivered by smoking. If NRT is viewed as a less risky alternative to smoking, it might encourage use of smokeless products and the promotion of new, “reduced exposure” products by tobacco companies. The use of NRT should always be envisaged only as a harm-reduction strategy for women who continue to smoke during pregnancy, in that it reduces exposure to other chemicals and, in particular, the CO generated by smoking cigarettes. There is no safe level of exposure to nicotine for the fetus. However, in cases where it is not possible to eliminate exposure to nicotine from cigarette smoking, verified reduced exposure would be a somewhat salutary goal for pregnant tobacco users.

Some studies have examined the effectiveness of adding NRT to behavioural treatments for smoking cessation. An open-label randomized trial called Baby Steps examined the addition of NRT to cognitive behavioural therapy (CBT) for 181 pregnant smokers who could choose between patch, gum, or lozenge.\textsuperscript{101} Investigators found that women in the CBT + NRT group were significantly more likely to have biochemically validated cessation at two pregnancy time points (24% vs 8% after 7 weeks and 18% vs 7% at 38 weeks). However, differences were not significant at the 3-month postpartum follow-up (20% vs 14%). This trial was suspended early because of some indication of a higher rate of negative birth outcomes in the NRT cohort, although this was found not to be significant when the rates were adjusted for prior history of pre-term births. Several other studies, reviewed by Schnoll et al.,\textsuperscript{3} found that the nicotine patch had limited efficacy for pregnant women.

Nicotine gum is currently classified by the Food and Drug Administration (FDA) as a pregnancy category C drug (i.e. risks cannot be ruled out, but there are no adequate human studies to confirm this, and potential benefits may outweigh potential risks). Other formulations are category D (evidence of risk from human studies, but potential benefits may still outweigh potential risks).\textsuperscript{3} Some important differences between the sexes also affect NRT efficacy. Women report more severe withdrawal symptoms than men, and pregnant women metabolize nicotine much faster than men and may require higher-dose patches. This need for more nicotine and larger doses of NRT raises concern about the risk to the fetus from nicotine exposure. There are no clear guidelines for the use of NRT by pregnant women,\textsuperscript{102} and more research is needed to understand whether and how NRT should be used by them.

In addition to the nicotine-based medications, two medications currently on the market have shown sufficient efficacy for modifying smoking behaviour to be evaluated by the FDA, and bupropion was approved for the treatment of tobacco dependence in 1997.\textsuperscript{3} The few studies that examined use of this drug for smoking cessation during pregnancy had inconclusive results.\textsuperscript{103} Bupropion is currently rated as FDA pregnancy category C. Varenicline has also been approved for treating tobacco dependence and has an FDA pregnancy category C rating. No data are available on the safety of its use during pregnancy, but studies indicate that there are no differences in its efficacy between men and women.\textsuperscript{3}

If medications or NRT can be used safely during pregnancy, they could offer some hope of increased cessation and possible assistance to prevent postpartum relapse. Additional studies are needed to evaluate these pharmacotherapy options. At present, we can recommend only that these medications and NRT be considered and studied to evaluate whether they can safely lessen the risk of smoke exposure for some women who are heavy smokers.
Conclusions and Actions

Most of the benefits of smoking cessation during pregnancy have focused on the fetus and the child. However, cessation programmes also help to improve the health and long-term well-being of mothers and fathers by reducing the incidence of cancer and other chronic illnesses caused by smoking. Pregnancy provides an opportunity for change. The challenges lie in finding the best methods to create a complete and comprehensive set of community and health-care programmes to eliminate smoking during pregnancy and fetal exposure, to protect newborn and developing children, to preserve the health and well-being of parents, and to create truly smoke-free families.

Reducing the personal and financial costs of smoking, particularly during pregnancy and following the birth of a child, are also important societal and economic goals. What are the critical approaches to interventions needed to meet these challenges? First, it is important to promote smoking cessation among women and men who are considering having a child by emphasizing cessation of tobacco use either prior to or as close to the beginning of pregnancy as possible. Potential parents can be reached in a variety of medical settings (especially gynaecological and obstetric settings), as well as through programmes and other health-care providers such as midwives, nurse practitioners, and genetic counsellors. Women of childbearing age and young families can also be targeted through media messaging about the benefits of smoking cessation. Such messages can even be incorporated into wedding preparations. These efforts would emphasize quitting smoking before becoming pregnant. This suggestion is consistent with recommendations for preconception counselling made a decade ago by an expert panel on the content of prenatal care.60

Cessation of smoking prior to pregnancy offers the best protection for infants and maximizes the possibility that women and men will integrate intrinsic motives about quitting for their own health with the motivation of quitting for their babies’ health.59,104 Including smoking cessation interventions in family planning programmes, in the distribution of various methods of birth control, and in pregnancy testing done at home or in clinic offices would provide opportunities to reach women smokers and their partners prior to pregnancy. In addition, with tobacco control messages that incorporate a focus on the health of both mother and baby, it may be possible to motivate quitting that will be more durable postpartum.

Second, tobacco control programmes should reach a pregnant smoker as early as possible in the pregnancy and follow her throughout the pregnancy to promote and support sustained smoking cessation. Women who have the most difficulty stopping smoking often are burdened by multiple life problems and a lack of adequate resources. Providing access to obstetric care as early as possible and embedding smoking cessation interventions in a comprehensive approach to these women’s problems would appear to have the greatest chance of success. However, more intervention is not necessarily more efficacious.105

Three critical issues need to be addressed when creating pregnancy smoking cessation programmes. First, the identification of pregnant women at risk must incorporate a broad definition of smoking risk that includes women who quit before becoming pregnant. If women are concerned that labelling will bring harassment, they may be reluctant to self-identify as former smokers, and interventions will not reach and influence those most in need of them.74,106,107 Sensitivity and tact are needed when addressing the issue of smoking with these women. Second, although many spontaneous quitters sustain cessation on their own throughout pregnancy, some need additional assistance. Sensitive probes and offers of support throughout the pregnancy rather than only at the first prenatal visit could be helpful to these women. Lastly, it is essential to create and sustain systems that ensure reliable, early, recurrent, and effective delivery of interventions throughout the pregnancy to all pregnant smokers. The system should include training of doctors, nurses, and staff in ob-gyn clinics, as well as midwives, nurse practitioners, and other alternative providers, in effective methods for counselling pregnant women about smoking. Educating them about the process of change and the windows of opportunity for intervention should be considered minimal preparation. They should also learn motivational and behavioural strategies to address each woman’s concerns. Creating office, clinic, and home-care systems that institutionalize identification and intervention protocols is critical. While this is an ambitious agenda, the payoff would be significant in terms of both quality of life and health-care costs.108 Research and clinical programmes that have already demonstrated efficacy can be used as models for creating intervention programmes for pregnant women in both public and private settings.107
Third, it is necessary to create interventions that shift the focus for women who stop smoking for the duration of their pregnancy to maintenance of cessation immediately after the birth and throughout the postpartum period. These interventions should be initiated near the end of the pregnancy, continue into the early postpartum period, and extend to at least one year postpartum, since many women return to smoking during this period. The interventions should shift motivational considerations from only protecting the fetus to protecting the health of the mother. Women who stop smoking only to protect the baby during the pre-pregnancy and pregnancy periods are the most vulnerable to relapse. Motivation and coping activities should shift to protecting the woman’s health and longevity and should include creating a smoke-free family.39, 73, 107

Fourth, tobacco control programmes need to create a specific strategy and set of interventions for women who continue to smoke during the later stages of pregnancy. Intervention efforts should promote behaviours such as smoking reduction and abstinence during critical periods immediately prior to the birthing process. They should also encourage other health-protection behaviours, such as taking vitamins and exercising, and should emphasize the opportunity to stop smoking during the postpartum period. Many women who continue to smoke during pregnancy are concerned about the health of the baby but find it very difficult to stop. Some have had prior births with few serious or obvious consequences from smoking. Others are overwhelmed by emotional, financial, and family problems. Working with these women to achieve possible rather than optimal outcomes can contribute to the overall goals of protecting the baby and promoting cessation. Harm-reduction strategies are appropriate here and can facilitate movement towards optimal goals.29,45,66

Newer cessation tools, such as medications and NRT, need to be explored for their potential utility with the difficult population of women who continue smoking during pregnancy and pregnancy periods are the most vulnerable to relapse. Few interventions include them. Cessation efforts during pregnancy should include spouses or partners as important targets and allies in the effort to create a smoke-free family. Pregnancy may be a very opportune time to intervene in smoking and other health habits of the partner. Parenthood brings a re-evaluation of lifestyle and family needs that offers an ideal opportunity to engage other members of the family in a discussion of values and health behaviours.

In sum, pregnancy offers multiple windows of opportunity for smoking cessation intervention. The course of pregnancy and the reality of the postpartum period create a prime target for cessation efforts. The goal of creating smoke-free families, however, must be achieved through a comprehensive tobacco control programme based on early prevention, as well as gender-specific service delivery. Understanding the process of change for smoking during pregnancy and using empirically supported treatments can provide guidance about how to promote healthy lifestyles for the entire family.

References

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