Contents

Contributors
Preface

1 OBSTETRIC DISORDERS
1 The diagnosis and management of preterm labor with intact membranes
   Roberto Romero, Tinnakorn Chaiworapongsa, Francesca Gotsch, Lami Yeo, Ichchha Madan, and Sonia S. Hassan

2 Prelabor rupture of the membranes
   Roberto Romero, Lami Yeo, Francesca Gotsch, Eleazar Soto, Sonia S. Hassan, Juan Pedro Kusanovic, and Ray Bahado-Singh

3 Cervical insufficiency
   Sonia S. Hassan, Roberto Romero, Francesca Gotsch, Lorraine Nikita, and Tinnakorn Chaiworapongsa

4 Recurrent pregnancy loss
   Christine E. Ryan and Danny J. Schust

5 Multiple gestation
   Isaac Blickstein

6 Gestational hypertension and pre-eclampsia
   Erol Amon and Erin Dickert

7 Coagulopathy in obstetrics*
   Hung N. Winn and Roberto Romero

8 Amniotic fluid embolism*
   Hung N. Winn

9 Placenta previa and placental abruption
   Ann K. Lal and William J. Watson

10 Postpartum hemorrhage
    Wade D. Schwendemann and William J. Watson

11 Septic shock
    Bryan E. Freeman and Michael R. Foley

12 Invasive hemodynamic monitoring in obstetrics
    Luis D. Pacheco, Shannon Clark, and Gary D. V. Hankins

13 Shoulder dystocia
    Randall C. Floyd and James S. Smeltzer

14 Breech presentation
    Randall C. Floyd and Martin L. Gimovsky

15 Cesarean section and vaginal birth after cesarean section
    Jessica Winn and Hung N. Winn

II MATERNAL MEDICAL DISORDERS
16 Diabetes in pregnancy
    Donald R. Coustan

17 Chronic hypertension and acute hypertensive crisis
    William F. Rayburn and Lauren Plante

18 Rheumatologic diseases and antiphospholipid syndrome
    Thomas J. Santoro, Michiyo Tomita, and Alfonse T. Masi

19 Sickle cell disease
    Marc R. Parrish and John C. Morrison

20 Cardiac diseases in pregnancy
    Saravanan Kuppuswamy and Sudarshan Balla

21 Dermatologic diseases and pregnancy
    Holly Edmonds, Dana Ward, Ann G. Martin, and Susana Leal-Khoury

22 Endocrine diseases and pregnancy
    Stephen A. Brietzke

23 Gastrointestinal diseases and pregnancy
    Murtaza Arif, Anjana Sathyamurthy, Jessica Winn, and Jamal A. Ibdah

24 Hepatic disorders in pregnancy
    Ghassan M. Hammoud and Jamal A. Ibdah

25 Neurologic disorders in pregnancy
    Robert Burger, Terry Rolan, David Lardizabal, Upinder Dhand, Aarti Sarwal, and Pradeep Sahota

26 Sleep disorders and pregnancy
    Pradeep Sahota and Sanjay Jain

27 Pulmonary diseases in pregnancy
    Leah Lande, Abraham Sanders, and Dana Zappetti

28 Psychiatric disorders in pregnancy
    Robin Kopelman and Scott Stuart

29 Renal diseases in pregnancy
    Dana Negoi and Khaled Mohamed

III MATERNAL SURGICAL, MALIGNANCY, AND OTHER ISSUES
30 Acute abdomen in pregnancy
    Nicole Fearing and William L. Holcomb

31 Trauma in pregnancy*
    Hung N. Winn

32 Medical evaluation and management of pregnant patients undergoing non-obstetrical surgery
    John G. Gianopoulos

33 Anesthesia and analgesia in pregnancy
    Steven T. Fogel

*This chapter will be made available in 2012.
34 Breast cancer and pregnancy  
   Beth Kliethermes, Dani Stramer, and Edward R. Sauter
35 Neoplasia in pregnancy  
   Nora T. Kizer and David G. Mutch
36 Chemotherapy in pregnancy  
   Mark I. Hunter
37 Maternal obesity  
   D. Yvette LaCoursiere and Thomas R. Moore
38 Medicolegal considerations  
   Erol Amon and Gilad Gross
39 Drug abuse in pregnancy: Marijuana, LSD, cocaine, amphetamines, alcohol, and opiates  
   Jacquelyn C. Howitt and Anita Bublik-Anderson
40 Tobacco and alcohol use during pregnancy  
   Beth A. Bailey and Robert J. Sokol
41 Exercise and pregnancy  
   Raul Artal
42 Ethical considerations  
   Frank A. Chervenak and Laurence B. McCullough

IV GENETICS AND FETAL DISORDERS
43 Basic genetics and patterns of inheritance  
   Dorothy K. Grange
44 Principles of teratology of drugs and radiation  
   Frank R. Witter
45 Fetal programming  
   Katherine E. Pelch, Jana L. Allison, and Susan C. Nagel
46 Assessment of fetal genetic disorders  
   Teresa Martino, J. Pratt Rossiter, and Karin J. Blakemore
47 Preimplantation diagnosis of genetic diseases*  
   The-Hung Bui
48 First-trimester screening for aneuploidy  
   Mark I. Evans and Howard S. Cackle
49 Second-trimester screening for fetal abnormalities  
   Jolene C. Muscat and Anthony M. Vintzileos
50 Genetic counseling  
   Zoltán Papp, Valéria Váradi, and Júlia Hajdú
51 Fetal anomalies*  
   Hung N. Winn
52 Assessment of fetal brain abnormalities  
   Ritsuko K. Pooh
53 Erythroblastosis fetalis  
   Avinash Patil, Brian Brocato, Rebecca A. Uhlmann, and Giancarlo Mari
54 Fetal alloimmune thrombocytopenia  
   Hung N. Winn
55 Nonimmune hydrops*  
   Hung N. Winn
56 Fetal arrhythmias  
   Júlia Hajdú, Valéria Váradi, and Zoltán Papp
57 Fetal growth restriction  
   Daniel L. Jackson, M. Y. Divon, and Hung N. Winn
58 Fetal demise*  
   Hung N. Winn

V FETAL ASSESSMENT
59 Application of 3D and 4D ultrasound in fetal medicine  
   Eberhard Merz
60 Prenatal diagnosis of fetal abnormality using fetal cells in maternal circulation  
   Gian Carlo Di Renzo, Elena Picchiassi, Michela Centra, and Giuliana Coata
61 Recent developments in fetal therapy  
   Gihad E. Chalouhi and Yves Ville
62 Chorionic villus sampling  
   Giovanni Monni, Maria Angelica Zoppi, and Carolina Axiana
63 Amniocentesis  
   Aris Antsaklis and Marianna Theodora
64 Fetal echocardiography  
   Caroline K. Lee, Erik C. Michelfelder, and Gautam K. Singh
65 Assessment of fetal behavior  
   Asim Karjak, Milan Stanojevic, Badreldeen Ahmed, Guillermo Azumendi, and Lara Spalidi-Barisic
66 Umbilical artery doppler sonography for fetal surveillance: Principles and practice  
   Dev Maulik, David Mundy, and Timothy Bennett
67 Assessment of fetal well-being: Fetal heart rate monitoring and the fetal biophysical profile  
   Yinka Oyelese, Martin Chavez, and Anthony M. Vintzileos
68 Intrapartum fetal heart rate monitoring*  
   Hung N. Winn
69 Amnioinfusion  
   James Kerns, Erol Amon, and Hung N. Winn
70 Assessment of fetal age and fetal lung maturity*  
   Hung N. Winn
71 The maternal immune system during pregnancy  
   Breton F. Barrier
72 Placental transport and metabolism  
   Jeffrey M. Dicke

*This chapter will be made available in 2012.
CONTENTS

73 Fertilization and normal embryonic and early fetal development
Asim Kurjak, Ritsuko K. Pooh, Aida Salihagic-Kadic, Iva Lausin, and Lara Spalldi-Barisic

VI PERINATAL INFECTION AND NEONATAL DISEASE

74 Group B streptococcus infection
Jessica Winn and Hung N. Winn

75 Gonorrhea infection*
Hung N. Winn

76 Postpartum infections
Dorothea Mostello

77 Urinary tract infections in pregnancy
Steven R. Allen

78 Other bacterial infection: Lyme, granuloma inguinale, gardnerella vaginale, chancroid*
Hung N. Winn

79 Bacterial vaginosis in pregnancy: Evidence-based approaches
James A. McGregor and Michael W. McCullough

80 Viral hepatitis in pregnancy
Dennis Ng

81 Toxoplasmosis
Edward R. Newton

82 Herpes*
Edward R. Newton

83 Cytomegalovirus (CMV)*
Hung N. Winn

84 Human immunodeficiency virus (HIV)
Richard Basilan and William Salzer

85 Other viral infections
Stanley A. Gall

86 Chlamydial infection
Joyce A. Ibana and Danny J. Schust

87 Candida and parasitic infection: Helminths, trichomoniasis, lice, scabies, and malaria
Jeanna M. Piper

88 Routine maternal immunizations for all pregnant women
Stanley A. Gall

89 Neonatal diseases I
John Pardalos

90 Neonatal diseases II
Brian P. Hackett, Jeffrey Dawson, Akshaya Vachharajani, Barbara Warner, and F. Sessions Cole

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Preface

The discipline of Maternal-Fetal Medicine has made great progress since the first edition of this textbook (Clinical Maternal-Fetal Medicine) published nearly a decade ago. Basic, clinical, and translation research has allowed clinicians and scientists to improve the understanding of the mechanisms of disease, and improve the care of the mother and fetus.

We are of the view that Maternal-Fetal Medicine is one of the most challenging disciplines in medicine, because we care for two patients; one of whom, the fetus, is often inaccessible, difficult to examine, and optimal medical care requires balancing the interests of mother and fetus. Yet, the importance of our discipline has become increasingly clear, as the concept that the “child is the father of the man” has gained ground through growing evidence that insults sustained during intrauterine life have a long-lasting effect and increase the risk for adult diseases (cardiovascular, metabolic, mental health, reproductive, etc.).

This book addresses the pathophysiology, diagnosis, and treatment of many important maternal medical and obstetric complications, as well as fetal complications. It is intended to provide a review of clinically relevant topics in Maternal-Fetal Medicine. In contrast to the first edition, this book is available online rather than as a traditional print book. This approach was embraced to make its use easier for the readers. You will be able to search the book across chapters and provide feedback. In addition, updates could be more frequently done as the information develops.

This book could serve as a convenient reference for clinicians, fellows, residents and students who have the privilege of caring for the mother and fetus. We hope that the constant search for new understandings of the biology of pregnancy would allow us to improve the diagnosis and treatment of complications of pregnancy, and the health of future generations.

Hung N. Winn
Frank A. Chervenak
Roberto Romero
40 Tobacco and alcohol use during pregnancy
Beth A. Bailey and Robert J. Sokol

INTRODUCTION
Substance use, including the most common behaviors of smoking and drinking, is a major health issue for women, regardless of age and reproductive or pregnancy status. Health risks to women can be substantial, and during pregnancy, these risks are shared with the developing fetus. Even with the recognition of the adverse impact of these substances on maternal and fetal health, obstetric clinicians, many of us who might be said to have "surgical personalities," often have difficulty dealing effectively with these "behavioral medicine" issues. Our goal in this concise chapter is to highlight some plausible mechanisms for effect. We then turn our attention to the practical issues of how to identify pregnant women who are smoking or consuming alcohol and how to help her make changes in her behavior to benefit both her own health and that of her unborn child.

EPIDEMIOLOGY
Cigarettes
Nationally, approximately 11% to 13% of women report smoking throughout pregnancy (1,2). However, rates of pregnancy smoking vary considerably by region. For example, many Southern states have rates of pregnancy smoking near 20% (2), with rural regions seeing rates from 30% to 40% (3–5).

Smoking during pregnancy can occur in any subpopulation; however, certain women are statistically more likely to smoke while pregnant. Research has revealed that white women are significantly more likely to smoke during pregnancy than their African-American or Hispanic counterparts (1,6). Additionally, women who live in poverty, who have lower levels of education, and who receive Medicaid are more likely to be pregnancy smokers than other women (6–8).

Alcohol
Each year in the United States, approximately half a million pregnant women are thought to drink alcohol (9). This translates into a prevalence rate of nearly 13% and is consistent with the more than 10% of pregnant women who reported current alcohol use as part of the 2002 Behavioral Risk Factor Surveillance Survey (10) and the 15% to 20% identified in a large-scale study conducted more than 15 years ago (11). While estimates vary, anywhere from 2% to 6% of women engage in heavy, frequent, or binge-drinking while pregnant (9,10,12).

Drinking during pregnancy occurs across diverse populations and sociodemographic conditions. However, certain racial groups see higher rates of pregnancy drinking, including African-Americans and American Indians/Alaskan Natives (13). Additionally, women over the age of 30, those who are unmarried, and those who have lower incomes are also at a statistically increased risk of pregnancy alcohol consumption (14). Finally, smoking and drinking often go hand in hand during pregnancy. Women who smoke more than half a pack of cigarettes per day during pregnancy are more than twice as likely as nonsmokers to consume alcohol (38% vs. 17%) (14).

ETIOLOGY AND PATHOPHYSIOLOGY
Cigarettes
A significant amount of evidence has accumulated documenting the deleterious effects of pregnancy smoking. The potential short- and long-term effects for the mother have been well reported and include significantly increased risk of respiratory, cardiovascular, and cancer-related diseases. The potential for harmful fetal effects is also profound. Tobacco use in pregnancy is associated with significantly increased rates of pregnancy complications and adverse birth outcomes (15). Ectopic pregnancy, placenta previa and abruption, stillbirth, premature rupture of membranes, and intrapartum growth restriction have all been associated with gestational exposure to cigarettes (16–19). For a smoke-exposed fetus that survives to delivery, the increased likelihood of low birth weight and preterm birth is substantial, with risk increasing with the number of cigarettes smoked per day (6,20). Nationally, smoking accounts for 20% to 30% of all low birth weight births (20), and research indicates that infants born to women who smoke are 200 to 300 g lighter than those born to nonsmokers (4,21). Smoking in pregnancy also nearly doubles the risk of preterm birth (22,23), producing a significant economic cost through neonatal intensive care unit (NICU) admission and treatment. Indeed, babies born to smokers are twice as likely to be admitted to the NICU as those born to nonsmokers (4). Smoke-exposed newborns have an increased risk for respiratory dysfunction, intraventricular hemorrhage, necrotizing enterocolitis, and retinopathy (15). Finally, an increased likelihood of infant mortality is associated with heavy pregnancy smoking, with exposure accounting for 5% of perinatal deaths (24).

Prenatal exposure to cigarettes has also been shown to have long-term developmental consequences. Physical health effects well into childhood include growth restriction, abnormal neuromotor tone, increases in respiratory infections, asthma, otitis media, and obesity (25–30). Long-term effects on cognitive development, including learning problems and delayed academic achievement, have also been reported (31–33). Finally, prenatal exposure to cigarettes has been implicated in significantly increased rates of behavioral and mental health problems, including attention deficit hyperactivity disorder, conduct disorders,
depressive and anxiety disorders, criminal behavior, and substance use, abuse, and dependence (34–44).

While not yet completely understood, the mechanisms by which maternal smoking leads to fetal harm and longer term developmental problems have been explored in both animal and human models. The most often cited compounds in cigarettes known to cause harm to the fetus are nicotine, carbon monoxide, and cyanide. Cyanide has been shown, in multiple studies, to be harmful to rapidly dividing cells (45). Carbon monoxide combines with hemoglobin to produce carboxyhemoglobin thus lowering blood oxygen tension and likely contributing to fetal hypoxia (46). In addition, nicotine and carbon monoxide both reduce placental blood flow, impacting fetal growth. A recent study suggested that maternal smoking leads to decreased concentrations of fetal insulin, insulin-like growth factor (IGF), and IGF binding protein, which all may be involved in the pathway by which prenatal cigarette exposure impacts development (47). Thus, both hypoxia and chemicals responsible for growth may be responsible for cell death, structural alterations, and consequent delayed development when prenatal cigarette exposure occurs. Still other studies have focused on the potential impact of nicotine on the developing nervous and neurochemical systems (48). Fetal exposure to smoking, and nicotine in particular, has been proposed to impact serotonin uptake, changes in dopaminergic systems, and changes in DNA and RNA synthesis in the brain during critical developmental periods (49,50). Any one of these potential pathways could impact both structural and functional development, leading to the negative outcomes that have been observed in children exposed to smoking during gestation (51). However, further study is needed.

Alcohol
It has been four decades since the characteristics of children born to women who consumed alcohol during pregnancy were described in the medical literature (52). The term “fetal alcohol syndrome” (FAS) describes children with prenatal alcohol exposure and resultant growth restriction, central nervous system/neurodevelopmental delays, and facial malformations. In addition to typical or classic FAS, terms such as “alcohol-related neurodevelopmental disorder” and “fetal alcohol spectrum disorder” characterize a range of problems associated with prenatal alcohol exposure (53). Research has clearly documented the adverse outcomes associated with alcohol exposure during gestation. Full FAS is characterized by prenatal and postnatal growth deficiency, including reduced overall height and microcephaly, and being born small for gestational age with little catch-up seen into childhood; specific facial dysmorphism including long smooth philtrum, thin upper lip, midfacial hypoplasia, small eyes, and inner epicanthal folds; and central nervous system and neurodevelopmental abnormalities including decreased cognitive abilities (52,53).

Even in the absence of diagnosable FAS, alcohol consumption during pregnancy increases the risk of poor outcomes in children. Prenatal alcohol consumption is a strong predictor of low birth weight. Early studies clearly identified a link between even moderate consumption and low birth weight (54), and recent large-scale studies have reported strong associations between exposure and birth weight (55). Consuming one or more drinks per day was associated with a fivefold increase in the likelihood of a low–birth weight delivery (56), while three or more drinks per week were associated with a nearly 150-g reduction in birth weight (57). Recent evidence suggests that some of the lowered birth weight associated with pregnancy alcohol consumption is accounted for by an increased risk of preterm birth. One or more drinks per day have been found to more than double the risk of preterm birth (56). Even lesser levels of consumption have been linked to 10-fold or more increases in the risk of extreme preterm birth (prior to 32 weeks of gestation) (58). Mild prematurity was also linked to pregnancy alcohol consumption, particularly in women over the age of 30 (58).

The link between prenatal alcohol exposure and low birth weight and preterm birth is of significant consequence as these are leading causes of neonatal morbidity and mortality in the United States and the strongest biologic predictors of immediate and long-term developmental outcomes (59). In addition to the pathway through birth weight and gestational age, gestational alcohol exposure, even in the absence of full FAS, appears to independently impact a multitude of outcomes into childhood. Continued growth restriction, delays in gross and fine motor development, and impairments in visual motor integration have all been reported (30,60–62). Decreases in overall cognitive performance and general intelligence quotient scores have been associated with even moderate levels of prenatal alcohol exposure (63), in addition to specific deficits including slowed mental processing (64), delayed language and reading abilities (65,66), and increased learning problems (63). Studies have shown that children with prenatal alcohol exposure have problems with organizing and maintaining attention, and with impulsivity (67). Behavioral problems, including hyperactivity and delinquent behavior, have also been reported (68,69). Finally, long-term studies have described associations between prenatal alcohol exposure and many specific psychiatric disorders (70).

The mechanism by which prenatal exposure to alcohol leads to adverse pregnancy, newborn, and longer term developmental outcomes is not yet thoroughly understood. As has been recently reviewed, neuroimaging studies have shown overall and region-specific surface area and volumetric reductions, structural alterations, and white and gray matter density abnormalities (71). These alterations could all be involved in the physical and neurobehavioral effects of exposure. In addition, both animal and human studies have suggested that exposure to alcohol during gestation may cause hypothalamic–pituitary–adrenal (HPA) axis hyperactivity, thereby leading to significant adverse cognitive and behavioral outcomes (72). Furthermore, animal models have shown alcohol intake to decrease blood flow to the placenta, impacting cell growth and death (73). Finally, alcohol consumption increases the production of prostaglandins during pregnancy (74), resulting in decreased cell division (75). Any one, or a combination of these processes, could explain the mechanism by which prenatal alcohol exposure impacts development and outcomes, but further study is clearly needed.

DIAGNOSIS

Cigarettes
In a 2000 bulletin (updated in 2005), the American College of Obstetricians and Gynecologists (ACOG) recommended...
screening all pregnant women for smoking (76). Recent reports suggest that prenatal care providers vary widely in rates of screening all pregnant patients for smoking. For example, one study found that 98% of Ohio obstetricians reported asking all patients about smoking (77), while another study found that only 28% of obstetricians in rural southern Appalachia reported always asking (78). Reasons providers have given for failure to screen for pregnancy smoking have included lack of time, other issues taking priority, lack of confidence in skills, lack of referral sources, and beliefs that attempts to intervene will not be successful (77,78).

The most common method of determining smoking status during pregnancy has been via self-report, either by oral or written questioning. Self-report data have the advantage of being inexpensive and easy to collect, with responses immediately available (79), and a handful of studies involving pregnant women have suggested that self-reported smoking status is accurate (80,81). Others have suggested, however, that self-report of smoking status during pregnancy is unreliable and results in significant misclassification and underestimation of prevalence rates (82). An examination of the numerous studies that have investigated the association between self-report of pregnancy smoking status and biochemical verification has revealed false denial or deception rates as low as 1% and as high as 35%. A recent review of this literature concluded that measuring smoking status during pregnancy by self-report alone significantly underestimates smoking rates and misclassifies a significant proportion of women (79).

Several factors likely contribute to inaccuracies in self-report of smoking status during pregnancy, including faulty recall and intentional deception (79). As greater attention is given to the health effects of smoking, both in general and during pregnancy, and as efforts to regulate and reduce smoking increase, smoking becomes stigmatized and individuals are sensitized to socially desirable forms of behavior (83). As this occurs, it is likely that concealment of smoking during pregnancy in particular may increase (84). Multiple studies have shown that many factors may help reduce false denial of smoking among pregnant women, including appropriate wording, timing, and setting of inquiries of smoking status (85,86). For example, we know that the use of a structured multiple choice format in a private confidential setting may increase disclosure (87). Indeed, studies have shown that use of a five-response choice question (Box 1) increases disclosure over asking “Do you smoke?” by 40% (87).

Given the drawbacks of self-report, determination of pregnancy smoking status in both clinical and research settings often relies on biochemical assessment. Cotinine, a major metabolite of nicotine, is a commonly used biomarker of exposure to tobacco smoke, and cotinine levels in saliva, blood, and urine are often considered the best measure of nicotine consumption (88). Compared with self-report, cotinine levels have been shown to be more accurate indicators of smoking (79) and to be better predictors of pregnancy outcomes (89). Biochemical assessment of smoking behavior is not without limitations, however (83). In addition to the factors of cost and inconvenience, acceptance of appropriately sensitive and specific cutoff points is far from universal. Varying cotinine cutoff levels have been proposed to distinguish smokers from nonsmokers and from those exposed to environmental tobacco smoke (ETS) (90–92). Given varying cut-point recommendations, the use of biochemical assessment may not ever be completely accurate in distinguishing those who smoke, especially intermittently, from those who are only exposed to ETS (93). Thus, using both self-report and biochemical assessment is likely to yield the most accurate information about pregnancy smoking status.

### Alcohol

For many years, ACOG has consistently advised clinicians to question all pregnant women at their first prenatal visit about current and past alcohol use (94). A recent survey of more than 600 practicing ACOG members revealed that over 90% asked all women at their first prenatal visit about alcohol use (95). Barriers noted by those who failed to routinely screen prenatal patients for alcohol use included time limitations, patient sensitivity, lack of confidence in skills, and inadequate referral sources.

Even when providers do assess pregnancy alcohol consumption, detection is complicated by many of the same factors that impact the determination of smoking status. Pregnancy alcohol consumption has also become increasingly stigmatized as public awareness of the dangers has increased, leading to the potential for high rates of denial via self-report (96). In addition, and unlike biochemical assessment of smoking status, no reliable biologic marker is available to reveal alcohol use. Although analysis of both meconium and hair samples for fatty acid ethyl esters has been proposed, neither would practically detect alcohol use during pregnancy, and no large population-based studies have validated these methods (97). Similarly, other biochemical markers, such as ethanol metabolites, that reveal only very recent use have not yet been well validated or have not been shown to have adequate diagnostic sensitivity and/or specificity in identifying drinking in pregnant women (98). Thus, most researchers and physicians rely on self-report of maternal alcohol use during pregnancy (53).

### Box 1 Pregnancy Smoking Screening Question

Please choose the response that best describes your smoking

(A) I have never smoked or I have smoked fewer than 100 cigarettes in my lifetime

(B) I stopped smoking before I found out I was pregnant, and I am not smoking now

(C) I stopped smoking after I found out I was pregnant, and I am not smoking now

(D) I smoke some now, but I cut down on the number of cigarettes I smoke since I found out I was pregnant

(E) I smoke regularly now, about the same as before I found out I was pregnant

If the patient responds A, no further follow-up is needed

If the patient responds B or C, reinforce her decision to quit, congratulate her on the success of quitting, and encourage her to remain smoke free

If the patient responds D or E, she should be classified as a smoker. Document and intervene

Source: From Ref. 87.
Studies indicate that obstetricians often obtain inaccurate alcohol consumption information from their patients. For example, in a prospective study that included high-risk women, almost twice as many admitted to drinking during a research interview compared with indications from maternal medical records (99). While tools are available to assist prenatal care providers in accurately identifying women who consume alcohol during pregnancy, a recent study revealed that fewer than one quarter who screen for pregnancy alcohol consumption use a standardized screening tool (95). The T-ACE, a modification of a traditional alcohol screening test, the CAGE, but specifically adapted for use before and during pregnancy, consists of four questions that may be asked as part of the medical history by physicians or office personnel (Box 2) (100). It typically identifies 90% or more of potential pregnancy risk drinkers, and follow-up questions can rule out false positives (101). The CAGE, also a four-item scale commonly used in obstetric practices, was developed for and validated with men and has not been shown to be valid with pregnant women (100). The TWEAK, a five-item scale, was developed for and validated with pregnant women (102). However, this tool appears to have lower sensitivity for detection of drinking among minority women and has no additional validity over the T-ACE. The AUDIT-C is a three-item scale to screen for alcohol use during pregnancy, rather than consequences of use as queried in the previously described screens. While this tool includes assessment of quantity and pattern of alcohol use, and initial data suggest good sensitivity across different samples, additional validation of the AUDIT-C is needed. Consequently, ACOG and the National Institute on Alcohol Abuse and Alcoholism have both recommended the T-ACE as the best tool for screening all reproductive-aged women and pregnant women specifically for alcohol use.

**Box 2 T-ACE Screening Tool for Pregnancy Risk Drinking**

| Tolerance | “How many drinks does it take to make you feel high?” A positive answer, scored a 2, is more than two cans of beer, two glasses of wine, or two mixed drinks. This suggests tolerance of alcohol and very likely a history of at least moderate-to-heavy alcohol intake |
| Annoyed | “Have people annoyed you by criticizing your drinking?” |
| Cut Down | “Have you felt you ought to cut down on your drinking?” |
| Eye-Opener | “Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover?” |

*The first question is scored 0 or 2 points. The last three questions are scored 1 point if answered affirmatively. A total score of 2 or more is considered positive for risk drinking. Source: From Ref. 100.

**Box 3 The 5 A’s Intervention for Pregnant Smokers**

**Ask**

Tobacco status is queried with a multiple-choice question format and answers are documented in the patient chart.

**Advise**

Urge all tobacco users to quit in a clear, strong, personalized manner. Discuss the benefits of quitting including the potential harms of smoking to the fetus and the long-term health consequences of the mother. Provide pregnancy-specific educational materials.

**Assess**

Determine the patient’s willingness to quit in the next 30 days and encourage the patient to minimize exposure to secondhand smoke. If the patient declines smoking cessation or is ambivalent, work to increase the patient’s motivation to quit.

**Assist**

Provide aid for the patient to quit. Set a quit date. Provide counseling with skills building, pregnancy-specific self-help and smoking cessation materials, and social support. Develop a contract to quit smoking. Encourage a patient diary to record successes, problems, and triggers. Discuss alternate behaviors, potential problem situations, and how to handle slipups.

**Arrange**

Provide follow-up contact, either in person or by telephone soon after the quit date, and further follow-up encounters as needed. Congratulate success during each visit. Review circumstances if relapse occurred and use it as a learning experience for the patient. Consider referral or more intensive treatment. Begin postpartum relapse prevention counseling late in pregnancy.

*Source: From Ref. 108.*

Evidence suggests that clinically proven interventions can lead to significant successes in smoking cessation (104). Increasingly, obstetric providers are implementing brief interventions (BIs)—low-cost, time-efficient, and effective self-help treatments involving counseling—with their prenatal smokers. The five A’s BI method of smoking cessation counseling (ask, advise, assess, assist, and arrange), which can be administered in as few as 3 minutes, is considered best practice and has been adapted for use during pregnancy (Box 3) (105). Most physicians have found this model effective and easy to use in the course of a regular prenatal visit.

When properly implemented, the five A’s method results in cessation rates up to four times higher than the rates for those who attempt to quit on their own (106), and 70% higher than traditional physician advice (105). To date, nearly 100 published studies have detailed the effectiveness of various office-based smoking cessation interventions for pregnant women. A 2008 Cochrane Review of clinical trials showed a significant reduction in pregnancy smoking intervention groups compared with controls (107). The most effective interventions were those based on or similar to the five A’s, with these “low-intensity” interventions just as effective as those of higher intensity (i.e., longer and more frequent sessions conducted by counseling professionals encompassing...
Box 4 Brief Intervention for Reducing Alcohol Use During Pregnancy—FRAMES Approach

F: Feedback of personal risk. Compare the patient’s level and drinking patterns with pregnancy-recommended abstinence. The patient may not be aware that what she considers normal activity is actually risky  
R: Responsibility for personal control. Stress to the patient that it is her responsibility to make the change for the health of her baby  
A: Advice to change. Give direct advice (not insistence) to the patient to change her drinking behavior  
M: Menu of ways to reduce/stop drinking. Identify when the patient is likely to drink and solicit alternate ways that she might handle these situations  
E: Empathy. Use a style of interaction that is understanding and involved. Remain positive and encouraging and avoid being judgmental and preachy  
S: Self-efficacy. Elicit and reinforce self-motivating statements such as “I am confident that I can stop drinking.” Encourage the patient to develop strategies, implement them, and commit to change  

Source: From Ref. 111.

multiple types of efforts). In a 2005 bulletin, ACOG established the five A’s as a standard component of prenatal care for all smokers (108). And in a 2009, the U.S. Preventive Services Task Force reaffirmed that the net benefit of using a five A’s office-based intervention with pregnant smokers is substantial (109).

Alcohol

Once a prenatal patient had been identified as consuming alcohol, the management options available to the provider will depend upon training, expertise, and available resources. For women who drink but are not alcohol dependent, an in-office BI may be all that is needed to reduce the risk of an alcohol-exposed pregnancy. For alcohol-dependent women, a BI, coupled with referral to specialized treatment programs, is recommended (110). BIs, including the structured five A’s approach described above for use with smokers, can be delivered by health professionals who are not specialists in the treatment of substance use and dependence. Increasing numbers of physicians have obtained continuing education training in motivational interviewing for use with pregnant women who consume alcohol. Motivational interviewing, a type of BI, helps empower the patient to make lifestyle changes while minimizing resistance (111). Using this approach with pregnant alcohol users specifically, the physician can illustrate the importance of abstinence or decreased alcohol intake and the avoidance of binge-drinking, and offer encouragement and optimism about change (112). The most successful interventions follow the FRAMES approach (Box 4).

Research has suggested that women, even those identified as heavy drinkers, respond to motivational interviewing (113,114). In a multicenter randomized controlled trial to reduce the risk for alcohol-exposed pregnancies, 830 at-risk women received educational information plus motivational interviewing or information alone (115). The intervention consisted of four counseling sessions and one contraceptive consultation. The intervention group had a 70% decrease in risk for alcohol-exposed pregnancies, more than twice the risk reduction for the information-only group at 3-, 6-, and 9-month follow-up (ORs 2.3, 2.2, and 2.1, respectively). In another randomized controlled trial involving only pregnant women, 255 patients who reported alcohol consumption were recruited from a community-based setting and randomly assigned to receive intervention or assessment only (116). The intervention consisted of multiple BI sessions with a nutritionist that included education and feedback, cognitive behavioral procedures, goal setting, and contracting. Compared with women in the control group, women who received the intervention were five times more likely to report abstinence by the end of the pregnancy. In addition, their newborns had significantly higher birth weights and lengths, and a three times lower fetal mortality rate. In another study, a BI administered by nurses and physicians during a prenatal care visit was evaluated with 300 alcohol-consuming women (117). The BI in this study was a single session, averaging 25 minutes, which included knowledge assessment with feedback, goal setting and contracting, behavioral modification, and tips for handling difficult situations. Although pregnancy alcohol consumption decreased for both those who received the intervention and those who received only an assessment, those who received the BI had the most significant decrease. In addition, the greatest decreases were seen among women with the highest initial consumption and those whose partners also participated in the BI. Still other studies have shown that follow-up is critical, as a series of BIs is generally more effective than a single suggestion to stop drinking (118).

CONCLUSIONS

As many as 20% of pregnancies are complicated by smoking and/or alcohol consumption. Exposure to either substance significantly increases the risk of poor pregnancy outcomes including low birth weight and preterm birth. Prenatal smoke exposure in particular is implicated in substantial health problems early in life, while both smoke and alcohol exposure can lead to long-term growth delays and cognitive and behavioral problems. While biochemical assessment can be used to identify women who smoke during pregnancy, no reliable biomarker for alcohol consumption is yet clinically applicable. Self-report of smoking and alcohol use is typically relied upon in clinical settings, and reliable and well-validated tools are available and recommended for use with all prenatal patients. Once women who smoke or drink during pregnancy are identified, brief proven interventions can aid the busy clinician in working with patients to reduce or eliminate these pregnancy risk behaviors.

REFERENCES


