# The clinical content of preconception care: alcohol, tobacco, and illicit drug exposures

R. Louise Floyd, DSN, RN; Brian W. Jack, MD; Robert Cefalo, MD, PhD; Hani Atrash, MD, MPH; Jeanne Mahoney, BSN, RN; Anne Herron, PhD; Corinne Husten, MD, MPH; Robert J. Sokol, MD

Substance abuse poses significant health risks to childbearing-aged women in the United States and, for those who become pregnant, to their children. Alcohol is the most prevalent substance consumed by childbearing-aged women, followed by tobacco, and a variety of illicit drugs. Substance use in the preconception period predicts substance use during the prenatal period. Evidence-based methods for screening and intervening on harmful consumption patterns of these substances have been developed and are recommended for use in primary care settings for women who are pregnant, planning a pregnancy, or at risk for becoming pregnant. This report describes the scope of substance abuse in the target population and provides recommendations from the Clinical Working Group of the Select Panel on Preconception Care, Centers for Disease Control and Prevention, for addressing alcohol, tobacco, and illicit drug use among childbearing-aged women.

**Key words:** alcohol, preconception, substance abuse, women

Alcohol, tobacco, and illicit drug use are among the leading causes of morbidity and mortality in the United States.[1,2] These exposures are modifiable by public health interventions[3] with tobacco use and substance abuse (alcohol and/or illicit drugs) being listed among the 10 leading health indicators for the US population in *Healthy People 2010*.[4] A substantial proportion of childbearing-aged women consume 1 or more of these substances, thereby increasing their risks for adverse health outcomes, and if pregnant, adverse pregnancy outcomes. Prenatal alcohol use is a leading preventable cause of birth defects and developmental disabilities. Smoking during pregnancy causes placenta previa, abruption, premature rupture of membranes, preterm delivery, fetal growth restriction, and low birthweight.[5,6] Prenatal smoking can also cause sudden infant death syndrome (SIDS),[5,7] and infants born to mothers who smoke are more likely to have orofacial clefts.[8] Illicit substance abuse increases risk for stillbirth, prematurity, low birth weight, and intrauterine growth retardation.[9] This report is one in a series of articles on preconception care and describes the prevalence of use of the above substances in childbearing-aged women along with current evidence and recommendations for best practices in detection and intervention in clinical practice settings serving women in the preconception period. Members of the Clinical Working Group of the Select Panel on Preconception Care, Centers for Disease Control and Prevention (CDC), developed the recommendations presented herein after their review of relevant literature, including previously published evidence-based recommendations. The methods used to judge the strength of the evidence for the recommendations were adapted from those used in the US Preventive Services Task Force (USPSTF) *Guide to Clinical Preventive Services* and are described in an earlier article by Jack et al.[10]

## Alcohol–Burden of Risk and Disease

The *2006 National Survey on Drug Use and Health* (NSDUH)[11] found that 11.8% of pregnant women reported current alcohol use and 2.9% reported binge drinking (≥ 5 drinks on the same occasion). Alcohol use rates for nonpregnant childbearing-aged women (15-44 years) in the survey were 53% for current use and 23.6% for binge drinking. National estimates using the 2002 Behavioral Risk Factor Surveillance System found that among the 7.6% of childbearing-aged women (18-44 years) who were sexually active and not using birth control, more than half reported alcohol use, and approximately 1 in 8 reported binge drinking.[12] Many of these women will become pregnant without realizing it and continue alcohol use during the early first trimester when fetal organ systems are being formed. Alcohol is a known teratogen that poses serious risk to the development of the central nervous system throughout gestation.[13] Prenatal alcohol

From the Centers for Disease Control and Prevention, Atlanta, GA (Drs Floyd and Atrash); Boston Medical Center, Boston, MA (Dr Jack); University of North Carolina School of Medicine, Chapel Hill, NC (Dr Cefalo); American College of Obstetrics and Gynecology, Washington, DC (Dr Mahoney); Substance Abuse and Mental Health Services Administration, Rockville, MD (Dr Herron); Partnership for Prevention, Washington, DC (Dr Husten); and Wayne State University School of Medicine, Detroit, MI (Dr Sokol).

Received June 17, 2008; revised Sept. 11, 2008; accepted Sept. 18, 2008.

Reprints: R. Louise Floyd RN, DSN, Centers for Disease Control and Prevention, National Center on Birth Defects and Developmental Disabilities, Fetal Alcohol Prevention Team, 1825 Century Center, E86, Atlanta, GA 30345. rlf3@cdc.gov.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Conflict of Interest: R. Louise Floyd, DSN, RN; Brian W. Jack, MD; Robert Cefalo, MD, PhD; Hani Atrash, MD, MPH; Jeanne Mahoney, BSN, RN; Anne Herron, PhD; and Robert J. Sokol, MD have no conflict of interest including grants, honoraria, advisory board membership, or share holdings. Corinne Husten, MD, MPH is on the board of Directors for the North American Quitline consortium and her family owns some stock in Pfizer, New York, NY; and Johnson and Johnson, New Brunswick, NJ.

0002-9378/$34.00
Published by Mosby, Inc.
doi: 10.1016/j.ajog.2008.09.018

exposure is associated with significant maternal and fetal health risks including spontaneous abortion,[14,15] prenatal and postnatal growth restriction birth defects, and neurodevelopmental deficits including mental retardation,[16-19] with fetal alcohol syndrome being the most commonly known condition along a spectrum of effects known as fetal alcohol spectrum disorders (FASD). Prenatal alcohol use is considered a leading preventable cause of birth defects and developmental disabilities in the United States[20] and there is no established safe level of alcohol consumption during pregnancy.[21,22] Using abstraction of existing records as a means of identifying cases of FASD (growth retardation, physical anomalies, and neurodevelopmental abnormalities including mental retardation) in Alaska, Arizona, Colorado, and New York, the CDC reported that prevalence rates among those states ranged from 0.3 to 1.5 cases per 1000 live-born infants.[23] Another study evaluated a variety of FASD estimates drawn from studies using a variety of methodologies and concluded that the prevalence of FASD in the United States is likely to be between 0.5 to 2 cases per 1000 live births.[24] The lifetime cost burden for FASD is estimated to be $2 million per case.[25] Alcohol use levels prior to pregnancy are the strongest predictor of alcohol use during pregnancy.

**Detection and Intervention**

Evidence-based guidelines have been developed for identifying and intervening with childbearing-aged women who are engaging in excessive drinking (ie, > 7 drinks/week or > 3 drinks on 1 occasion). A number of validated screening instruments are available for use in pregnant and nonpregnant, preconception childbearing-aged women including the TWEAK (Tolerance or number of drinks needed to feel high; Worry or concerns by family or friends about drinking behavior; Eye-opener in the morning; blackouts or Amnesia while drinking; self-perception of the need to [K] cut-down on alcohol use), T-ACE (Tolerance [how many drinks does it take to make you feel high?]; Annoyed [have people annoyed you by criticizing your drinking?]; Cut down [have you ever 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?]), AUDIT (Alcohol Use Disorders Identification Test; a 10-item screening tool for identifying risky drinkers), and AUDIT-C (3-item version of the Alcohol Use Disorders Identification Test).[26-28] A recent systematic review of the evidence on the effectiveness of behavioral interventions in reducing risky/harmful alcohol use[1] in adults was conducted by the USPSTF. Twelve clinical trials of adults, most of which included childbearing-aged, nonpregnant women, were reviewed. The clinical outcomes of interest were drinks per day, drinks per week, and not binge drinking. The systematic review found good evidence overall for the effectiveness of screening and behavioral interventions in reducing these outcomes among adults in primary care settings at 6 and 12 months, but found limited evidence for their effectiveness in reducing alcohol-related morbidities.[29,30] A second systematic review and meta-analysis based on 8 trials focused on patients in primary care also concluded that brief alcohol interventions are effective in reducing alcohol consumption at 6 and 12 months.[31] Currently, the USPSTF recommends screening and brief counseling interventions for adults with alcohol use problems in primary care settings including nonpregnant and pregnant childbearing-aged women, concluding that the benefits of behavioral counseling interventions in reducing risky drinking outweighs any potential harm.

Two additional alcohol studies have appeared that target nonpregnant, childbearing-aged women in specific with counseling interventions aimed at reducing risky drinking. One study, appearing after the USPSTF report, confirms the efficacy of a brief motivational intervention in combination with effective contraception use in reducing risk for alcohol-exposed pregnancies (AEP) in women at high risk in the preconception period.[32] The study provided women at high risk in diverse settings with a 4-session counseling intervention and a contraception counseling and services visit during a 14-week window of time. Outcome measures were assessed at 3, 6, and 9 months postintervention. Women could reduce their risk for an AEP by reducing risky drinking, initiating effective contraception use, or both. The study found that the odds of reducing risk for an AEP were 2-fold higher for women in the intervention group as compared with women in the control group at all 3 follow-up visits, and that significantly more women in the intervention group changed both risk behaviors as compared with the control group. Another study targeting childbearing-aged women attending physicians' offices in community health practice settings found that alcohol use screening and brief advice from a physician significantly decreased alcohol use among women who received the intervention compared with those who did not receive the intervention.[33]

The National Institute on Alcohol Abuse and Alcoholism produced a guidance document for clinicians (*Helping Patients Who Drink Too Much: A Clinician's Guide*)[34] that uses quantity, frequency, and maximum amounts of alcohol consumed as a guide for advising and treating individuals who exceed recommended alcohol consumption limits (www.niaaa.nih.gov). In 2005, in collaboration with the CDC, the American College of Obstetricians and Gynecologists (ACOG) produced and distributed a tool kit (*Drinking and Reproductive Health: A Fetal Alcohol Spectrum Disorders Prevention Tool Kit)* that is available free at www.acog.org and describes techniques for screening and counseling prenatal and preconception women who consume alcohol. In addition to the recommendation of the USPSTF to screen and intervene with adults with alcohol use disorders in primary care settings, the American Academy of Pediatrics and ACOG have identified alcohol, tobacco, and illicit drug use as areas that should be assessed at all health encounters during a woman's reproductive years and particularly visits that are part of preconception care.[35] They further recommend that patients should be counseled about the benefits of abstaining from alcohol,

tobacco, and illicit drug use before and during pregnancy. The Department of Health and Human Services, Office of the Surgeon General, released an updated *Advisory on Drinking and Pregnancy* in 2005 advising women who are pregnant, planning to become pregnant, or at risk of becoming pregnant to abstain from alcohol use.

*Recommendation.* All childbearing-aged women should be screened for alcohol use and brief interventions should be provided in primary care settings including advice regarding the potential for adverse health outcomes. Brief interventions should include accurate information about the consequences of alcohol consumption including the effects of drinking during pregnancy, that effects begin early during the first trimester, and that no safe level of consumption has been established. Those women who show signs of alcohol dependence should be educated as to the risks of alcohol consumption, and for women interested in modifying their alcohol use patterns, efforts should be made to identify programs that would assist them to achieve cessation and long-term abstinence. Contraception consultation and services should be offered and pregnancy delayed until it can be an alcohol-free pregnancy. *Strength of recommendation*: B; *quality of evidence*: I-a.

## Tobacco–Burden of Risk and Disease

Smoking during pregnancy can be harmful to the mother and the fetus. National data drawn from birth certificates filed from 1990-2002 documented a decline in smoking during pregnancy with 18.4% reporting prenatal smoking in 1990 as compared with 11.4% in 2002.[36] A population-based study in 10 states that looked at quit rates during pregnancy found that between 1993 and 1999, rates of smoking cessation in pregnancy increased from 37-46%.[37] The 2006 NSDUH found tobacco use was reported by 16.5% of pregnant women and 29.5% of nonpregnant childbearing-aged women.[11] Regardless of pregnancy status, women who smoke are at increased risk for a wide range of cancers (ie, lung, cervical, pancreatic, bladder, and kidney), cardiovascular disease, and pulmonary disease.[38]

Fetal effects of exposure to maternal smoking include intrauterine growth retardation, prematurity, low birthweight, and sudden infant death syndrome (SIDS). Maternal complications include premature rupture of membranes, placenta previa, and placental abruption with suggestive evidence for an association between smoking and ectopic pregnancy and spontaneous abortion.[5] Estimates indicate that eliminating smoking during pregnancy would reduce infant deaths by 5% and reduce the proportion of low birthweight singleton births by 10%.[39,40] Secondhand smoke exposure of an infant causes respiratory illnesses such as asthma and bronchitis, ear infections, and SIDS.[41,42]

### Detection and Intervention

Screening for tobacco use in clinical settings usually consists of the patient's self-report of smoking when queried by the health provider. Nondisclosure of smoking does not appear to be a significant problem among nonpregnant women of childbearing age (nondisclosure rate about 1.2%),[43] but it may be a problem for pregnant women. One randomized controlled study used cotinine-verified quit rates to test the efficacy of an intervention to reduce smoking during pregnancy.[44] The study found a 35% nondisclosure rate for smoking at the endpoint measure of the study (eighth month) through comparison of self-reported smoking and urinary cotinine levels that were indicative of smoking. Another study on smoking during pregnancy found 73% of self-reported nonsmokers had elevated cotinine levels.[45] Researchers have found that the use of a multiple-choice format question when assessing smoking status that consists of asking the patient to describe her smoking using 1 of 3 options (I smoke regularly now, about the same as before finding out I was pregnant; I smoke regularly now, but I've cut down since I found out I was pregnant; or I smoke every once in a while) can improve disclosure. In a randomized controlled study this approach resulted in a 40% increase in disclosure over the standard question "do you smoke?"[46]

Although substantial research literature exists for interventions to increase smoking cessation among adults, women in general, and pregnant women, clinical studies focusing specifically on nonpregnant women of childbearing age are not available. Because the efficacy of cessation interventions are robust across population groups, the recommendations for women in the preconception period are the same as those for adults overall. Studies find that spontaneous smoking cessation rates among women who become pregnant range from 11-28% among publicly funded pregnant smokers and from 40-65% among privately insured pregnant smokers.[47] Such results have led some to suggest that even higher cessation rates could occur among women in the preconception period if evidence-based tobacco-dependence treatments were provided uniformly to this group.[48] Clinical trials demonstrating that preconception smoking cessation improves pregnancy outcomes have not been a research focus. However, if a woman achieves smoking cessation in the preconception period and maintains it throughout the prenatal period, pregnancy outcomes should be comparable with, if not better than, those reported in prenatal smoking cessation programs.

An authoritative clinical practice guideline for clinicians in identifying and treating childbearing-aged women who use tobacco products is *Treating Tobacco Use and Dependence*,[49] which contains comprehensive, evidence-based guidelines that have been developed for the treatment of tobacco dependence and have been shown to be safe and effective. A total of 6000 articles were reviewed for the guideline and 180 randomized controlled studies were identified for potential inclusion in the systematic review. Evidenced-based recommendations resulting from the summaries of the reviews and meta-analyses addressed screening and intervention. The guideline concluded that screening for tobacco use significantly increases rates of physician intervention (strength of evidence = A). Further, the findings

support the conclusion that tobacco dependence treatment is effective (strength of evidence = A). This dependence treatment includes brief advice and intervention using the 5 A's (ask, advise, assess, assist, arrange) and pharmacotherapies. Food and Drug Administration-approved medications for nonpregnant women include bupropion, nicotine replacement therapy (gum, inhaler, lozenge, nasal spray, and patch), and verenacline. Face-to-face individual and group counseling as well as telephone counseling have also been shown to be effective treatments.[48] For women who do not wish to attempt tobacco cessation, use of effective motivational enhancement strategies can increase future quit attempts. A concise summary of the guideline recommendations can be found online at http://jama.ama-assn.org/cgi/content/abstract/283/24/3244.

In May 2008, a new updated version of the guideline was released that further confirms the efficacy of smoking cessation interventions. It finds that although both psychosocial and medication interventions are efficacious, a combination of the 2 can bring about even higher rates of smoking cessation. The guideline recommends psychosocial interventions for pregnant women, but notes that the safety and efficacy of medications has not been established for this population.[50] The new report can be accessed at www.surgeongeneral.gov/tobacco/. A useful guide for clinicians (*Helping Smokers Quit: A Guide for Clinicians)* is available at www.ahrq.gov/clinic/tobacco/clinhlpsmksqt.htm.

Currently, there are tobacco prevention and control programs in all states and the District of Columbia, funded from various sources (eg, tobacco taxes, master settlement agreements, general state budget, and CDC). All states provide free telephone cessation counseling accessible through a single portal number (1-800 QUIT NOW), although the level of support available (number of counseling calls, availability of free medication) varies between states. These programs can be of much assistance to clinicians in referring women for more intensive counseling services.

*Recommendation.* All childbearing-aged women should be screened for tobacco use. A brief intervention should be provided to all tobacco users that includes: counseling describing the benefits of not smoking before, during, and after pregnancy; a discussion of medications; and referral to more intensive services (individual, group, or telephone counseling) if the woman is willing to use these services. *Strength of recommendation*: A; *quality of evidence*: I-a.

## Illicit Substances–Burden of Risk and Disease

The 2006 NSDUH reported that 8.3% of respondents 12 years and older stated they had used illicit drugs during the past month. Commonly used illicit drugs used included marijuana (6%), cocaine (1%), inhalants (1.3%), hallucinogens (0.7%), and heroin (0.14%). Among nonpregnant women aged 15-44 years, 10% reported illicit drug use during the past month and 4% of pregnant women reported using illicit drugs during this same time period. These rates are similar to a report in 2001 that found the proportion of nonpregnant and pregnant women who reported using illicit drugs to be 8.3% and 3.7%, respectively.[51] Women who use illicit drugs often experience higher rates of sexually transmitted diseases, human immunodeficiency virus, hepatitis, domestic violence, and depression as compared with women who do not use illicit drugs.[52] Use of illicit drugs during pregnancy is associated with an increased risk of maternal complications and adverse outcomes for infants and children. The effects of cocaine and marijuana have been the focus of a number of studies but difficulties arise in sorting out the independent effects of these and other drugs given the high prevalence of polydrug use (including alcohol and tobacco). Cocaine use has been linked to increased risks for low birth weight, prematurity, perinatal death, abruptio placenta, and small for gestational age births.[53,54] A meta-analysis found increased risk for these outcomes in children exposed to cocaine vs those not exposed, but among those only exposed to cocaine, significant associations were found only for placental abruption and premature rupture of membranes.[55] Evidence of increased risk for maternal and postneonatal mortality associated with perinatal cocaine use has also been reported for substance abuse disorders in general use.[56,57] Marijuana use has been less implicated in adverse pregnancy outcomes,[58] but effects on intellectual development have been reported in young children tested using the Stanford-Binet Intelligence Scale.[59,60]

Effects of prenatal cocaine exposure on development and behavior in the children have been extensively studied. A systematic review reported in 2001 concluded there was no convincing evidence of cocaine-specific effects on development in that the effects observed could be the sequelae of multiple other risk factors including tobacco, marijuana, alcohol, and environment.[61]

### Detection and Intervention

Although a number of well-validated, brief instruments are available for use in primary care setting for screening childbearing-aged women for alcohol abuse, fewer such instruments are available for use in screening women for illicit drug use. A recent systematic review of screening instruments for illicit drug use found fair evidence for the use of the CRAFFT[2] (C, have you ever ridden in a Car driven by someone [including yourself] who was high or had been using alcohol or drugs?; R, have you ever used alcohol or drugs to Relax, feel better about yourself, or fit in?; A, have you ever used alcohol or drugs while you are by yourself, Alone?; F, do you ever Forget things you did while using alcohol or drugs?; F, does your Family or do your Friends ever tell you that you should cut down on your drinking or drug use?; T, have you ever gotten in Trouble while you were using alcohol or drugs?) in adolescents. For adult populations, the Alcohol Substance Involvement Screening Test and Drug Abuse Screening Test have acceptable accuracy and reliability for use in practice settings.[62] However, the USPSTF stopped short of endorsing routine use of these screening tools in primary care settings because of the unavailability of evidence sufficient to weigh the potential benefits and potential harm associ-

ated with their use. Nevertheless, in a Committee Opinion in 2004 addressing at-risk drinking and illicit drug use, the Committee on Ethics of the ACOG endorsed the use of universal screening questions, brief intervention, and referral to treatment for both obstetric and gynecologic patients.[48] The Substance Abuse Mental Health Services Administration, Center for Substance Abuse Treatment has produced 3 best practices guidelines addressing treatment of substance abuse, all of which recommend screening by either clinician questioning or use of a validated screening tool with follow-up assessment of those screening positive; brief interventions for mild to moderate substance-related problems; and referral to specialized treatment for dependence disorders.[63-65] Toxicologic drug testing is available from a number of commercial laboratories but is generally not recommended for use in universal screening in primary care settings.

Effective interventions for treating illicit drug abuse and dependence are both behavioral and pharmacologic. There is substantial literature around effective treatments for illicit drug abuse. One recent metaanalysis assessed the efficacy of psychosocial treatments for cannabis, cocaine, opiate, and polysubstance abuse in 34 controlled trials.[66] Types of psychosocial treatments included contingency management, relapse prevention, general cognitive behavior, and cognitive behavior therapy and contingency management combined. The researchers found a moderate effect size across all conditions and all substances ($d = 0.45$; confidence interval: 0.27-0.63), which they noted was comparable with other effective treatments in psychiatry. Psychosocial therapies worked best for cannabis abuse and least well for polysubstance abuse. Medications were also used in 16 of the studies. Medications used in the polysubstance use studies included methadone and buprenorphine; methadone in the opiate studies; and naltrexone, buprenorphine, and methadone in the cocaine studies. Antidepressants are also used in treating cocaine abuse.[67] Research continues in evaluating pharmacotherapeutics for substance abuse with one recent study finding both methadone maintenance therapy and buprenorphine maintenance therapy more effective and more cost-effective than no drug therapy, but also tempered these findings with a word of caution about monitoring patients for safety concerns previously identified in the use of these medications.[68]

Manualized guides for behavioral treatment of substance abuse have also been investigated. One multisite study looked at 4 psychosocial treatments for cocaine-dependent patients and found that a manual-guided treatment consisting of intensive drug counseling and group drug counseling produced better outcomes on the Addiction Severity Index-Drug Use Composite score than cognitive therapy or supportive-expressive therapy and group drug counseling or group counseling alone.[69] Another 9-session efficacious intervention for treating marijuana dependence that combined motivational enhancement therapy and cognitive behavioral therapy was recently adapted into a manualized version for clinicians.[70]

Some evidence exists for reducing drug-exposed pregnancies by improving contraception use among women who are sexually active and engaging in alcohol and illicit drug abuse. In one intervention study using an advocacy model, participants increased participation in alcohol and drug treatment programs and increased contraception use from 5% prior to enrollment to 61% at 12 months, thereby effectively reducing their risk for a drug-exposed pregnancy.[71] A clinical trial that focused on reducing risks for an AEP among polysubstance users also found success in reducing risk for an AEP by providing a motivational intervention in conjunction with contraceptive consultation and services. At the 9-month follow-up, significantly more women in the treatment group had reduced risky drinking and instituted effective contraception use.[32]

*Recommendation.* A careful history should be obtained to identify use of illegal substances as part of the preconception risk assessment. Childbearing-aged women should be counseled on the risks of illicit drug use before and during pregnancy and offered information on counseling and treatment programs that support abstinence and rehabilitation. Contraception services should be offered and pregnancy should be delayed until individuals are drug free. *Strength of recommendation*: C; *quality of evidence*: III.

## Conclusions

Alcohol, tobacco, and illicit drug use pose significant health risks to the health of childbearing-aged women and their children. Early identification of patterns of use of these substances in the preconception period provides the opportunity to assist women in reducing major health risks. Studies have shown the feasibility and efficacy of interventions designed to reduce substance use in childbearing-aged women. Implementation of these recommendations in clinical practice settings can play an important role in improving the health of women and their families. ■

## REFERENCES


**1.** McGinnis JM, Foege WH. Actual causes of death in the United States. JAMA 1993;270:2207-12.

**2.** Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States [erratum appears in JAMA 2005;293:293-4]. JAMA 2004;291:1238-45.

**3.** Thacker SB, Ikeda RM, Gieseker KE, , et al. The evidence base for public health: informing policy at the Centers for Disease Control and Prevention. Am J Prev Med 2005;28:227.e1-27.

**4.** US Department of Health and Human Services. Healthy people 2010. 2nd ed. With understanding and improving health. Vol 1. Washington, DC: US Government Printing Office; November 2000.

**5.** The health consequences of smoking: a report of the Surgeon General. Atlanta, GA: Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.

**6.** Kramer MS. Determinants of low birth weight: methodological assessment and meta-analysis. Bull World Health Organ 1987;65:663-737.

**7.** DiFranza JR, Lew RA. Effect of maternal cigarette smoking on pregnancy complications and sudden infant death syndrome. J Fam Pract 1995;40:385-94.

**8.** Honein MA, Rasmussen SA, Reffhuis J, et al. Maternal smoking and environmental tobacco smoke exposure and the risk of orofacial clefts. Epidemiology 2007;18:226-33.

**9.** Ruiz P, Strain EC, Langrod JG. The substance abuse handbook. Philadelphia, PA: Lippincott Williams & Wilkins; 2007.
**10.** Jack BW, Atrash H, Coonrod DV, Moos MK, Cefalo R, Johnson K. The clinical content of preconception care: an overview. Am J Obstet Gynecol.
**11.** Substance Abuse and Mental Health Services Administration. Results from the 2006 national survey on drug use and health: national findings. NSDUH series H-32, Department of Health and Human Services publication No. SMA 07-4923. Rockville, MD: Office of Applied Studies; 2007.
**12.** Centers of Disease Control and Prevention. Alcohol consumption among women who are pregnant or who might become pregnant–United States, 2002. MMWR Morb Mortal Wkly Rep 2004;53:1178-81.
**13.** Streissguth AP, O'Malley K. Neuropsychiatric implications and long-term consequences of fetal alcohol spectrum disorders. Semin Clin Neuropsychiatry 2000;5:177-90.
**14.** Kesmodel U, Wisbong K, Olsen SF, Henriksen TB, Secher NJ. Moderate alcohol intake in pregnancy and the risk of spontaneous abortion. Alcohol Alcohol 2002;37:87-92.
**15.** Windham GC, Von Behren J, Fenster L, Schaefer C, Swan SH. Moderate maternal alcohol consumption and the risk of spontaneous abortion. Epidemiology 1997;8:509-14.
**16.** Sokol RJ, Delaney-Black V, Nordstrom B. Fetal alcohol spectrum disorder. JAMA 2003; 290:2996-9.
**17.** Stratton K, Howe C, Battaglia F, eds. Fetal alcohol syndrome: diagnosis, epidemiology, prevention and treatment. Washington, DC: Institute of Medicine National Academy Press; 1996.
**18.** Centers of Disease Control and Prevention. Guidelines for identifying and referring persons with fetal alcohol syndrome. MMWR Morb Mortal Wkly Rep 2005;54:1-15.
**19.** Mattson SN, Schoenfeld REP. Teratogenic effects of alcohol on brain and behavior. Alcohol Clin Exp Res 2001;25:185-91.
**20.** American Academy of Pediatrics; Committee on Substance Abuse and Committee on Children with Disabilities. Fetal alcohol syndrome and alcohol-related neurodevelopmental disorders. Pediatrics 2000;106:358-61.
**21.** Hanson JW, Streissguth AP, Smith DW. The effects of moderate alcohol consumption during pregnancy on fetal growth and morphogenesis. J Pediatr 1978;92:457-60.
**22.** Maier SE, West JR. Drinking patterns and alcohol-related birth defects. Alcohol Res Health 2001;25:168-74.
**23.** Centers of Disease Control and Prevention. Fetal alcohol syndrome–Alaska, Arizona, Colorado, and New York, 1995-1977. MMWR Morb Mortal Wkly Rep 2002;51:433-5.
**24.** May PA, Gossage JP. Estimating the prevalence of fetal alcohol syndrome: a summary. Alcohol Res Health 2001;25:159-67.
**25.** Lupton C, Burd L, Harwood R. Cost of fetal alcohol spectrum disorders. Am J Med Genet 2004;127C:3-9.
**26.** Chang G. Alcohol-screening instruments for pregnant women. Alcohol Res Health 2001;25:204-9.
**27.** Floyd RL, O'Connor MJ, Bertrand J, Sokol R. Reducing adverse outcomes from prenatal alcohol exposure: a clinical plan of action. Alcohol Clin Exp Res 2006;30:1271-5.
**28.** Bradley KA, DeBenedetti AF, Volk RJ, Williams EC, Frank D, Kivlahan DR. AUDIT-C as a brief screen for alcohol misuse in primary care. Alcohol Clin Exp Res 2007;31:1208-17.
**29.** Whitlock EP, Polen MR, Green CA, Orleans T, Klein J. Behavioral counseling interventions in primary care to reduce risky/harmful alcohol use by adults: a summary of the evidence for the US Preventive Services Task Force. Ann Intern Med 2004;140:557-68.
**30.** US Preventive Services Task Force. Screening and behavioral counseling interventions in primary care to reduce alcohol misuse: recommendation statement. Ann Intern Med 2004;140:554-6.
**31.** Bertholet N, Daeppen JB, Wietlisback BA, Fleming M, Burnand B. Reduction of alcohol consumption by brief alcohol intervention in primary care: a systematic review and meta-analysis. Arch Intern Med 2005;165:986-95.
**32.** Floyd RL, Sobell M, Velasquez MM, et al. Preventing alcohol-exposed pregnancies: a randomized controlled trial. Am J Prev Med 2007;32:1-10.
**33.** Manwell LB, Fleming MF, Mundt MP, Stauffacher EA, Barry KL. Treatment of problem alcohol use in women of childbearing age: results of a brief intervention trial. Alcohol Clin Exp Res 2000;24:1517-24.
**34.** US Department of Health and Human Services. Helping patients who drink too much: a clinician's guide. National Institutes of Health. National Institute on Alcohol Abuse and Alcoholism. NIH Publication No. 07-3769. Rockville, MD. 2005.
**35.** American Academy of Pediatrics and the American College of Obstetricians and Gynecologists. Guidelines for perinatal care. 5th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2002.
**36.** Centers of Disease Control and Prevention. Smoking during pregnancy–United States, 1990-2002. MMWR Morb Mortal Wkly Rep 2004;53:911-5.
**37.** Colman GJ, Joyce T. Trends in smoking before, during, and after pregnancy in ten states. Am J Prev Med 2003;24:29-35.
**38.** US Department of Health and Human Services. Health consequences of tobacco use among women. In: Women and smoking: a report of the surgeon general (177-450). Rockville, MD: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics; 2001.
**39.** Salihu HM, Aliyu MH, Pierre-Louis BJ, Alexander GR. Levels of excess infant deaths attributable to maternal smoking during pregnancy in the United States. Matern Child Health J 2003;7:219-27.
**40.** Ventura SJ, Hamilton BE, Mathews TJ, Chandra A. Trends and variations in smoking during pregnancy and low birth weight: evidence from the birth certificate, 1990-2000. Pediatrics 2003;111:1176-80.
**41.** Gold DR, Burge HA, Carey V, Milton DK, Platts-Mills T, Weiss ST. Predictors of repeated wheeze in the first year of life: the relative roles of cockroach, birth weight, acute lower respiratory illness, and maternal smoking. Am J Respir Crit Care Med 1999;160:227-36.
**42.** US Department of Health and Human Services. The health consequences of involuntary exposure to tobacco smoke: a report of the surgeon general–executive summary. US Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; Atlanta, GA. 2006.
**43.** Caraballo RS, Giovino GA, Pechacek TF, Mowery PD. Factors associated with discrepancies between self reports on cigarette smoking and measured serum cotinine levels among persons aged 17 years or older. Am J Epidemiol 2001;153:807-14.
**44.** Kendrick JS, Zahniser CS, Miller N, et al. Integrating smoking cessation into routine public prenatal care: the smoking cessation in pregnancy project. Am J Public Health 1995;85: 217-22.
**45.** Webb DA, Boyd NR, Messina D, Windsor RA. The discrepancy between self-reported smoking status and urine cotinine levels among women enrolled in prenatal care at four publicly funded clinical sites. J Public Health Manag Pract 2003;9:322-5.
**46.** Mullen PD, Carbonari JP, Tabak ER, Glenday MC. Improving disclosure of smoking by pregnant women. Am J Obstet Gynecol 1991;165:409-13.
**47.** Melvin CL, Gaffney CA. Treating nicotine use and dependence of pregnant and parenting smokers: an update. Nicotine Tob Res 2004;6:S107-24.
**48.** Rosenthal AC, Melvin CL, Barker DC. Treatment of tobacco use in preconception care. Matern Child Health J 2006;10:S147-8.
**49.** Fiore MC, Bailey WC, Cohen CJ, et al. A clinical practice guideline for treating tobacco use and dependence. Rockville, MD: US Department of Health and Human Services, Public Health Service; 2000.
**50.** Fiore MC, Jaen CR, Baker TB, et al. Treating tobacco use and dependence: update. Clinical practice guideline. Rockville, MD: US Department of Health and Human Services, Public Health Service; May 2008.
**51.** Substance Abuse and Mental Health Services Administration. Results from the 2001 national household survey on drug abuse. Vol 1. Summary of national findings. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2002.
**52.** ACOG Committee on Ethics. ACOG committee opinion. No. 294. At-risk drinking and

illicit drug use: ethical issues in obstetric and gynecologic practice. Obstet Gynecol 2004; 103:1021-31.
**53.** Handler A, Kistin N, Davis F, Ferre C. Cocaine use during pregnancy: perinatal outcomes. Am J Epidemiol 1992;135:1425-7.
**54.** Hadeed AJ, Siegel SR. Maternal cocaine use during pregnancy: effect on the newborn infant. Pediatrics 1989;84:205-10.
**55.** Addis A, Moretti M, Syed F, Einarson T, Koren G. Fetal effects of cocaine: an updated meta-analysis. Reprod Toxicol 2001;15:341-69.
**56.** Wolfe EL, Davis T, Guydish J, Delucchi KL. Mortality risk associated with perinatal drug and alcohol use in California. J Perinatol 2005;25: 93-100.
**57.** Kelly R, Russo J, Holt V, et al. Psychiatric and substance use disorders as risk factors for low birth weight and preterm delivery. Obstet Gynecol 2002;100:297-304.
**58.** Shiono PH, Klebanoff MA, Nugent RP, et al. The impact of cocaine and marijuana use on low birth weight and preterm birth: a multicenter study. Am J Obstet Gynecol 1995;172:19-27.
**59.** Day NL, Richardson GA, Goldschmidt L, et al. Effect of prenatal marijuana exposure on the cognitive development of offspring at age three. Neurotoxicol Teratol 1994;16:169-75.
**60.** Goldschmidt L, Richardson GA, Willford J, Day NL. Prenatal marijuana exposure and intelligence test performance at age 6. J Am Acad Child Adolesc Psychiatry 2008.
**61.** Frank DA, Augustyn M, Knight WG, Pell T, Zuckerman B. Growth, development, and behavior in early childhood following prenatal cocaine exposure. JAMA 2001;285:1613-25.
**62.** Lanier D, Ko S. Screening in primary care settings for illicit drug use: assessment of screening instruments–a supplemental evidence update for the US Preventive Services Task Force. Evidence synthesis No. 58, part 2. AHRQ publication No. 08-05108-EF-2. Rockville, MD: Agency for Healthcare Research and Quality; January 2008.
**63.** US Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Public Health Service, Center for Substance Abuse Treatment. TIP 24: a guide to substance abuse services for primary care clinicians. DHHS publication No. (SMA) 97-3139. Rockville, MD; 1997.
**64.** US Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Public Health Service, Center for Substance Abuse Treatment. TIP 34: brief interventions and brief therapies for substance abuse. DHHS Publication No. (SMA) 99-3353. Rockville, MD; 1999.
**65.** US Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Public Health Service, Center for Substance Abuse Treatment. TIP 35: enhancing motivation for change in substance abuse treatment. DHHS Publication No. (SMA) 99-3354. Rockville, MD; 1999.
**66.** Dutra LD, Stathopoulou G, Basden SL. Leyro TM, Powers MB, Otto MW. A meta-analytic review of psychosocial interventions for substance use disorders. Am J Psychiatry 2008;165:179-87.
**67.** Kleber HD. Pharmacologic treatments for heroin and cocaine dependence. Am J Addict 2003;12(Suppl2):S5-18.
**68.** Connock M, Juaez-Garcia A, Jowett S, et al. Methadone and buprenorphine for the management of opioid dependence: a systematic review and economic evaluation. Health Technol Assess 2007;11:1-171.
**69.** Crits-Christoph P, Siqueland L, Blaine J, et al. Psychosocial treatments for cocaine dependence: National Institute on Drug Abuse collaborative cocaine treatment study. Arch Gen Psychiatry 1999;56:493-502.
**70.** Steinberg KL, Roffman RA, Carroll KM, et al. Brief counseling for marijuana dependence: a manual for treating adults. DHHS publication No. (SMA) 05-4022. Rockville, MD: Center for Substance Abuse Treatment, Substance Abuse and Mental Health Services Administration; 2005.
**71.** Grant TM, Ernst CC, Streissguth AP. An intervention with high-risk mothers who abuse alcohol and drugs: the Seattle advocacy model. Am J Public Health 1996;86:1816-7.