Maternal Substance Abuse and Infant Health: Policy Options across the Life Course

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THE CAMPAIGN TO REDUCE INFANT MORTALITY AND morbidity re ects both triumphs and disappointments in medical care and public health policy in the United States. Over the past 25 years, the incidence of death during the rst year of life has dropped by approximately 60 percent (Singh and Yu 1995). Yet infant mortality remains higher in the United States than in most other developed countries. The rate of infant mortality among African Americans is nearly twice the rate for whites, a gap that has widened rather than diminished over the past decade (National Center for Health Statistics 1994). In addition, rates of low birth weight and preterm delivery have remained remarkably stable for the past 25 years (National Center for Health Statistics 1994).

Many public health interventions have been devised to improve birth outcomes through a focus on maternal health. The goal of these initiatives has been to reduce the use of tobacco, alcohol, and illegal drugs by pregnant women. The reasoning behind such efforts is straightforward and compelling: maternal substance use can have serious health consequences for fetuses and accounts for a signi cant proportion of infant morbidity and mortality.

This article reviews the means and opportunities for reducing the impact of maternal substance abuse on infant health. Its objectives are

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as follows:

1. to identify a wide range of interventions and policies, and their optimal timing in the female life course, that could reduce the number of pregnant women who abuse tobacco, alcohol, or illicit drugs
2. to illustrate the utility of a life course perspective on maternal substance abuse by reviewing the published literature on the ef cacy of tobacco prevention and cessation interventions
3. to describe similarities and differences in interventions that are designed to dissuade mothers from using tobacco, alcohol, and illicit drugs
4. to articulate speci c conclusions and recommend policies based on our proposed framework and review of the literature

Many of the interventions we describe were devised for women who are using substances while pregnant. However, other methods with great potential for reducing maternal substance use are appropriate when the woman is not pregnant. The goal is to create a framework for thinking beyond pregnancy-triggered interventions and to stimulate discussion of a broader array of policy responses to maternal substance abuse.

Teratogenic Effects of and Trends in Maternal Substance Abuse

Tobacco

Tobacco has long been identi ed as a leading cause of poor birth outcomes in the United States (Brandt 1987). The National Center for Health Statistics estimates that approximately 40,000 cases of low birth weight and 2,800 infant deaths per year are directly related to maternal tobacco use (Hoyert 1996). Cigarette smoking is an independent risk factor for Sudden Infant Death Syndrome, and infants of mothers who smoke are signi cantly more vulnerable (Golding 1997; MacDorman, Cnattingius, Hoffman, et al. 1997). In addition, maternal smoking is a factor in an estimated 140,000 spontaneous abortions annually (King 1997). Exposure to environmental tobacco smoke can also increase the prevalence of respiratory and middle ear infections among infants (Samet, Lewit, and Warner 1994).

Controlling for race and other factors, maternal smokers are about twice as likely to deliver a low-birth-weight infant (under 2500 grams) as those who do not smoke during pregnancy (Brandt 1987; Chomitz, Cheung, and Lieberman 1995). Even when they have used different methods and data sources, researchers have consistently shown that smoking is associated with a 150- to 230-gram reduction in mean birth weight, and there is signi cant evidence of a dose–response relationship (Butler, Goldstein, and Ross 1972; Anderson 1992). In addition, it is estimated that maternal smoking is responsible for 14 percent of preterm births. Quitting or reducing the number of cigarettes smoked during pregnancy has a signi cant, positive effect on both birth weight and pregnancy length (Secker-Walker, Vacek, Flynn, et al. 1997).

Cigarette smoking can be considered the most prevalent form of maternal substance abuse. It is currently estimated that 25 to 30 percent of women of reproductive age and 14 to 20 percent of pregnant women are smokers (Floyd 1993; Kendrick and Merritt 1996; King 1997). Although the incidence of maternal smoking has decreased over the past decade, the rates reached a plateau a few years ago. Another alarming fact is that the majority of women who quit smoking while they are pregnant resume the habit during the year after delivery, most often during the rst three months postpartum (Fingerhut, Kleinman, and Kendrick 1990).

Alcohol

Although the prevalence of alcohol consumption among pregnant women has decreased over the past twenty years, that trend may be leveling off and perhaps even reversing. Population-based survey data indicate that, among pregnant women aged 18 to 44, those who reported any drinking during the previous month increased from 12.4 percent in 1991 to 16.3 percent in 1995 (Centers for Disease Control and Prevention 1997). More signi cantly , the rate of frequent drinking increased from 0.8 percent in 1991 to 3.5 percent in 1995 (Centers for Disease Control and Prevention 1997).

Heavy alcohol use during pregnancy is associated with Fetal Alcohol Syndrome (FAS), resulting in the following constellation of disabilities: growth retardation; physical, mental, and behavioral abnormalities; central nervous system impairment, including developmental delay, small head size, and speech or language delay; and characteristic facial

abnormalities (Institute of Medicine 1996). Heavy drinking during pregnancy has been labeled the world's leading preventable cause of mental retardation (Chomitz, Cheung, and Lieberman 1995). In addition, in utero exposure to lesser amounts of alcohol seems to result in physical and behavioral problems that may be less obvious, and thus more dif cult to detect, than those associated with FAS. Isolated growth retardation can result from as little as one ounce of alcohol per day (Fried and O'Connell 1987), as can alcohol-related neurodevelopmental disorder (Ouellette, Rosett, Rosman, et al. 1977; Day, Jasperse, and Richardson 1989; Chomitz et al. 1995; Institute of Medicine 1996). Additional evidence suggests that moderate alcohol use is associated with reduced gestation, and that it may retard mental and motor development during infancy (Little, Asker, Sampson, et al. 1986; Larroque, Kaminski, and Lelong 1993; Streissguth, Bookstein, Sampson, et al. 1990; 1993; Chomitz et al. 1995).

The degree to which alcohol affects fetal development depends on the usage pattern and timing during pregnancy (Streissguth et al. 1993). Like other substances, the impact of alcohol on fetal development is strongest when used early in pregnancy. Rosett, Weiner, Zuckerman, et al. (1980) showed that reducing drinking by the midpoint of the pregnancy can modify some of the delay in growth and development.

Illicit Drugs

Illicit drugs pose several challenges for both public policy and research. First, the sheer variety of illegal drugs defeats easy generalization. Marijuana, cocaine, amphetamines, the major opiates, and illegal prescription drugs have a wide spectrum of effects on the pregnant woman and her developing fetus. Some produce important morphologic changes during the rst days or weeks following conception. Others are associated with intrauterine growth retardation or bleeding late in pregnancy.

Second, the adverse social circumstances associated with drug abuse confound both clinical and policy research. Illicit drug use is associated with late and inadequate prenatal care, deep poverty, poor nutrition, domestic and stranger violence, sexual abuse, and other severe threats to maternal and infant health (Amaro, Fried, Cabral, et al. 1990; Daley and Argeriou 1997; Hutchins and DiPietro 1997; Sanchez and Wendel 1997). Some illicit drug users engage in commercial sex work or participate in sex-for-drug exchanges that heighten pregnancy risks (El-Bassel,

Schilling, Irwin, et al. 1997). Widespread abuse of multiple drugs makes it especially dif cult to identify the biologic impact of a speci c substance. In addition, many long-term harms that are linked with illegal substances, such as behavioral disorders and subtle neurologic defects, are dif cult to observe reliably (Lewis, Haller, Branch, et al. 1996; Carta, McConnell, McEvoy, et al. 1997). Most illicit drug users also consume tobacco or alcohol, which have known teratogenic effects (Chasnoff, Grif th, Freier, et al. 1992; Kleiman 1992). Further, because maternal substance use is typically undetected in healthy deliveries, particularly when it has been light or moderate, reliance on detected cases may exaggerate the severity of drug-related infant harms.

Third, the furtive nature of illicit drug use creates special problems of measurement and estimation. Researchers do not know the true prevalence of illicit drug use by pregnant women. Population estimates indicate that consumption of tobacco and alcohol is far more prevalent than illegal drug use. However, marijuana and cocaine abuse may rival alcohol and tobacco use among disadvantaged subgroups that experience a high incidence of infant mortality and morbidity (Frank, Zuckerman, Amaro, et al. 1988). Maternal self-reports appear to severely understate the prevalence of such behaviors. When the 1992 National Pregnancy and Health Survey corrected this problem by examining urine test data from a representative sample of women during labor and delivery, it uncovered a relatively low prevalence of heroin and other opiates. However, 6.3 percent of non-Hispanic African Americans had positive toxicology screens for cocaine at labor and delivery. Only 0.1 percent of non-Hispanic whites tested positive for the same substances. Marijuana use by the two groups was similar: 1.6 percent of whites and 1.2 percent of African Americans tested positive for marijuana and related substances (National Pregnancy and Health Survey 1996). A more intensive study of 1992 California births yielded similar results (Vega, Kolody, and Hwang 1993).

The Range of Policy Options

For the past several decades, the focus of interventions and policies for improving population birth outcomes has been on prenatal care (Sardell 1990; Alexander and Korenbrot 1995). Similarly, many policies for reducing maternal substance abuse focus on the *pregnancy period* and on

prenatal care as the critical environment in which to intervene. Most programs educate pregnant women about the harmful effects of tobacco, alcohol, and illicit substances and assist pregnant users either to halt or to reduce their consumption. More coercive approaches have been advocated, including toxicology screening and legal interventions.

The problem of maternal substance abuse, however, extends beyond the mere fact of substance use by pregnant women. First, because fetal organ development begins approximately 17 days after conception, many adverse effects of substance use can damage the developing fetus before a woman knows she is pregnant and has the opportunity to seek prenatal care. Second, many alcohol and drug treatment centers will not take pregnant women into their programs (Chavkin 1992). Third, continued maternal substance abuse after birth can expose an infant to various health problems and can put the infant at risk for abuse and neglect. Thus, it is essential to adopt a broad perspective on the problem and to assess a range of opportunities for intervention.

We have identi ed many opportunities for interventions and policies regarding maternal substance abuse and have organized them according to their timing in the female life course (table 1). Although identifying pregnant women who abuse substances and intervening appropriately is a critical public health activity, other stages in life require intervention as well. Viewed this way, we see that there are opportunities for both primary prevention (reducing the number of women of reproductive age who abuse tobacco, alcohol, or illicit drugs, which will lead to fewer numbers of pregnant users) and secondary prevention (recognizing and reducing pregnant women's use of potentially harmful substances). Thus, interventions do not have to be limited to the prenatal period, and policy options can encompass more than prenatal education, cessation and treatment programs, and legal interventions.

Many interventions to reduce the prevalence of tobacco, alcohol, and other drug use start in *childhood*: prevention education in schools; regulation of tobacco and alcohol advertising and promotion; and laws restricting youth access. Similar strategies have been created to reduce substance use among young adults in their *reproductive years*. During this time, policies can target women who may become pregnant in order to produce bene ts before a pregnancy begins. Such policies include public education programs and increases in excise taxes (or strategies for in ating the cost of illicit substances). In contrast to community-level outreach or educational campaigns are interventions that recruit individuals into a program when they enter the health care delivery system. In this type

TABLE 1
Reducing the Impact of Substance Abuse on Infant Health: Policy Options across the Female Life Course

	Tobacco	Alcohol	Illicit drugs
Childhood	Preventive education Advertising restrictions Youth access restrictions Excise taxes	Preventive education Advertising restrictions Youth access restrictions Excise taxes	Preventive education — Youth access restrictions —
Reproductive ages	Public education/media campaigns In-reach interventions for smoking cessation Excise taxes Preconceptional care services Direct restrictions	Public education/media campaigns In-reach interventions for alcohol treatment Excise taxes Preconceptional care services —	Public education/media campaigns In-reach interventions for illicit drug treatment Supply-side law enforcement Preconceptional care services —
Prenatal period	Prenatal education Identi cation of users Cessation programs through prenatal care —	Prenatal education Identi cation of users Treatment programs Legal intervention	Prenatal education Identi cation of users Treatment programs Legal intervention
Labor/delivery hospital stay	Education and discharge planning —	Education and discharge planning Legal intervention	Education and discharge planning Legal intervention
Postpartum period	Interventions through pediatric care —	Interventions through pediatric care Child protective services intervention	Interventions through pediatric care Child protective services intervention

of intervention, generally referred to as in-reach," health care professionals educate, guide, and assist patients who are seeking their services for other reasons, thereby taking advantage of the opportunity to work with a captive audience.

In addition, women are increasingly bene ting from preconceptional care or counseling, which offers them a risk assessment or appraisal, health promotion and education, or therapeutic interventions before becoming pregnant in order improve their chances for a healthy pregnancy and birth outcome (Hollingsworth, Jones, and Resnick 1984; Swan and Apgar 1995). Preconceptional care is offered to women through a variety of models and venues: primary care settings; family planning settings; and at the time of a negative pregnancy test (Adams, Bruce, Shulman, et al. 1993; Jack, Campanile, McQuade, et al. 1995). Obtaining a history of substance use is an essential component of the guidelines that were developed for preconceptional care (American College of Obstetricians and Gynecologists 1995). Thus, occasions and settings that are appropriate for preconceptional care offer ideal opportunities for intervention in substance abuse. Identi cation of substance-using mothers *during and after delivery* can also be a useful intervention. With this knowledge, the health care team may be able to minimize potential morbidities for the newborn. Subsequently, programs can be implemented to help the baby and mother and to prevent substance abuse during future pregnancies. These can take the form of basic education for the mother, either during her brief hospital stay for delivery or during her encounters with pediatric health professionals.

A wider focus on the life course, rather than a narrow concern with the term of a pregnancy, is more effective in reducing the impact of maternal substance abuse on infant health and protecting the health outcomes of both the mother and her infant. A review of the policy options for reducing women's use of tobacco, alcohol, and illicit drugs over her life course (as listed in table 1) is outside the scope of a single review article. Thus, to illustrate our life course approach, we will review the wide range of policy and programmatic options for one substance—tobacco. We will follow up our review of tobacco-control policy with a brief discussion of the ways in which it both resembles and differs from policies for alcohol and illicit drug use, and we conclude with a discussion of the bene ts to be derived from tackling maternal substance use over the course of a lifetime.

Life Course Policy Options for Reducing Maternal Tobacco Use

Interventions during Childhood

Preventive Education. More than one out of four adolescent girls in the United States currently smokes; the highest rates occur among white and Native American adolescents (French and Perry 1996). Nearly nine of ten current adult smokers (both males and females) started smoking before the age of 18 (Centers for Disease Control and Prevention 1994). Thus, tobacco prevention and control efforts have tended to be youth centered" (Institute of Medicine 1994).

Many interventions designed for younger children educate them about the dangers of smoking in order to prevent them from experimenting with, or becoming habitual users of, tobacco. Mass media campaigns, school-based programs, and community interventions have all been used to persuade youths not to smoke. Interventions work better when they go beyond the standard appeals to reason that dwell on the dangers and negative consequences of tobacco use. A number of school-based programs highlight the *social in uences* of tobacco use and teach skills for resisting peer and social pressure. Evaluations suggest that some of these programs signi cantly reduce or delay adolescent smoking initiation (Institute of Medicine 1994). For example, in a meta-analysis, Rooney and Murray (1996) estimated that social in uence programs have reduced youth smoking by 5 to 30 percent. In another meta-analysis, Bruvold (1993) concluded that interventions with a social reinforcement orientation (i.e., those that emphasize developing skills for recognizing and resisting social pressures) have the largest impact on adolescents' attitudes and tobacco use.

A highly publicized educational intervention is the Drug Abuse Resistance Education, or DARE, program. Taught by uniformed police of cers, DARE currently expends $750 million annually to provide information and teach resistance skills to approximately three million students in the United States (Ennett, Tobler, and Ringwalt 1994). Despite its proliferation, most evaluations indicate that DARE may not be an ef cacious or cost-effective strategy for preventing tobacco use (Clayton, Cattarellow, and Johnstone 1996; Tobler 1997). The long-term impact of most school-based prevention interventions appears to be minimal;

their effects tend to dissipate with time unless reinforcing interventions or program booster" sessions are added.

Other models for preventive education are community interventions, in which schools, churches, businesses, community groups, government, the media, and families work together on multiple activities that target several institutions and channels simultaneously (Aguirre-Molina and Gorman 1996). The mobilization of parent and community groups enhances school-based efforts and increases the potential for a sustained impact (Institute of Medicine 1994). Community interventions, although dif cult to evaluate, can be effective in reducing youth tobacco consumption. The long-range impact of programs in the schools and the community that enlist parents, the mass media, and community organizations is strengthened when the sponsoring groups collaborate and when they adopt policies that restrict youth access to tobacco products (Flynn, Worden, Secker-Walker, et al. 1992; 1994; Institute of Medicine 1994; Aguirre-Molina and Gorman 1996; Worden, Flynn, Solomon, et al. 1996; Forster and Wolfson 1998).

There is a growing literature on gender differences in patterns and causes of smoking (Waldron, Lye, and Brandon 1991; French and Perry 1996; Husten, Chrismon, and Reddy 1996; Michelle and Amos 1997). Charlton and Blair (1989) revealed that some predictors of adolescent smoking differed for boys and girls. For example, peer pressure apparently in uences boys more than girls. Girls, however, are most in uenced by beliefs about what smoking can do for them (i.e., calm their nerves and keep their weight down). In a review of research on psychosocial determinants of adolescent smoking, Clayton (1991) reports that female smoking appears to be linked with self-con dence, social experience, and rebellion, whereas male smoking is more strongly associated with social insecurity.

Few primary prevention interventions, however, have incorporated gender-speci c components. In addition, most evaluations suggest that differences in male–female responsiveness to gender-neutral interventions were not signi cant or strong (Bruvold 1993; Elder, Sallis, Woodruff, et al. 1993; Noland, Kryscio, Riggs, et al. 1998). Some studies, however, suggest that boys and girls respond differently to various types of prevention strategies (Rose, Chassin, Presson, et al. 1996; Kellam and Anthony 1998; Svoen and Schei 1999). For example, Altman, Wheelis, McFarlane, et al. (1999) found that a community intervention in four rural communities was more successful among girls than boys.

Advertising Restrictions. Of particular concern to many people is the effect of tobacco advertising (including the distribution of promotional paraphernalia) on youth demand for cigarettes. Some studies suggest a relation between advertising and smoking attitudes and behavior (Altman, Levine, Coeytaux, et al. 1996; While, Kelly, Huang, et al. 1996; Pierce, Gilpin, and Emery 1998). However, the econometric literature does not reveal any clear results on the relation between tobacco advertising and cigarette consumption (Chaloupka and Warner 1999). Some states and municipalities have restricted tobacco advertising. Many municipalities also ban or restrict the distribution of free tobacco samples. The effect of advertising restrictions or cigarette distribution bans on the smoking behavior of youths is largely unknown; earlier studies reached divergent conclusions (Chaloupka and Warner 1999). As Saffer (1999) explains, however, the inconsistent results are largely the result of a failure to distinguish between complete and partial bans in the analysis. Complete bans can signi cantly deter smoking, whereas partial bans do not succeed as well because they allow tobacco companies the opportunity to switch to alternative promotional methods and media.

Youth Access Restrictions. In the past decade, the number of policies that restrict youth access to tobacco products has dramatically increased (Choi, Novotny, and Thimis 1992; Forster and Wolfson 1998). All states have youth access laws," or policies that restrict minors from possessing and purchasing tobacco products. Few states, however, seriously enforce these restrictions (Jacobson, Wasserman, and Anderson 1997). Unfortunately, the impact of such laws is dif cult to study and verify empirically. In general, undercover or sting operation" studies reveal a high prevalence of illegal tobacco sales to minors. Jacobson and Wasserman (1997) concluded, after an extensive study of tobacco control laws in the United States, that ongoing enforcement is the key to reducing illegal sales to minors: to be effective, local ordinances must have a graduated penalty structure that starts with a moderate ne for the rst offense and escalates in severity with each subsequent effect."

Rigotti, DiFranza, and Change (1997) found that enforcing tobacco sales laws in Massachusetts improved vendors' compliance and thus reduced illegal sales to minors. Such effects, however, were not accompanied by changes in adolescents' perceptions of their access to tobacco or in their smoking behavior. In summary, some analyses suggest that aggressive enforcement of laws and policies that restrict youth access can reduce illegal tobacco sales to minors (Jacobson and Wasserman 1997;

Forster and Wolfson 1998). A clear effect of these restrictions on actual smoking behavior, however, has yet to be demonstrated.

Excise Taxes. The use of economic incentives to discourage smoking is another way to deter or control youth tobacco use. Lewitt and colleagues found that teenagers were more price sensitive than adult smokers (Lewitt, Coate, and Grossman 1981; Lewitt and Coate 1982). Wasserman, Manning, Newhouse, et al. (1991) took issue with this nding and reported on their own empirical results, which suggest that teenagers are no more or no less price sensitive than adults. However, the most recent research supports the notion that children are more price responsive than adults, and indeed that young adults are more price sensitive than older adults (Chaloupka and Laixuthai 1994; Chaloupka and Wechsler 1996). Thus, increases in state or federal tobacco excise taxes are typically viewed as a relatively strong and effective policy for discouraging young people from smoking (Centers for Disease Control and Prevention 1994).

Interventions during the Reproductive Years

Public Education/Media Campaigns. Although the effectiveness of broad-based interventions has been dif cult to evaluate, many researchers and policy makers have developed interventions based on the premise that public education about the hazards of substance abuse can prevent later problems. Beginning with public service announcements in the early 1970s, public education and media campaigns (involving both print and electronic media) against tobacco use continue to be waged. Many target speci c sociodemographic groups, including youth, racial and ethnic minorities, and even pregnant women. Several states, including California and Massachusetts, have used public revenues from an increase in the tobacco excise tax to fund large antitobacco public education initiatives. Although it is dif cult to counteract the tremendous resources that the tobacco industry devotes to advertising, many believe that public education (or social marketing) can deter youth from smoking and promote cessation among current smokers. For example, Popham, Potter, Hetrick, et al. (1994) found that a signi cant percentage of California youth had been exposed to an aggressive antitobacco media campaign and were able to recall speci c aspects of it. In addition, Hu, Sung, and Keeler (1995) found that the California media campaign led to a signi cant decrease in per capita cigarette consumption

above and beyond the decrease caused by the concomitant increase in the tobacco excise tax.

Of concern to tobacco control advocates is the strong evidence that media with large advertising revenues from tobacco companies or their larger conglomerates are less likely to report on the effects of smoking on health (Warner and Goldenhar 1989). Through their study of a sample of U.S. magazines, covering the periods 1959 to 1969 and 1973 to 1986, Warner, Goldenhar, and McLaughlin (1992) provide statistical evidence that cigarette advertising results in less coverage of the ill-effects of smoking, particularly in women's magazines.

In-Reach Interventions for Smoking Cessation. Targeted interventions during the reproductive years can direct resources to the populations that are most likely to bene t. Brief counseling sessions on the dangers of smoking and the bene ts of quitting delivered by physicians during of- ce visits have promoted smoking cessation effectively (Epps and Manley 1992; Thorndike, Rigotti, Stafford, et al. 1998). Based on the results of ve randomized, controlled trials, the National Cancer Institute (NCI) began to promote this form of physician counseling. In the original NCI trials, which used biochemical veri cation, 15 percent of patients receiving the intervention were smoke free at 12 months (Glynn, Manley, and Pechacek 1990). This type of intervention does not have to be restricted to physicians' of ce settings. Secker-Walker and colleagues suggest that a variety of health professionals can effectively provide brief counseling interventions, including dentists, dental hygienists, family planning counselors, WIC counselors, and community mental health counselors (Secker-Walker, Solomon, Flynn, et al. 1994).

Research suggests that, although gender is not a strong or critical predictor of smoking cessation among adults, women appear more likely to quit with an intervention than without one (Whitlock, Vogt, Hollis, et al. 1997; Gritz, Thompson, Emmons, et al. 1998). In a study of a brief clinic-based smoking intervention, no gender differences were found in quit attempts, cessation rates, or relapses (Whitlock et al. 1997).

Various studies have examined factors that can help to predict whether smoking cessation efforts will succeed over the long run. Having a nonsmoking spouse or partner is a strong predictor of initial quitting (Murray, Johnston, Dolce, et al. 1995) and long-term cessation (Gourlay, Forbes, Marriner, et al. 1994; Osler and Prescott 1998). Roski, Schmid, and Lando (1996) examined speci c behaviors by spouses and found that supportive behaviors were associated with more frequent attempts to

quit, whereas fewer undermining behaviors predicted long-term cessation. In a study of women in a low-income community, being married (independent of smoking status) was the only predictor of six-month cessation, highlighting the importance of spousal support for smoking cessation attempts.

Excise Taxes. Some of the best evidence of the impact of excise taxes has been developed for tobacco use. An extensive econometric literature has demonstrated that adult demand is highly responsive to cigarette prices (Lewitt et al. 1981; Lewitt and Coate 1982; Becker and Murphy 1988; Chaloupka 1991; Becker, Grossman, and Murphy 1994). In addition, several studies have investigated the potential impact of increased cigarette taxes on adult mortality, typically focusing on tobacco-related ailments, such as lung cancer and heart disease. A 1993 National Cancer Institute Expert Panel concluded that a 10 percent increase in the price of cigarettes would reduce adult consumption of cigarettes by 4 percent (National Cancer Institute 1993). Harris (1982), Warner (1986), and Grossman (1989) also document important health bene ts associated with such taxes. As a result, raising the price of tobacco products through an increase in the excise tax has become a tobacco-control strategy in a number of jurisdictions. Evaluations of many of these policies show concomitant reductions in tobacco consumption (Breslow and Johnson 1993; Hu et al. 1995).

Preconceptional Care Services. Although no one to date has studied the effect of preconceptional cessation counseling on smoking behavior, such interventions potentially can reduce the negative impact of maternal smoking on infant health (Adams et al. 1993; American College of Obstetricians and Gynecologists 1995). Adding preconceptional care to prenatal health services raises their cost. However, in cases where the risk of adverse outcomes is signi cant and high-risk women—like those, for example, with diabetes mellitus—can be ef ciently targeted, preconceptional care may result in overall cost savings (Elixhauser, Kitzmiller, and Wechsler 1996).

Direct Restrictions. Policies to restrict public smoking have proliferated during the past decade (Rigotti and Pashos 1991; Scheg 1996; Brownson, Eriksen, Davis, et al. 1997; Jacobson et al. 1997). States and localities have restricted smoking in public facilities and outdoor spaces, in work sites, in hospitals, in restaurants and bars, in hotels and motels, and on airline ights. Although the intent has largely been to reduce exposure to environmental tobacco smoke (ETS), these restrictions are also

believed to have a bene cial effect on current smokers by reducing daily cigarette consumption or by promoting total cessation. Brownson and colleagues (1997) concluded that the limited empirical evidence available to date does suggest that public smoking bans are effective in reducing nonsmokers' exposure to ETS, and that work site bans not only in uence the intensity of smoking among workers but may also increase quit rates.

Interventions during the Prenatal Period

Prenatal Education. The American College of Obstetricians and Gynecologists (ACOG), along with other professional associations, recommends that prenatal care providers counsel patients about the risks of smoking during pregnancy. Kogan, Alexander, Kotelchuck, et al. (1994) found that, in a nationally representative sample, the incidence of low infant birth weight among women who reported receiving advice about smoking during prenatal care was signi cantly below average. In addition, randomized trials of educational interventions—both self-help methods and clinician-based interventions—for pregnant women in different types of medical care settings have found these efforts to be somewhat ef cacious in reducing maternal smoking and increasing infant birth weight (Ershoff, Mullen, and Quinn 1989; Ershoff, Quinn, Mullen, et al. 1990; Windsor, Lowe, and Perkins 1993).

Identi cation of Users. Women's self-reports of smoking behavior routinely underestimate the true amount of their tobacco use during pregnancy (Floyd 1993). Whether or not a woman receives an intervention typically is based on an assessment of her smoking behavior that is derived from self-reports. Routine urine cotinine screening of pregnant women as a part of standard prenatal care may improve the identi cation of smokers, and thus could increase the number of interventions. However, many women may perceive this test as invasive and threatening and shun subsequent prenatal care visits as a result. Thus, identi cation of users is likely to continue to rely predominantly on women's self-reports.

Cessation/Treatment Programs through Prenatal Care. Floyd (1993) and O'Campo, David, and Gielen (1995) have published reviews of the ef cacy of smoking cessation interventions for pregnant women. Studies of more intensive interventions have reported validated cessation rates ranging from 10 percent to 32 percent. Quit rates, however, are lower

in trials of smoking cessation interventions that target disadvantaged mothers who attend public clinics or WIC facilities. O'Campo and colleagues (1995) conclude:

> [Smoking cessation interventions for pregnant women] have demonstrated that, in the aggregate, participants have been able to reduce smoking signi cantly and improve on the problem of low birth weight. Nonetheless, the substantial variation in the effectiveness of the array of intervention strategies that have been evaluated suggests that there is no single intervention that can be recommended for universal adoption by prenatal care providers.

These researchers, however, did identify common elements of successful interventions:

- The type of intervention was carefully matched to the cultural or sociodemographic characteristics of the target audience.
- The program materials were written speci cally for pregnant women (rather than for a general audience).
- Each client's readiness to quit was assessed before an intervention was undertaken.
- Multiple methods were used (i.e., written materials, counseling, and follow-up).
- A strict no smoking" policy in the woman's home was encouraged.

Some studies have concluded that the use of a variety of maternal smoking interventions is not only ef cacious but also cost effective (Windsor, Lowe, and Perkins 1993). For example, Ershoff and colleagues (1990) found that a self-help cessation program in an HMO setting saved $2.80 in neonatal hospital expenditures for every $1 spent on the intervention. Windsor and colleagues (1993) found even greater savings from a behavioral intervention in public health maternity clinics. Based on data from a variety of studies, Marks, Koplan, Hogue, et al. (1990) concluded that offering a smoking cessation program to all pregnant smokers would result in a 15 percent quit rate among participants, shift almost 5,900 low-birth-weight infants to normal birth weight, and prevent 338 deaths per year. The authors also concluded that, compared with the costs of caring for low-birth-weight infants in neonatal intensive care units, smoking cessation programs would save $3.31 for every $1 spent. These lower-bound estimates do not incorporate other

smoking risks, such as childhood asthma and maternal health problems, that might be avoided through smoking cessation interventions. Because of the high social costs associated with maternal cigarette use and the low cost of smoking cessation interventions, it is possible for a smoking cessation program to be cost effective, even when few of its intended clients quit smoking (Warner 1997).

However, many women do not know they are pregnant until well into their first trimester. By the time they receive prenatal care and a referral to a smoking cessation program, some growth retardation or other damage may already have occurred. In addition, many maternal smokers who manage to quit during their pregnancy take up the habit again after delivery (Fingerhut et al. 1990). Although interventions during pregnancy can reduce the incidence of low birth weight and other infant health problems related to maternal smoking, infants' risks from exposure to environmental tobacco smoke remain if smoking is resumed postpartum.

Legal Intervention. We know of no cases where the legal system or the social/human services system was used to control or punish pregnant smokers.

Interventions during the Labor/Delivery Hospital Stay

Education and Discharge Planning. Rigotti, Arnsten, and McKool (1997) found that a low-intensity educational intervention among hospitalized adult patients led to an increase in smoking cessation one month after discharge, although the effect was lost by six months. Interventions during the hospital stay may help to reduce the rate at which mothers who have managed to quit during pregnancy resume the habit after delivery. However, no studies of the efficacy of such interventions for women who have just delivered babies exist in the literature to date. Obviously, such interventions would have no impact on the antepartum health or birth weight of the infant; yet they ostensibly could reduce risks to infant health associated with environmental tobacco smoke exposure and could also benefit women's general health. We found no accounts of women receiving routine toxicology screening for tobacco use at the time of labor or delivery.

Legal Intervention. We know of no cases where the legal system or the social/human services system was used to control, punish, or intervene

with women who smoke during their hospital stay for labor and delivery.

Interventions during the Postpartum Period

Interventions through Pediatric Care. A family's continued contact with pediatric care provides another opportunity to reduce maternal substance use or to ameliorate its effects. Pediatricians and other providers can underscore the role of smoking cessation in SIDS prevention (Willinger 1995). They can also discuss ways to manage the stress that accompanies parenthood and offer guidance for coping with situations that can lead to relapse (Friedmann, Saitz, and Samet 1998). Research shows that most pediatricians feel con dent and prepared to address the issues surrounding environmental tobacco smoke with their patients, but that many are less comfortable advising parents on how to stop smoking or to remain abstinent (Frankowski and Secker-Walker 1989; Frankowski, Weaver, and Secker-Walker 1993). Such training, however, is easily provided through the NCI program, described above, and other venues. Research shows that trained pediatricians are effective in soliciting commitments from mothers to stop smoking (Secker-Walker, Solomon, and Flynn 1992). Thus, pediatricians and obstetricians are ideally placed in the early postpartum period to reduce relapse rates among smokers who have managed to quit during pregnancy.

Child Protective Services Intervention. We know of no cases where either the legal system or the social/human services system was used to control, punish, or intervene in cases of mothers' exposing their infants to environmental tobacco smoke.

Summary. The epidemiology of smoking initiation makes it clear that tobacco prevention and control require a strong focus on youth. Certain policy options for reducing the number of women who are addicted to cigarettes when they become pregnant are promising: inaugurating programs to encourage youth and young adults to stop smoking; increasing the tobacco excise tax signi cantly; and making counseling for smoking prevention a part of preconceptional care. Identi cation of pregnant smokers, accompanied by intervention, is critical, as the bene- ts of smoking cessation during pregnancy are great. Additionally, it is important to help women who have stopped smoking while pregnant to avoid relapses after they have given birth and encourage those who are still smoking to stop in order to lessen infant exposure to environmental

tobacco smoke, reduce health risks for the next pregnancy (should there be one), and promote health among women.

Life Course Policy Options for Reducing Maternal Alcohol and Illicit Drug Use

Out of the myriad options for tobacco control, we will identify some similarities and differences in policies for curbing alcohol and illicit drug use among women.

Although the use of alcohol and illicit drugs among pregnant women is less prevalent than the use of tobacco, the potential of these substances to in ict harm on infants exposed in utero is signi cant. They can adversely affect the developing neurologic system; unlike tobacco, they can do so during the rst few weeks of fetal development, often before a women even knows she is pregnant. Thus, interventions during childhood and the reproductive years assume even greater importance.

The effectiveness of alcohol and drug education programs for youth is mixed. Some studies have shown a modest reduction in alcohol use among students who completed these programs (Shope, Copland, Marcoux, et al. 1996), whereas another review found very few studies that demonstrated an impact (Foxcroft, Lister-Sharp, and Lowe 1997). On the other hand, a number of well-designed, multilevel community programs have overcome some of the aws reported in earlier studies and have managed to achieve meaningful decreases in alcohol and drug use among teens (Pentz, Dwyer, and MacKinnon 1989; Botvin, Baker, Dusenberry, et al. 1995; Perry, Williams, and Veblen-Mortenson 1996). Botvin emphasizes the need for booster" sessions for up to two years after the initial intervention in order to sustain the effect.

Like tobacco, youth demand for alcohol is also sensitive to market prices. Grossman, Chaloupka, and Sirtalan (1995) examined addiction models for alcohol use. Although these authors obtained varying estimates within their sample, they found that consumers are very price sensitive in beer purchases once the addictive character of alcohol consumption is taken into account. Chaloupka and Wechsler (1995) summarized the impact of price, availability, and alcohol control policies on driving infractions, drinking, and bingeing among college and university students. These authors found alcohol consumption to be moderately related to beer prices. The drinking behavior of young women appeared especially responsive to beer prices.

The primary economic strategy for combating illicit drug use is to raise prices through aggressive police enforcement. Arresting suppliers and customers increases the cost and risk of drug use. If drug consumers are price sensitive, such policies are likely to reduce drug use. Precise studies in this area are dif cult because market demand or price cannot be directly measured. Some earlier researchers appear to have assumed that drug users are not price sensitive because of the addictive nature of heroin and other drugs. However, that view has recently come under theoretical and empirical attack, as more analyses are showing that price changes can have a strong effect on whether people begin or continue to use addictive substances. For example, Saffer and Chaloupka (1995) found prices for both heroin and cocaine to be extremely elastic. Through a novel method that linked positive drug tests among arrestees to local drug prices, Caulkins (1994) found that price elasticity is considerably higher than 1. Grossman, Chaloupka, and Brown (1996) found that a permanent 10 percent drop in cocaine prices would raise the number of users by 8 percent. These analyses suggest that policies designed to raise illegal drug prices can sharply reduce consumption. Less is known about the demand behavior of reproductive-age or pregnant women.

Preconceptional counseling for preventing alcohol and drug-related morbidity overshadows even the importance of tobacco-related counseling because alcohol exerts many of its harmful effects early in the pregnancy. A number of investigators have documented that drinking around the time of conception is common. The 1988 National Maternal and Infant Health Survey found that 45 percent of pregnant women reported drinking in the three months before they discovered they were pregnant (Institute of Medicine 1996). More recent data from an Oklahoma study, in which 50 percent of women reported alcohol use in the three months before pregnancy, con rm these ndings (Cloud, Baker, DePersio, et al. 1997).

Identifying women with substance abuse problems before they become pregnant can greatly facilitate their enrollment in treatment programs. However, identi cation is problematic. Self-report is a measure that is frequently used; yet the public's knowledge of the risks of alcohol and illicit drug use during pregnancy makes it unlikely to be a valid one. In one study, the reports of alcohol use were much larger when they were obtained retrospectively than during pregnancy (Ernhart, Morrow-Tlucak, Sokol, et al. 1988). Questionnaires, such as

the T-ACE (an acronym for Tolerance, Annoyed, Cut down, and Eye-opener), have been used to detect risk-drinking" (greater than one ounce of alcohol per day) during pregnancy and have been shown to be a sensitive measure (Sokol, Martier, and Ager 1989). Outside of pregnancy, the broader use of alcohol screening tests, such as TWEAK (an acronym for Tolerance, Worry about drinking, Eye-opener, Amnesia [blackouts], and Cut down [K/C]) and the Alcohol Use Disorders Identi cation Test (AUDIT), can identify women who are at risk (Bradley, Boyd-Wickizer, Powell, et al. 1998). However, medical providers have not been aggressive about incorporating routine chemical screening into prenatal care because they fear it will deter substance abusers from obtaining the care they need (Chavkin 1991). However, because many substance users also smoke cigarettes, identi cation of smokers may be useful in identifying women who use other substances.

Pregnant women face many obstacles to timely, appropriate, and accessible drug treatment services (Breitbart, Chavkin, and Wise 1994; LaFrance, Mitchell, Damus, et al. 1994). Many treatment programs do not accept pregnant women because they lack the staff, facilities, or expertise to serve pregnant women's special needs. Other programs do not participate in Medicaid. In one study, 87 percent of drug treatment programs surveyed in New York City would not accept pregnant crack users who were covered by Medicaid (Chavkin 1991). Furthermore, a report by the U.S. General Accounting Office (1991) concluded that the most important barrier to treatment is the lack of adequate treatment capacity and appropriate services among programs that will treat pregnant women and mothers with young children." One study of pregnant California Medicaid recipients found that 74 percent had at least one older child (Ellwood, Adams, Crown, et al. 1993).

Women substance users often have male partners with signi cant substance abuse or dependence. Assortative mating" is well documented among heavy alcohol users, and similar patterns likely exist for other substances (Jacob and Bremer 1986; Grif n and Weiss 1989; Blume 1997). Such patterns make relapse more likely and create other family risks for women experiencing problem substance use. Successful interventions, therefore, must either include the male partners or be designed to remove women from disruptive settings (Brown, Kokin, Seraganian, et al. 1995). Interventions to improve spousal support, coupled with marital therapy, have improved alcohol abstinence rates (McCrady, Stout, Noel, et al. 1991).

Some of the barriers to treatment may have been removed in recent years. Since 1989, Congress has made drug treatment for pregnant women a high priority for research and funding (Carter and Larson 1997). The federal government has enacted several major initiatives to expand the supply and quality of drug treatment services for pregnant women, but the effectiveness of these interventions has not been carefully evaluated (Center for Substance Abuse Prevention 1996; Price 1997). Most recently, Svikis, Golden, Huggins, et al. (1997) found that drug treatment services for pregnant women produced net reductions in medical expenditures of $4,644 per mother–infant pair. These gures do not include associated treatment-related bene ts, such as reduced special education costs, improved maternal and child health, or the wider social bene ts associated with reduced substance use.

Legal intervention in alcohol and illicit substance use is a controversial policy arena. Although women who drink alcohol during pregnancy are rarely prosecuted, at least six states mandate reporting of maternal alcohol consumption during pregnancy to child protection authorities. In addition, maternal drinking is explicitly considered in child protective hearings in several other states (Madden 1993). Sixty-one percent of states require mandatory reporting of positive toxicology results for pregnant women, and 65 percent require such reporting for positive results among neonates (Chavkin, Breitbart, Elman, et al. 1998). Chavkin and colleagues recently noted that legal intervention against pregnant substance users is occurring more frequently. Although little evidence exists to test the proposition that prosecution deters maternal substance abuse, there is evidence that it discourages high-risk women from seeking appropriate prenatal care or treatment services (Chavkin 1991).

The goal of most legal interventions is to direct pregnant substance users into treatment. Several policy makers have advocated mandatory treatment, and even prosecution, of drug offenders (Condon 1995). South Carolina and some other jurisdictions have prosecuted pregnant drug users who did not adhere to prescribed treatment. Although precise gures are unavailable, between 200 and 300 women have been prosecuted for prenatal drug or alcohol abuse since 1985 (Gomez 1997; Jos, Marshall, and Perlmutter 1997).

Although these policies have generated controversy, prosecution is unusual in cases of known or suspected prenatal substance abuse. A more common policy response has been to frame problems of maternal substance abuse as child neglect or abuse (Pearson and Thoennes 1996).

Pregnant women who persist in their substance abuse or who otherwise do not adhere to prescribed therapy may lose custody of their newborn infant or other children. The threat of intervention by child-protective authorities can help to convince pregnant women that they should adhere to outpatient treatment (Lewis et al. 1996; Laken, McComish, and Ager 1997).

Close follow-up after delivery is essential for women who have abused alcohol or other drugs for two main reasons: First, early intervention for children affected by alcohol and drug use during pregnancy can reduce morbidity by alleviating physical and neurologic problems and correcting social problems, such as abuse and neglect. Second, the long-term relationship that develops between parents and their child's health care provider may build the rapport and trust that these parents need in order to seek treatment for substance abuse problems. Secondary prevention for this pregnancy becomes primary prevention for subsequent pregnancies.

Discussion

This essay, which has explored several policy interventions for reducing the harms associated with maternal substance abuse, leads us to a number of conclusions that traverse a wide range of substances and interventions.

1. *Effective interventions to prevent, treat, or manage the consequences of maternal substance abuse must occur throughout the life course of mothers and children.*

Pregnancy is a pressing and salient time to address maternal substance abuse. A woman's use of tobacco, alcohol, or illicit drugs has wider implications when she is pregnant. Pregnant women themselves are especially motivated to protect the health of their developing infants. Most women who consume cigarettes, alcohol, or illicit drugs try hard to halt or reduce their substance use during pregnancy. In many respects, however, pregnancy is the wrong time—and prenatal care is the wrong setting—to address this problem. Alcohol and illicit substances can cause fetal harm early in pregnancy, often before a woman even knows she is pregnant or before meaningful behavior change is likely, given available interventions. Pregnancy-based interventions also fail to address physical and psychosocial risks (including nutritional de ciency , weight problems, poor general health, depression, domestic violence) that exist before conception and are often related to substance use.

Many of these shortcomings re ect the inherent limitations of pregnancy-triggered interventions in the management of deeply rooted behaviors. Prenatal interventions must be complemented by primary prevention to forestall initiation into substance abuse, as well as by interventions that halt or reduce existing substance abuse before conception occurs. In contrast to pregnancy-triggered interventions, population-based interventions designed for youth or women of reproductive age may sidestep the political, ethical, and administrative problems that arise during pregnancy itself.

2. *It is dangerous to overstate the teratogenic effects of in utero substance exposures. It is equally dangerous to understate the social, economic, and psychological factors that both contribute to and are consequences of maternal substance abuse.*

Discussions of the problem of maternal substance abuse should not exaggerate the prevalence of speci c behaviors or dwell on the related harms to infant and fetal health. Many adverse health outcomes have several causes and are confounded by factors associated with substance use, such as poor nutrition, low socioeconomic status, and inadequate access to the medical system. For this reason, the true impact of substance use remains controversial.

Using legal or illegal substances is clearly an individual behavior. Yet many individual behaviors are related to socioeconomic position and to other factors not solely determined by individual choice. Behaviors are reinforced or discouraged in speci c social environments (Carroll, Bennett, and Davey-Smith 1993; Lynch, Kaplan, and Salonen 1997). Women smoke while they are pregnant, not only because of nicotine addiction but also to reduce the stress of family caregiving, to assist in weight control, and for other reasons that are socially rooted. The partners of many pregnant women smoke, drink alcohol excessively, and/or use illicit drugs. Some women enter pregnancy with a history of poor nutrition, wasting, or poor general health as the result of their substance use. Less educated and less af uent women, as well as those who are depressed or experiencing family dislocation, are signi cantly more likely to smoke, to drink heavily, and to use illicit drugs.

Effective interventions to improve infant and child health must therefore address the dif cult social and family settings within which pregnant women are most likely to engage in substance abuse. Because substance abuse is correlated with poverty, effective interventions must provide for the basic economic needs of substance-abusing women.

Recent policy initiatives, like the inauguration of drug testing for recipients of Temporary Assistance to Needy Families (TANF) and the elimination of substance abuse as a qualifying disability for Supplemental Security Income, may have unintended negative effects. Policies that restrict Medicaid enrollment for substance-abusing women are especially problematic because they may restrict access to treatment services.

3. *Postnatal management of maternal substance abuse is primary prevention for future pregnancies.*

Pregnant women and new mothers who abuse legal or illegal substances require a range of interventions to secure their own and their children's well-being. An important aim must be to forestall substance abuse in future pregnancies. The incidence of drug-related harm appears to be high in the subsequent children of known current abusers. Notably, Abel (1988) reported rates of fetal alcohol syndrome that exceed 75 percent among siblings of diagnosed FAS patients.

These ndings underscore the importance of proper counseling, treatment, and case management of known substance abusers in preventing future drug-related harms. As we have documented in this essay, parent skills training and family support services are correlated with improved retention in prenatal substance abuse treatment. Contraceptive counseling and family planning services are essential elements of such interventions. Within the labor and delivery setting, proper diagnosis and discharge planning are equally important to assure proper follow-up when in utero exposures become known.

Policy Recommendations

Prenatal substance abuse occurs in a social context that contains many cues for tobacco use, excessive alcohol consumption, and use of illicit substances. Creating a social environment that minimizes overall use of teratogenic substances is crucial. Likewise, some dif cult-to-reach women may be aided by the expansion of services in venues other than the medical of ce. We believe that the six policy recommendations listed below will meet these aims and improve the outcomes for pregnant substance abusers and their children.

1. Excise taxes for tobacco and alcohol should be increased.

For both alcohol and cigarettes, existing data suggest that reducing overall population demand is more effective than pregnancy-triggered

interventions in reducing prenatal use. Excise taxes for tobacco and alcohol are especially promising strategies to reduce overall consumption, and thereby prenatal consumption as well. These policies also bring important bene ts in other aspects of population health, such as decreased incidence of lung cancer, cardiovascular disease, liver problems, and alcohol-related accidents and crimes. Existing literature suggests that young adults are likely to be especially sensitive to price increases for tobacco and alcohol.

2. Tobacco settlement dollars should be used for tobacco control.

On November 19, 1998, 46 state attorneys general agreed to a $206 billion settlement with the tobacco industry to reimburse states for past and future health care costs associated with smoking. There are no requirements for how states spend their settlement money, and many states are currently considering investments in a number of different areas, ranging from education to roads to general tax relief. We believe that a signi cant portion of the settlement dollars ought to be used to reduce the health burden on society caused by tobacco use. Thus, settlement resources should be devoted to developing and evaluating new programs and policies designed to discourage young people from smoking and to expanding interventions that are known to help young people and adults stop smoking or not to start at all. Reducing the number of youths and young adults who smoke will likely reduce the number of women who smoke during pregnancy. In addition, settlement resources should be invested to improve and expand interventions that would help pregnant women stop smoking and support them in efforts not to relapse after delivery.

3. Interventions to prevent postpartum relapse of substance use need to be developed and evaluated.

A lot of women are motivated to quit smoking or eliminate other drug use during pregnancy. However, relapse following delivery is quite common (Fingerhut et al. 1990). Brief interventions for smoking cessation during the hospital stay, like those developed by Rigotti and colleagues (Rigotti, Arnsten, and McKool 1997), should be evaluated for use during the postpartum period. Pediatricians have been able to motivate women to quit smoking (Secker-Walker et al. 1992); brief advice and counseling has also helped women to reduce their alcohol consumption (WHO Brief Intervention Study Group 1996). Such interventions should be more extensively evaluated in the postpartum setting and across all substances. Finally, the social context after delivery is an

important consideration. Women often return home to increased stress and new parental roles; using tobacco, alcohol, or other drugs may be a way to relieve stress. To be truly effective, interventions must account for all the issues faced by these women.

4. *The importance of preconceptional care in reducing health risks should be communicated to providers and the general public.*

Preconceptional care, although less visible than traditional prenatal care, provides another avenue for intervention. Educating providers in nonobstetric settings, such as family planning clinics, emergency departments, pediatrics, and internal medicine, about the importance of preconceptional counseling will improve service delivery to women who lack standard obstetric care. The public also should be educated about the usefulness of these services through public service announcements and other public relations strategies. Public and private insurers should encourage the use of these services by reimbursing providers for the costs of preconceptional care.

5. *Treatment programs for pregnant women should be adapted to meet the needs of this special population.*

Traditional substance abuse treatment is poorly suited to the unique needs of pregnant and parenting women and misses important opportunities to serve infants and young children in these family settings. For example, only one item out of the 123 that comprise the standard clinical assessment tool, the Addiction Severity Index, assesses the relationship between substance abusers and their children (Schottenfeld and Viscarello 1994). An especially promising approach is the provision of drug treatment within a broader, family-centered context. Lack of child care is a critical barrier for many women and has been identi ed as an obstacle to both treatment and retention.

6. *Case management services should be expanded to meet the needs of pregnant substance users.*

A minority of pregnant women who consume alcohol or illicit drugs have severe medical and social problems that require specialized intervention. These patients require detailed case management and close coordination among many organizations and social services. Clinical and policy interventions for HIV/AIDS may provide useful models of how to coordinate services for out-of-treatment substance abusers. Case management interventions have also been developed speci cally for substance abuse and should be applied more widely (Grant, Ernst, and Streissguth 1996).

Conclusion

Maternal substance abuse is not an issue that can only be acknowledged and addressed in the context of pregnancy. Nor is it one discrete problem that allows for one all-purpose solution. Rather, it is a constellation of public health, clinical, social, and family problems that must be addressed with due regard for the unique features of each substance and the psychosocial factors associated with use. In this article, we have argued for a life course perspective on this complex problem and the associated policy and programmatic responses. Our approach contrasts with the current focus on pregnancy-triggered interventions and punishments. Progress in reducing the harms associated with maternal substance abuse is likely to be slow, measured, and piecemeal. There are no magic policy bullets. However, many speci c interventions have been demonstrated to be ef cacious and perhaps even cost effective. By patiently channeling resources to proven or compelling new interventions across the life course, it is possible to reduce the infant morbidity and mortality caused by maternal substance abuse. The health of many children and their mothers depends on the development of new, expanded ways of thinking about this problem and on the dedication of suf cient human and nancial resources to our policy responses.

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