Preconception Health Care: A Critical Task For Family Physicians

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***Abstract*: Health care leaders in the United States have recently advised that preconception care be made available to all prospective parents because health in pregnancy depends on health status prior to pregnancy. Prenatal care usually begins after the early critical period of pregnancy has passed, and optimal early prenatal care can be achieved only through preconception care. Family physicians, who are ideally suited to provide this care, can readily integrate it into the routine health maintenance they currently provide for their patients of childbearing age. This review highlights components of the medical, family, and social histories, current health, and physical examination that are important to preconception health. There is good evidence that attention to patients' health needs before conception is related to improved perinatal outcomes. (J Am Board Fam Pract 1991; 4:237-50.)**

The Panel on the Content of Prenatal Care[1] appointed by the Public Health Service recently recommended that preconception care be available to all age-appropriate women and their partners and that such care be integrated into primary care services. The goal of preconception health care is to ensure that a woman and her partner are healthy and practicing healthy lifestyles before pregnancy because, in the words of the Panel, "Healthy parents are more likely to have healthy babies." Because it is unusual for pregnant women to have their first prenatal visit before organogenesis,[2] optimal early prenatal care can be achieved only through preconception care. As with prenatal care, preconception care can be structured to provide risk assessment, health promotion, and intervention for correctible conditions that could have a negative impact on perinatal outcomes.

Family physicians not only are in an excellent position to provide preconceptual care but also have a responsibility to do so. Because of the scope and nature of their specialty, family physicians generally are aware of their patients' family, medical, and social histories. In addition, those health maintenance visits that are a standard part of family practice—routine pelvic, premarital, and school or work physical examinations—provide an ideal setting for preconception care. Indeed, many persons currently receive some components of preconception care during their routine visits to physicians. Nevertheless, attention to preconception issues is often haphazard, and the importance of systematic, thorough preconception care for each prospective parent cannot be overemphasized in light of potential benefits to the newborn.

The purpose of this review is to examine the content of preconception care and to highlight those areas where family physicians can have an especially important influence on perinatal outcomes.

Medical History

Components of the medical history important to preconception care include past gynecologic and obstetric factors, chronic medical problems, childhood illnesses, and immunizations. The patient inventory shown in the Appendix, developed from two previously tested inventories,[3,4] provides an efficient means of gathering this information.

History Related to Reproductive Function

If a woman has had previous pregnancies, it is important to determine how many and any complications and the outcomes. Although repeated spontaneous abortions are probably chance phenomena, several investigators recommend karyotyping after the parents have experienced two or three spontaneous abortions.[5] In addition,

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the women with a history of spontaneous abortion should be screened for lupus anticoagulant using activated partial thromboplastin time or kaolin clotting time; if lupus anticoagulant is present, they can be offered treatment with prednisone and aspirin.[6,7] Another cause of pregnancy loss—preterm labor—can be caused by surgically correctable abnormalities of the pelvic organs.

Both men and women should be asked about any problems with fertility or other abnormalities of the reproductive system that could affect fertility. Women with oligo-ovulation, endometriosis, or a history of pelvic inflammatory disease, for example, should be advised that they might take longer to conceive. Women who report a history of infertility should have the cause of their infertility investigated and treated, if possible. Similarly, men who report a history of infertility should have the cause further investigated, a process often initiated with a genital examination and semen analysis.

A history of abnormal findings on a Papanicolaou smear is also important. Management of abnormal cervical cytology during pregnancy is complicated by physiologic changes in the cervix, specifically edema and increased vascularity, which mimic neoplasia.[8] Cone biopsy for suspected invasive cervical carcinoma increases risk for the patient and her pregnancy. Complications observed following cone biopsy during pregnancy include hemorrhage, infection, inadvertent interruption of pregnancy, stillbirth, and preterm labor.[9] Ideally, then, follow-up of abnormal Papanicolaou smear results with either colposcopy, cryotherapy, or surgery should be accomplished before pregnancy.

A sexual history from both prospective parents is essential. This information allows the physician to identify important risk factors, including number of sexual partners and history of sexually transmitted diseases, such as herpes, gonorrhea, syphilis, chlamydia, venereal warts, and acquired immune deficiency syndrome (AIDS). Women who have a history of sexually transmitted diseases are more likely to be infertile and are at increased risk for similar infections during pregnancy. In a recent study of 193 randomly selected pregnant women, participants' history of multiple sexual partners was related to premature rupture of membranes.[10] Further, a recent literature review of the role of infection in preterm delivery showed that the following sexually transmitted organisms occur more frequently among women experiencing preterm delivery: *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, *Ureaplasma urealyticum*, *Trichomonas vaginalis*, group B streptococcus, and bacterial vaginosis.[11]

In addition to screening for these infections in patients who are either symptomatic or at high risk, family physicians should also inform their patients how to avoid these diseases, e.g., carefully selecting a sexual partner and using barrier contraceptives. These practices can be lifesaving for the newborn and, in the case of the human immunodeficiency virus, for the parents as well.

Finally, a discussion of contraception or the couple's approach to family planning is appropriate in preconception care.[3] The physician should provide nonjudgmental information regarding conception rates for unprotected intercourse and the reliability of the couple's chosen method of contraception. Although the ingestion of oral contraceptives immediately before or during the first weeks of pregnancy probably has no adverse effects on the fetus,[17] women using oral contraceptives should be advised that they should wait for one normal menstrual period off the pill before trying to conceive to allow early dating of the pregnancy.

Chronic Medical Diseases

Diabetes, hypertension, and seizure disorders are among the more common chronic medical diseases that cause complications in pregnancy. Infants born to women whose diabetes was inadequately controlled during their pregnancies have a higher rate of developmental anomalies, such as skeletal malformations, cardiovascular disorders, neural tube defects, and genitourinary abnormalities.[18] Preconception diabetic control appears to be related to a lower rate of spontaneous abortions,[19] as well as a reduction in congenital malformations.[20] In a recent study, pregnancy outcome of 292 diabetic women who began strict metabolic control after 8 weeks' gestation was compared with that of 128 diabetic women who initiated strict diabetic control before conception. The preconception treatment group had a significantly lower rate of congenital malformations (0.8 percent) than the delayed treatment group (7.5 percent).[20] Other benefits result from careful preconception diabetic control. Dicker, et al.[21]

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compared the course and outcome of pregnancy for 136 women who regularly consulted a diabetological team at least 2 months before conception with that of 154 women who did not receive preconception counseling. The treatment group experienced improved glucose control, fewer Cesarean sections, and less weight gain, preeclampsia, and infant macrosomia and hypoglycemia.

Women who have a history of hypertension may find that their disease is aggravated by pregnancy; these women are also at increased risk for preeclampsia. Although some physicians prefer treating hypertension with methyldopa during pregnancy, others have seen good outcomes when antihypertensive medications were discontinued in women with mild-to-moderate hypertension.[5] Worsening hypertension can be treated by increasing antihypertensive medications or reducing activity. In addition, hypertensive women need increased fetal surveillance in the third trimester, with nonstress tests, stress tests, biophysical profiles, or ultrasonic examinations.[22]

Women who have a seizure disorder represent a third high-risk group for pregnancy because of both their disease and the medications required to control the seizures. Overall, epileptic women receiving anticonvulsant therapy have a 5 percent risk of fetal malformations compared with a 2 to 3 percent risk in the general population.[22] Infants whose mothers take phenytoin fare worse: approximately 10 percent of these babies are born with fetal hydantoin syndrome (craniofacial dysmorphism, prenatal and postnatal growth delay, and mental retardation). They also can have congenital heart defects, cleft lip and palate, and distal digital hypoplasia. An additional 30 percent show milder abnormalities.[18] A less commonly used seizure medication, valproic acid, has been associated with neural tube defects.[23] The use of trimethadione during pregnancy can produce in an infant a syndrome characterized by developmental delays, low-set ears, palatal anomalies, irregular teeth, V-shaped eyebrows, and speech disturbances.[23] Even phenobarbital, which has been recommended by many practitioners for use during pregnancy, has been associated with "hydantoinlike" malformations, as well as hemorrhagic disease of the newborn, neonatal addiction, and withdrawal syndrome.[24]

Preconception care is especially applicable to women receiving seizure medications. When they are seen before pregnancy and meet the following three criteria: (1) idiopathic epilepsy, (2) seizure-free for 2 or more years, and (3) normal electroencephalogram, they can be offered a trial off the drug before attempting pregnancy. These women have a 75 percent chance of nonrecurrence of seizures.[22] Unnecessary risks should not be taken in discontinuing anticonvulsant medications, however, because hypoxia from grand mal seizures can be far more damaging than the medications themselves. If seizure medications are required, anticonvulsant serum levels should be measured at regular intervals, and medications should be adjusted to keep serum levels in a low-normal therapeutic range.[25] To select anticonvulsants for a prospective mother is not easy. Although phenobarbital, carbamazepine (Tegretol™), and phenytoin (Dilantin™) have all been recommended for use during pregnancy,[5,23,25] both phenobarbital and phenytoin are considered category D drugs (drugs that have caused fetal malformations).[24] Carbamazepine (Tegretol™)—a category C drug (a drug that may cause risk to the fetus)—is considered by many authorities to be the drug of choice during pregnancy, but it has also been associated with malformations similar to those found with the hydantoin syndrome, and more experience with this drug is needed.[24]

Childhood Illnesses and Immunizations

Physicians should ask prospective mothers about their childhood illnesses and immunizations, rubella in particular. Approximately 80 percent of women who have rubella during the first 12 weeks of pregnancy will have a fetus with congenital infection, which includes two or more of the following abnormalities: eye lesions, heart disease, auditory defects, central nervous system defects, retarded fetal growth, thrombocytopenia and anemia, hepatosplenomegaly and jaundice, chronic diffuse interstitial pneumonitis, osseous changes, and chromosomal abnormalities.[5] Current recommendations for rubella immunization include routine vaccinations at 15 months and again at 5 years. If the rubella immunization is unknown, antibody levels should be determined, and nonimmune women should be vaccinated. Studies of 1176 susceptible women who were

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immunized within 3 months of conception have shown no evidence of vaccine-induced malformations; however, the rubella vaccine should be avoided shortly before or during pregnancy.[5]

Family History

Prospective parents should be questioned about a history of medical problems within family members, and genetic counseling should be considered if close relatives have experienced such problems as chromosomal abnormalities, cystic fibrosis, congenital heart disease, hemophilia, dwarfism, spina bifida, limb abnormalities, or myotonic dystrophy. Patients' racial or ethnic heritage is also specific for inheritable disorders; for example, blacks should be offered preconception screening for sickle-cell trait, American Jews for Tay-Sachs disease, and persons of Asian and Mediterranean descent for α- and β-thalassemia.

Social History

The social history gives some idea about the prospective parents' family and social structure. Good social support around the time of childbirth is important to the mental and physical health of the new mother.[26] In addition, the infant's birth weight appears to be related to the quality of support (help with daily tasks) the mother-to-be receives[27] and to overall family functioning.[28] If there are concerns about family function, preconception family counseling is invaluable to the health of both the parents and their baby.

It is also wise to inquire about the presence of household pets. Cats can transmit toxoplasmosis to their caregivers, and many health care providers advise that, to avoid toxoplasmosis in pregnancy, women should not contact cat feces or eat raw meat. This recommendation, however, has been challenged by a recent study that compared 2986 women who were not taught these preventive measures with 3563 women who were. The informed group showed a lower rate of seroconversion when compared with the control group (1.97 percent versus 1.43 percent), but this difference was not statistically significant.[29] To detect a significant difference between the groups at the 95 percent confidence level, a difference of 45 seroconversions (rather than 5) is required between the two groups, which would have necessitated a several-fold increase in the total sample size. Therefore, avoiding raw meat and cat litter during pregnancy might have some benefit.

For women who develop toxoplasmosis during pregnancy, the risk of congenital infestation increases from 15 percent in the first trimester to 60 percent in the third trimester. Fortunately, the virulence of congenital infestation is greatest when the risk is lowest—during the first trimester.[5] Fetal infestation with *Toxoplasma gondii* can result in stillbirth, spontaneous abortion, or severe disease in the newborn with subsequent central nervous system damage, chorioretinitis, or sensorineural hearing loss.[30] For pregnant women who become infested with *T gondii*, treatment with spiramycin can reduce the chance of fetal infestation.[5,31]

Inquiries about the nature of employment for both parents provides clues about exposure to potential toxins harmful to their reproductive systems. In a recent investigation of 900 pregnant women who made prenatal inquiries to the Toxicology Center in Washington, DC, 15 percent of the expectant mothers experienced potentially adverse chemical exposure at work, 2 percent had physical exposure at work, and 6 percent had chemical exposure at home.[32] In another study of 198 Massachusetts chemical and electronics manufacturing companies, over one-half of the firms reported that they used at least one of four substances hazardous to reproduction—lead, glucol ethers, mercury, and radiation. Of these firms, 56 percent provided information on reproductive risks to employees, and 20 percent excluded certain workers from substance exposure because of reproduction concerns.[33]

It is often difficult to determine whether an exposed person will have adverse reproductive consequences. Problems encountered in assessing hazard and risk include poor characterization of exposure, a potential toxic synergism with combined substances, extrapolation of animal data to humans, and methodological flaws in human studies (e.g., small sample sizes or selection of controls).[34-36]

Several physical and chemical agents associated with adverse pregnancy outcomes in human studies are shown in Table 1.[36-38] One of the more well-studied reproductive toxins is lead, which is found in paint, ink, ceramics, pottery, ammunitions, textiles, and leaded gasoline. High exposure to lead is associated with sterility of both sexes,

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Table 1. Chemical and Physical Agents that Have Been Associated with Reproductive Toxicity in Humans.*

Agent	Source	Reproductive Effects
Anesthetic gases	Surgical suites	Spontaneous abortion Low birth weight Birth defects
Benzene	Gasoline and other hydrocarbons Dry cleaning Printing Adhesives Solvents	Sperm toxicity Blood dyscrasias Mutagenesis
Carbondisulfide	Viscose rayon Fumigant	Impotence Decreased male and female fertility Spontaneous abortion
Carbon monoxide	Industry Paint removers Smokers	Growth retardation Neurologic abnormalities
Chloroprene	Latex and rubber manufacturing	Possible mutagenesis
Dibromochloropropane	Pesticide	Male infertility
Ethylene oxide	Sterilization of food and surgical equipment Antifreeze Fungicide Fumigant Polyester fiber	Spontaneous abortions
Heat	Environmental	Sperm toxicity
Ionizing radiation	Medical and dental work, nuclear industry	Decreased male and female fertility Chromosome aberrations Growth retardation Mental retardation Childhood cancers
Kepone	Pesticide	Decreased libido Sperm toxicity
Lead	Smelting Batteries Some paints Ceramics and pottery Ammunitions Gasoline	Sperm toxicity Menstrual disorders Spontaneous abortions Prematurity Increased neonatal mortality
Mercury	Contaminated food	Growth retardation Neurologic changes
Polychlorinated biphenyls	Capacitors in telephones or electrical equipment Contaminated food	Menstrual disorders Stillbirth Low birth weight Abnormalities of skin, hair, and nails Developmental delays
Styrene	Plastics	Menstrual disorders Chromosome aberrations
Vinyl chloride	Manufacturing	Chromosome aberrations Miscarriage Stillbirth Sperm toxicity Birth defects

*Kipen and Favata,[36] Zenz,[37] and Raffle and Lee.[38]

spontaneous abortions, stillbirths, increased infant mortality, decreased infant birth weights, slow infant development, and mental retardation.[37] The occupational standard for safe lead exposure established by the Occupational Safety and Health Administration (OSHA) is 50 μg/m^3 of air or 1.93 μmol/L (40 μg/dL) of blood; however, these levels might not be protective for the fetus. The Centers for Disease Control recommends that the upper margin of blood lead levels in the fetus should be 1.21 μmol/L (25 μg/dL) blood; therefore, the pregnant

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worker's level should be maintained at or below that concentration.[37]

Standards that have been set for exposure of nonpregnant adults to other chemical substances[37] are not always easy to translate into practical advice for the pregnant worker. The physician can recommend reviewing material safety data sheets provided by the workplace, environmental testing for level of exposure, blood studies when applicable (e.g., serum lead level), a work-site inspection by OSHA, or consultation with appropriate computer databases, such as REPROTOX (Reproductive Toxicology Center, Washington, DC).[39] If toxicity seems likely, steps should be taken to decrease or eliminate the exposure.

Health care workers are exposed to toxic or infectious agents through accidental skin punctures, contact with patients' blood and body fluids, and use of anesthetic gases, radiography, and laboratory chemicals. The use of anesthetic agents by pregnant medical personnel in surgical suites has been associated with spontaneous abortions and infants with low birth weight and birth defects.[36] Even nitrous oxide, commonly used in hospitals and dental offices, has been associated with spontaneous abortions and congenital anomalies.[40] Consequently, pregnant workers should avoid situations where nitrous oxide exposure is greatest: pediatric surgical procedures, surgical suites with rapid patient turnover, and nitrous oxide administration by mask.[40]

Pregnant homemakers and domestic workers or those contemplating pregnancy should minimize their exposure to oven cleaners, wood-finishing products, paint and paint-removal products, bleaches, and detergents containing enzymes and lye. Although concern has been raised about emissions from video display terminals, a recent review of the literature concluded that a fetus is not harmed by the expectant mother's use of a video display terminal.[41]

Current Health

Three additional components of parents' current health—nutrition, medications, and alcohol and tobacco habits—are especially important to infant outcomes. Furthermore, these variables are probably the most amenable to interventions that would benefit the infant.

Nutrition

The importance of nutrition for prospective mothers is highlighted by the effects of the Dutch famine during World War II. Infants born to women who were subjected to famine when they conceived had higher rates of mortality and central nervous system anomalies.[2,42,43] In December 1945—approximately 8 months after the food shortage ended—the perinatal mortality rate peaked at 65/1000, almost twice as high as the rates for infants born either 1 year before (34/1000) or 1 year later (33/1000).[43] For infants who were conceived at the height of the famine, the relative risk of having a congenital anomaly of the central nervous system was twice that of those conceived when the food supply was adequate.[42] Subsequent research has shown that the two strongest factors associated with low-birthweight infants are the mother's prepregnant weight and her weight gain during pregnancy.[2] Recent confirmation of the importance of maternal nutrition before conception comes from the Caan, et al.[44] study of 642 women who became pregnant twice within 27 or fewer months and who received food supplements through the Special Supplemental Food Program for Women, Infants, and Children (WIC) between pregnancies. While the one group (n = 307) received supplements for 0 to 2 months after the first pregnancy, a second group of 335 women received supplemental food for 5 to 7 months between pregnancies. In addition, both groups received food supplements during each of their two pregnancies. Results showed those who had extended supplementation had larger infants; the mothers had higher hemoglobin levels and a lower risk of maternal obesity at the onset of the second pregnancy.

Inquiry about vitamin and other dietary supplements is appropriate during preconceptual counseling. Ingesting multiple supplements or megavitamins can cause fetal toxicity. On the other hand, supplements are recommended in special circumstances, such as iron deficiency anemia. Early prenatal multivitamin and folic acid supplements have been advocated on the basis of studies showing a relation between supplements and reduced rates of neural tube defects.[45,46] Nevertheless, a recent investigation with matched controls showed no protective effect from periconception multivitamin and folic acid supplement use.[47]

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Whether early prenatal vitamin supplements provide benefit in preventing neural tube defects remains controversial.

In general, physicians offering preconception nutrition counseling should recommend a well-balanced diet that provides adequate calories to achieve or maintain ideal body weight. Whereas underweight women tend to have low-birth-weight babies, obese women have more difficult deliveries; a higher frequency of twinning; increased risks of Cesarean sections; and complications from anesthesia, postpartum hemorrhage, and infection.[48]

Medications and Recreational Drugs

An estimated 3 percent of all developmental anomalies are attributed to drugs and chemicals.[2] Although this proportion is not high, neonatal problems secondary to maternal drug use—for example, mental or developmental disturbances—would not be classified as anomalies and therefore would not be included in this figure. There is further evidence that the number of babies exposed to addicting chemicals in utero is mushrooming. A Minnesota hospital trade group reported that the number of addicted newborns in the group rose from 79 in 1987 to 198 in 1988—a 150 percent increase in 1 year.[49]

Careful attention to women's medication use, including prescription drugs, over-the-counter drugs, and recreational drugs, is important throughout pregnancy, particularly in the 17th through 56th day after conception, when the developing fetus is most sensitive to its environment.[2] On the average, women take 4 to 11 drugs during pregnancy, and 40 percent of these drugs are consumed within the first trimester.[2] Commonly used drugs that are not safe for the fetus include gold, isotretinoin (Accutane™), ergot alkaloids, lithium, tetracycline, and warfarin (Coumadin™).[2,50] The safety of aspirin during pregnancy is a subject of controversy. Although aspirin does not appear to be teratogenic, it is listed as category C,[5] and when taken in moderate-to-high doses, it has been associated with antepartum and postpartum hemorrhage, longer gestations, and prolonged labor and neonatal hemorrhage, jaundice, pulmonary hypertension, and decreased birth weight.[50,51] Recent investigations suggest that low-dose aspirin (60 to 80 mg) is safe for both the mother and child[51,52] and can improve perinatal outcomes in women at risk for pregnancy-induced hypertension.[52]

Recreational drug use is particularly hazardous to the developing fetus, and the current wave of cocaine use by prospective mothers contributes to significant problems in affected offspring.[53] Investigators, in studies in which unselected populations of women recently giving birth were screened for cocaine abuse, found that 8 to 10 percent of the urine tests were positive for cocaine.[54-56] Of 35 mother–infant pairs with urine tests positive for cocaine, 17 percent of the newborns had microcephaly, 27 percent were growth retarded, 26 percent experienced mild withdrawal symptoms, and 6 percent had withdrawal symptoms severe enough to require treatment.[57] Cocaine use is also associated with higher rates of spontaneous abortion, abruptio placentae, preterm delivery, premature rupture of membranes, neonatal morbidity, small-for-gestational-age infants, and developmental difficulties that persist for years.[53,58-60]

For expectant mothers who use heroin, drug withdrawal during pregnancy can lead to fetal death.[48] In addition, infants born to heroin users have a higher rate of jaundice, respiratory distress syndrome, low birth weight, growth retardation, chromosome damage, and impaired behavioral, perceptual, and organizational abilities. Infants who experience withdrawal from heroin, cocaine, or other drugs during the newborn period have in the first year of life a death rate twice that of normal babies.[48] Other mood-altering drugs—codeine, methaqualone, amphetamines, diet pills, and hallucinogens—produce both short- and long-term problems for affected babies.

The use of controlled substances during pregnancy is defined as child abuse in some states and must be reported. In Minnesota, patient consent for testing is not required, and failure to test when there is reason to suspect drug abuse is a misdemeanor.[61] Findings from the patient's history and physical examination can suggest drug abuse. Factors that have been associated with illicit drug use include: nonwhite, poor, receiving public assistance, having one or more children, and giving birth at a regional perinatal center.[62] Conflicting information, however, comes from a recent study comparing 380 women attending public health clinics with 335 women from private obstetric offices in Florida. Socioeconomic status and race

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were not significant predictors for drug use in pregnancy, and women who attended public clinics had only a slightly higher rate of positive screening tests than women from private offices (16.3 percent versus 13.1 percent).[63] The investigators have warned that association of prenatal substance abuse with minority groups, urban populations, and lower socioeconomic groups can bias physicians in identifying substance exposure in newborns.[63]

Several nondemographic variables are related to prenatal drug use: a history of drug use, elective abortion, or venereal diseases[64]; increased negative life events[64]; and during pregnancy, premature separation of the placenta, preterm labor, diminished fetal growth,[65] fetal anomalies,[55] and violence.[64] Any of these factors should prompt the physician to investigate possible drug use.

Women who use recreational drugs often do not seek prenatal care, much less preconception care. To reach this population of women, preconception care probably should begin in adolescence and preadolescence with educational programs on the effects of drug use and abuse.

Smoking and Drinking Habits

As with recreational drugs, use of tobacco and alcohol can have major ramifications for the fetus and newborn. Smoking during pregnancy increases the risk of abortion, fetal death, premature birth, low birth weight, placenta previa, and abruptio placenta.[2] In addition, smoking by either parent after birth can be harmful to the new infant, resulting in an increase in lower respiratory tract infections,[66-68] bronchiolitis,[69] tracheitis,[70] and bronchitis.[68,70] Pregnant women exposed to passive smoke are more likely to have a low-birth-weight infant than nonsmoking women, and exposure for as little as 2 hours a day can double the risk of a low-birth-weight baby.[48]

A mother's alcohol consumption has even more serious consequences for her fetus. Alcohol is now the chief cause of preventable mental retardation in the United States.[71] It is estimated that approximately 5 to 10 percent of all women drink sufficient quantities to place their babies at risk.[2] The severity of fetal abnormalities from maternal alcohol use appears to be dose related, and women who consume six or more drinks a day during pregnancy have approximately a 50 percent chance of having a child with fetal alcohol syndrome.[18] The fetal alcohol syndrome is characterized by craniofacial dysmorphism, which contributes to dental malalignments, malocclusions, and eustachian tube dysfunction[72]; prenatal and postnatal growth delay; mental retardation; and serious malformations, including cardiac defects, cleft palate, and joint anomalies.[18] The mother's drinking can also affect her infant's birth weight and growth.[48]

Many of the effects of maternal alcohol use on offspring appear to be long term.[72,73] Streissguth and colleagues[72] reported in 1985 that, of 11 children with fetal alcohol syndrome diagnosed 10 years earlier, 2 were dead (1 from drowning in the tub and the other from apneic episodes 5 days after birth), 1 was lost to follow-up, and 8 continued to be growth deficient and dysmorphic. Four of these 8 survivors were of borderline intelligence, and the other 4 had severe intellectual handicaps.[72]

No safe level of alcohol consumption has been established for pregnant women; therefore, abstinence during pregnancy is prudent[71] and has been recommended by the Surgeon General's Advisory on Alcohol and Pregnancy.[74] If abstinence is not a reasonable goal, however, reducing alcohol intake also is beneficial, as evidenced by Halmesmaki's[75] research. In this Finnish study, 85 pregnant problem drinkers were given intensive counseling throughout pregnancy to encourage them to discontinue or reduce their ingestion of alcohol; 65 percent of the women were able to decrease their alcohol intake by at least 50 percent. Eighty-nine percent of those who continued to abuse alcohol, compared with 40 percent of women who decreased their alcohol intake, had infants with at least one symptom of fetal alcohol exposure.[75] Although this study did not use a control group of patients, the results suggest that physicians' advice to decrease alcohol use before and during pregnancy has some positive outcomes.

Reliable tools have been developed for explicit history taking to screen for alcohol abuse in the outpatient setting. One such tool is the CAGE questionnaire (Table 2).[76] All prospective parents, from adolescents to middle-aged men and women, should be questioned about their use of alcohol and other chemicals, and when abuse of alcohol or other drugs is identified, appropriate management should be instituted. Management

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Table 2. The CAGE Questionnaire*

1.	Have you ever felt you should Cut down on your drinking?
2.	Have people Annoyed you by criticizing your drinking?
3.	Have you ever felt bad or Guilty about your drinking?
4.	Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover (Eye-opener)?

*Mayfield, et al.[76]

of chemical dependency includes referring the person to an appropriate treatment program, arranging psychiatric services, involving social service agencies, increasing prenatal surveillance for women who become pregnant, and arranging for neurodevelopmental follow-up for affected infants.[54] Although managing alcohol and drug abuse is frustrating, positive changes improve outcomes at any stage—preconceptually prenatally, or even postnatally—and the potential rewards benefit both the parent and the child.

The Physical Examination

The physical examination provides important information either by confirming problems already noted from the medical history or by discovering new problems that can affect reproduction. Abnormalities important to reproductive outcomes in women include hypertension, severe cardiovascular or respiratory problems, uterine myomas, cervical or other gynecologic lesions, abnormal vaginal discharge, and structural abnormalities of the pelvic organs. For men, the most common correctible abnormality affecting fertility is the varicocele, which can be treated by surgical ligation of the spermatic vein or nonsurgical techniques, such as balloon insertion or sclerosis of the spermatic vein.[77]

The Timing of Reproduction

A recent trend to postpone childbearing has resulted from women's expanding career opportunities, advanced education, control over fertility, financial concerns, and late or second marriages. Consequently, the number of women bearing children in their 30s and 40s has increased.[78] Women who give birth at an older age risk delay in conception or infertility,[78] fetal chromosomal abnormalities,[78] and an increased probability of having a Cesarean section.[79] Although some question exists whether advanced maternal age is associated with increased perinatal mortality,[5,80-84] data from the National Infant Mortality Surveillance project, which examined 1,579,854 births, showed that mothers aged 40 to 49 years had a 69 percent greater risk of their infants dying than mothers aged 25 to 29 years.[85] As a result of these risks, the older pregnant woman requires more costly, high-technology prenatal care, such as genetic counseling, genetic antenatal testing, amniocentesis, and ultrasonography.[86] Older fathers also bear greater risks. In a study of approximately 7500 infants with birth deficits, fathers aged 40 years and older had a 20 percent increased chance of having a baby with a birth defect than did fathers younger than 40 years, even when maternal age and race were controlled.[87] Although these problems are not contraindications to delayed reproduction, they should be considered when discussing the timing of pregnancy.

Implementing Preconception Care

Providing comprehensive preconception care can appear overwhelming. When this care is integrated into the established routines of a primary care practice, however, it is easily managed. Preconception care should be provided to any sexually active adolescent or adult seen for a routine or health maintenance examination. The patient can complete a questionnaire such as that shown in the Appendix, and any problem identified can be further investigated during the history and physical examination. Appropriate interventions should follow.

This approach, however, misses those high-risk women who can benefit most from preconception services. To address this deficit, Jack and Culpepper[88] have suggested that preconception care be introduced into settings that serve women with limited access to health care (e.g., women's shelters, halfway houses, detention centers, sexually transmitted disease clinics, and substance abuse treatment centers) and that access to primary care be improved in needy areas.

Few data document the advantage of preconception care over early prenatal care.[88] Although preconception care produces superior outcomes for women who have diabetes, phenylketonuria, or nutritional needs, data about

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the overall impact of preconception care on perinatal outcomes are not available. Nevertheless, interventions aimed at improving parents' health risks before they conceive should prove worthwhile.

Summary

Preconception health care is increasingly recognized as important by policy makers and professional organizations dedicated to maternal and newborn health. Family physicians are in an ideal position to provide this care through routine health maintenance visits. Risk assessment, health promotion, and appropriate medical intervention can be accomplished within the framework of a complete history and physical examination for one or both prospective parents. The medical history should include questions related to reproductive function, chronic diseases, childhood illnesses, and immunizations. The family history can provide information about inheritable disorders that require genetic counseling or screening studies. Important aspects of the social history include family structure, social support, and employment, in particular, exposure to environmental hazards. Perhaps most important to infant outcomes are the parents' preconception and prenatal lifestyles, including nutrition and the use of medications, recreational drugs, cigarettes, and alcohol.

Attention to the health of prospective parents before they conceive requires that physicians expand their view of prenatal care to include lifestyle and risk-assessment counseling for any person of childbearing age. Although broad in scope, this approach offers exciting potential to reduce perinatal morbidity and mortality and to achieve perinatal outcomes that exceed those expected from standard prenatal care.

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Appendix*
Preconception Inventory

GENERAL INFORMATION

Your Name _____ Today's Date _____

Ethnic Background _____ Age _____

Your Occupation _____

Your Partner's Occupation _____

FAMILY HISTORY

Does anyone in your family (including your grandparents, parents, siblings, spouse, and yourself) have the following problems? Please check all that apply, and specify who has the problem.

___ High blood pressure
___ Bleeding disorder
___ Diabetes
___ Multiple pregnancies
___ Birth defects (specify):
_____
___ Mental retardation
___ Cystic fibrosis
___ Tay-Sachs disease
___ Sickle cell disease
___ Seizure disorders
___ Other

MEDICAL HISTORY

Please list other health problems not included above. _____

_____

Immunization history—please give us a copy.
Allergies _____

Reproductive history (please complete this section if you have ever been pregnant).

Number of live births ___
Number of premature births ___
Number of abortions ___
Number of miscarriages ___
Number of stillbirths ___
Number of Cesarean sections ___

Do you have a child (or children) with a birth defect?
___ Yes; ___ No
→ Please describe _____

Have you ever had a problem with infertility? ___ Yes; ___ No

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Have you ever had an abnormal Papanicolaou smear? ___ Yes; ___ No
→ When? ____

Have you had any venereal (or sexually transmitted) diseases?
___ Yes; ___ No
→ Please describe _____

How many sexual partners have you had in the past year?
Have you ever had surgery of the pelvic organs?
___ Yes; ___ No
→ Please describe _____

CURRENT HEALTH

Please list the medications you are taking (prescription and over-the-counter). _____

_____

Do you smoke? ___ Yes; ___ No
→ packs/day _____

Do you drink? ___ Yes; ___ No
→ How often? _____
→ How much at a time? _____

Do you use street drugs? ___ Yes; ___ No
→ Specify _____

Do you use a contraceptive? ___ Yes; ___ No
→ Specify _____

Briefly describe your diet. _____

Do you work with any of the following substances in the home or workplace? Please check all that apply.

___ Lead
___ Solvents
___ Pesticides
___ Paint strippers
___ Fumigants
___ Anesthetics
___ Gasoline
___ Ceramics or pottery
___ Printing materials
___ Manufacture of plastics, latex, or rubber

Do you have a cat in your home? ___ Yes; ___ No

How many people would you feel comfortable asking for practical or emotional help, if you needed it? _____

* Adapted from Frigoletto and Little[3] and Moos.[4]

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