CME Feature

Adolescents and sexually transmitted infections

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ABSTRACT **Adolescents are the age group at greatest risk for nearly all sexually transmitted infections—one out of four sexually active girls will be diagnosed with such an infection in the upcoming year. The reasons are many, including cognitive development, physiologic susceptibility, peer pressure, logistic issues, and specific sexual behaviors. However, assessing adolescent patients for medical conditions often requires inquiry about their sexual practices, which could be embarrassing and confusing. Two experts suggest the best approach to the adolescent patient and to the management of the most common of sexually transmitted infections in this population. The practical advice offered here will increase the clinician's comfort level when approaching adolescents at risk for, or diagnosed with, such infections.**

Sexually transmitted infections (STIs) are a major public health concern in the United States and worldwide. Many of those infected are asymptomatic and are therefore unaware of their being infected. In addition to not seeking treatment, they can, and often do, continue to spread the disease. Although the prevalence of some STIs is at an all time low (eg, syphilis, gonorrhea), the prevalence of other infections has been increasing (eg, herpes, chlamydia).[1] The apparent increase in these infections may reflect the availability of more sensitive tests or more widespread screening rather than an actual increase in prevalence.

In the United States, adolescents account for approximately 3 million STIs annually, which means that one out of four sexually active teens will be diagnosed with a reportable STI.[2] This high prevalence will not only affect teens during adolescence, but also have an impact on their adult years through long-term sequelae, such as pelvic inflammatory disease, ectopic pregnancy, chronic abdominal pain, or infertility. Teens are at a particularly high risk for acquiring STIs for several reasons, including stage of cognitive development, increased physiologic susceptibility, inaccurate information regarding STIs, and specific sexual behaviors, such as partner selection and inconsistent use of condoms.

Even though the age of initiating sexual intercourse has decreased, the age of first marriage has increased—resulting in an overall greater span of time for premarital sex among teens and young adults.[3] Logistic issues such as poor access to comprehensive health care, transportation, inability to pay for services, and confidentiality issues are also affecting many teens. These and some demographic variables put certain groups of adolescents at greater

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Educational needs addressed: Adolescents are at a particularly high risk for sexually transmitted infections and for transmitting the infection to their partners. Assessing teens' sexual behavior can be embarrassing and complicated for the primary care clinician. This article highlights the need to address sexual activity with adolescents and how best to approach this patient population to elicit their honest responses, implement prevention measures, and manage the most common infections .

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risk for infections, especially minorities, homosexuals, drug users (particularly parenteral), homeless, runaways, prostitutes, and pregnant or incarcerated youths.

CASE 1 Judy is a 15-year-old new patient who presents to the office, accompanied by her mother, complaining of a 1-week history of dysuria. You have not met the family before, but they have come on the recommendation of patients you have seen in your office for several years. After obtaining an initial history from Judy and her mother together, you ask to see Judy by herself. It is quite evident from her sulky demeanor and her mother's angry, overbearing tone that there are problems in their relationship. You assure Judy of confidentiality and learn that she has been sexually active for more than 6 months, without any contraception. Her latest partner, with whom she has been sexually intimate for the past month, is a 16-year-old boy. For the past week, Judy has been experiencing dysuria and frequency. You order a urinalysis and urine pregnancy test and ask your assistant to help set up a pelvic examination, after discussing the examination with Judy. You ask her if she wishes her mother to be present during the examination, but she defers. A pelvic examination is notable for a mucopurulent vaginal discharge, with cervical friability, but without cervical motion tenderness. The urinalysis reveals pyuria, but is negative for nitrites. A saline vaginal swab examination reveals several epithelial cells and lots of white blood cells.

Younger adolescents have admitted to not being completely honest when reporting their sexual behaviors.

CASE 2 Mike is a 16-year-old boy coming in for a sports preparticipation examination. He has been in good health and denies substance use or sexual activity. He denies symptoms of any kind. You perform a complete physical examination, which is unremarkable. You obtain a leukocyte esterase test on a urine specimen, which is reported as 2+.

Risk factors

Cognitive stage. Cognitive development of adolescents may place them at increased risk of acquisition and transmission of STIs, as well as impede treatment and prevention efforts. Adolescence is a time of immense change in the physical, cognitive, and social realms. The cognitive stage at the beginning of adolescence is typically still concrete with a present orientation. The concrete thinker is unable to succinctly conceptualize an action and its consequences. It is during early adolescence that teens begin to develop formal operational, or abstract, thinking. Adolescents at this stage may still have difficulties recognizing cause and effect, especially around emotional or health issues. They may have developed decision-making skills, but still have difficulty negotiating safe sex with their partner.

Peer pressure. It is no surprise that adolescents report peer pressure as a factor in the initiation of sexual intercourse. Less expected is the notion that peer pressure also affects risk of STIs. An adolescent may intellectually realize the need for a condom when having sex, to prevent STIs. However, if adolescents anticipate a negative response from a sexual partner, they may choose not to approach the subject, and instead take the risk of acquiring an infection.[4] Others may feel that they need to show loyalty and implicit trust in their partner, and that insistence on condom use shows distrust. Together with a developing sense of invulnerability—"it can't happen to me"—adolescents may not perceive any risk of a STI. It is unfortunate, but not unusual, that a teen may feel comfortable enough to engage in intercourse with a partner but not comfortable enough to discuss sexual histories or behaviors (erotophobia).[5]

Misinformation. Research about adolescents' knowledge of sexuality and health has revealed major areas where teens may be misinformed about and/or unaware of basic reproductive and health functions, independent of age, sexual experience, or exposure to sex education.[6] Adolescents may perceive a greater prevalence of STIs among teens in general than among their friends, resulting in a low perceived personal risk.[7] Recent surveys show that many adolescents receive formal education regarding HIV and other STIs[8] and that teens have a greater knowledge of STIs than adults, but in reality knowledge among both groups is low.[9]

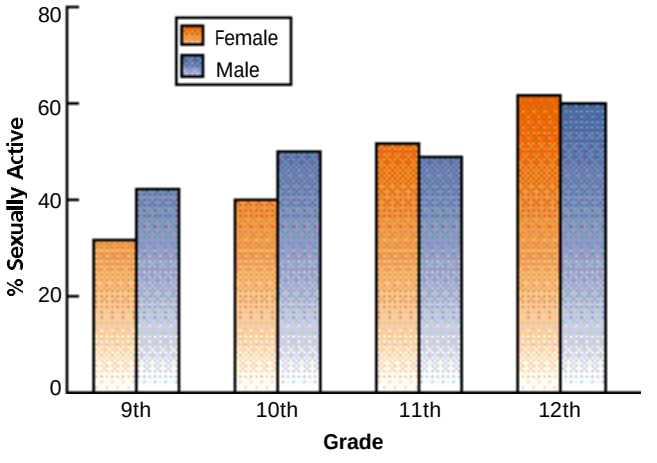
Female biology. Biologic factors may also contribute to the acquisition of STIs in female adolescents. Adolescent girls have persistence of vaginal columnar epithelium extending to the outer surface of the cervix within a few years of menarche. Columnar epithelium is more susceptible than squamous epithelium to infection with chlamydia,[10] thus inevitably predisposing adolescent girls to this infection. Although they cannot eradicate this susceptibility, barrier contraception (eg,

condoms) can be used as a preventive measure. Adolescent girls may also have differences in characteristics of the cervical mucous, such as greater penetrability and lower secretory immunoglobulin A (IgA).[11]

Early sexual activity. As shown in Figure 1, in the 1999 Youth Risk Behavior Survey, 38% of ninth graders and 42% of tenth graders acknowledged they had engaged previously in sexual intercourse.[12] An earlier age of sexual debut is associated with a greater number of sexual partners and lower likelihood of condom use,[13] thereby increasing risk and acquisition of STIs.

Be aware that girls who experience intercourse by age 13 have a greater likelihood (24%) of nonvoluntary intercourse at that time, and that an additional 25% reported that the experience was not sought or wanted.[14] You should also familiarize yourself with the legal requirements of your state regarding statutory rape, which may include age of the younger partner, as well as differences in age between the two partners.

FIGURE 1 **Sexual intercourse among high school students**



Data from the Youth Risk Behavior Survey, 1999.[12]

Interviewing strategies

To provide appropriate health care to adolescents who engage in risk-taking behaviors, you need to conduct a thorough and accurate interview to obtain complete information, especially a sexual history. Conducting interviews with adolescents about sexual practices may make you feel uncomfortable; as primary care physicians we often feel these matters are outside our scope of training, or experience embarrassment when discussing sensitive subjects with adolescents.[15,16] A firm grasp of the most appropriate interview techniques to use with teens may lessen any discomfort and make it possible to obtain all the needed information from your patient.

Interview techniques. The three interviewing styles include active-passive, guidance-cooperation, and mutual participation. The active-passive interview is appropriate when the patient is incapable of making an informed decision, such as in an emergency situation. The guidance-cooperation interview occurs when the physician is the authority figure and the patient is expected to cooperate, such as in an acute, but not life-threatening, illness. Mutual participation is the most appropriate model in the majority of outpatient settings. This allows you and your patient to actively participate in the evaluation and treatment, and improves communication and compliance.[17]

Ask questions. Conduct a portion of the interview privately; it allows your patient to feel more comfortable disclosing sensitive information. Include questions about sexual preference, number of partners, frequency and types of intercourse, correct and consistent use of condoms and/or other contraception, and history of STIs in the patient or partner. In addition, it is important to discuss the reasons the patient is engaging in sexual intercourse, such as curiosity, physical attraction, pleasure, to maintain a relationship, or partner/peer pressure. Ask these questions using language that the patient will understand. One study showed that 9% to 30% of patients may not ask for clarification if they do not understand what their physician discussed about sexual behaviors.[18]

Assess honesty. When asked if there were occasions when they would be tempted not to tell the truth, teens replied that they would be less likely to answer truthfully when asked about number of partners, number of STIs, and frequency of condom use.[19] In that study, the interviewed teens denied that they themselves had been untruthful in responding to these questions.[19] In another study, younger adolescents admitted they were not completely honest when reporting their sexual behaviors, with males overstating and females understating their true sexual behaviors.[20]

Discuss STIs. The clinical encounter is an opportunity for you and your patient to discuss STIs, including screening, management, and prevention. A study of high school students reported that 82% wanted to hear information about STIs, 73% about condoms, 70% about sex, 80% about safe sex, and 85% about HIV. Adoles-

TABLE 1 Treatment of sexually transmitted infections, by common organisms

Infection	Recommended regimens	Alternative regimens
Chlamydia trachomatis	Azithromycin 1g PO single dose **or** Doxycycline 100 mg PO 2x/d for 7 days	Erythromycin base 500 mg PO 4x/d for 7 days **or** Erythromycin ethylsuccinate 800 mg PO 4x/d for 7 days **or** Ofloxacin 300 mg PO 2x/d for 7 days
Neisserria gonnorrhoeae Uncomplicated cervical, urethral, or rectal	Cefixime 400 mg PO single dose **or** Ceftriaxone 125 mg IM single dose **or** Ofloxacin 400 mg single dose **+** Azithromycin 1 g PO single dose **or** Doxycycline 100 mg PO 2x/d for 7 days	Erythromycin base 500 mg PO 4x/d for 7 days **or** Erythromycin ethylsuccinate 800 mg PO **or** May be substituted for azithromycin or doxycycline
Pharyngeal	Ceftriaxone 125 mg IM single dose **or** Ciprofloxacin 500 mg PO single dose **or** Ofloxacin 400 mg PO single dose **+** Azithromycin 1g PO single dose **or** Doxycycline 100 mg PO 2x/day for 7 days	None
Trichomoniasis	Metronidazole 2 g PO single dose **or** Metronidazole 500 mg PO 2x/day for 7 days	None

Adapted from the Centers for Disease Control and Prevention. 1998 Guidelines for Treatment of Sexually Transmitted Diseases. *MMWR* 47:1998.

cents and their parents suggested that one of the roles of physicians was to discuss sensitive topics, including sexuality.[21] Another study reported the majority of adolescents believed that it was important for their physician to discuss issues related to sexuality (eg, sexual intercourse, STIs), and that they would ask their parents and physicians about issues related to sexuality.[18]

Confidentiality issues

When caring for adolescents you must be aware of the many, sometimes confusing, legal issues surrounding treatment of this patient population. These issues typically deal with confidentiality and consent, and often arise around reproductive health care and substance use. Statutes vary from nation to nation, from state to state, and often from institution to institution. Confidentiality supports trust between you and your adolescent patient and expedites the sharing of a full and accurate history. Possibly, the most important reason is to encourage adolescents to seek necessary care, but addtional reasons are to support autonomy and growing requirements for privacy.

At the initial visit, share your policies regarding confidentiality and consent with the adolescent and, if present, the accompanying adult. Discuss the types of information that you will not share with anyone without patient consent, and, as appropriate, statutes regarding reasons for breech of confidentiality (such as personal

TABLE 2 Treatment of sexually transmitted infections, by syndrome

Syndrome	Recommended regimens	Alternative regimens
Urethritis	Cefixime 400 mg PO single dose **or** Ceftriaxone 125 mg IM single dose **or** Ofloxacin 400 mg PO single dose **+** Azithromycin 1 g PO single dose **or** Doxycycline 100 mg PO 2x/d for 7 days	None
Recurrent/persistent Urethritis	Metronidazole 2 g PO single dose **+** Erythromycin base 500 mg PO 4x/d for 7 days **or** Erythromycin ethylsuccinate 800 mg PO 4x/d for 7 days	None
Epididymitis	Ceftriaxone 250 mg IM single dose **+** Doxycycline 100 mg PO 2x/d for 10 days **or** Ofloxacin 300 mg PO 2x/d for 10 days	None
Bacterial vaginosis	Metronidazole 500 mg PO 2x/d for 7 days **or** Clindamycin cream 2%, one full applicator (5 g) intravaginal at bedtime for 7 days **or** Metronidazole gel 0.75%, one full applicator (5 g) intravaginal 2x/d for 5 days	Metronidazole 2 g PO single dose **or** Clindamycin 300 mg PO 2x/day
Prophylaxis after sexual assault	Ceftriaxone 125 mg single dose **+** Metronidazole 2 g PO single dose **+** Azithromycin 1 g PO single dose **or** Doxycycline 100 mg 2x/d for 7 days	None

Adapted from the Centers for Disease Control and Prevention. 1998 Guidelines for Treatment of Sexually Transmitted Diseases. *MMWR* 47: 1998.

safety). This should minimize confusion in the future regarding these issues, and provide an opportunity to address any concerns from the start your relationship. You may wish to discuss these issues when alone with your patient, to further clarify confidentiality.

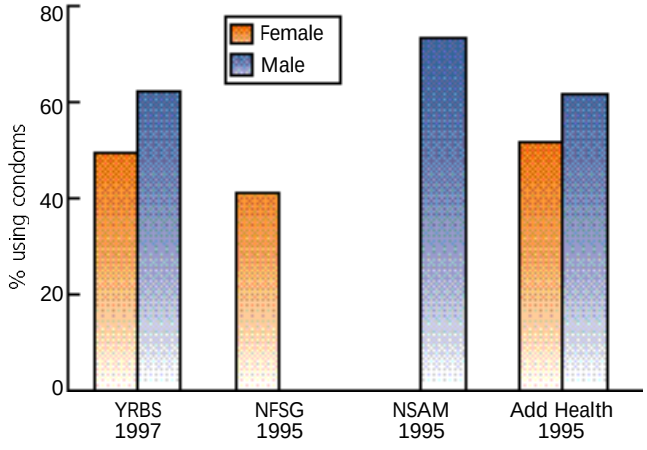
Treatment considerations

In 1999, the Centers for Disease Control and Prevention (CDC) reported that the prevalence of chlamydia among 15- to 19-year-old women was 2,483 cases per 100,000 persons.[22] These findings do not account for the fact that almost half (49%) of women between 14 and 18 years of age are not sexually active. In contrast, the rate of chlamydia among 15- to 19-year-old men is 344 cases per 100,000 persons,[22] the second highest rate for all male age groups. Again, this does not incorporate the finding that 52% of all 14- to 18-year-old men are not sexually active.[12]

Single-dose therapy. Compliance can be a serious problem among adolescents. Therefore, it is highly recommended that you use single-dose therapy whenever possible in the adolescent patient, to minimize compliance issues. Also, be sure your patients understand the need to abstain from sexual intercourse for at least 7 days following the completion of their therapy. Remember, patients with gonococcal infections should be treated for chlamydia as well, because of a coinfection in one third of cases of gonorrhea.

FIGURE 2 **Condom use among teens**

Condom use at last intercourse among female and male adolescents 15 to 17 years old in the four national surveys.



Data from Youth Risk Behavior Survey (YRBS)[26]; National Survey of Family Growth (NSFG)[28]; National Survey of Adolescent Males (NSAM)[30]; and the National Longitudinal Study of Adolescent Health (Add Health).[29]

In addition, such dual treatment of adolescents infected with gonorrhea may prevent the development of resistant strains of the infection.[4] The Gonococcal Isolate Surveillance Project of the CDC found that 30% of the isolates collected were resistant to penicillin, tetracycline, or both.[23] Treatment guidelines for common organisms are listed in Table 1. The approaches to clinical syndromes are listed in Table 2.

Although practitioners have used quinolones for single-agent treatment of gonorrhea, several studies have documented increasing antimicrobial resistance. For example, in Japan gonorrhea isolates with ciprofloxacin increased from 6.6% in 1993 to 24.4% in 1998.[24]

The partner. Be sure to inquire about treatment of the patient's partner. Adolescents at times may be in denial, angry, or shocked that they have a STI, and may not realize the necessity of informing their partner of their diagnosis. Be sure to emphasize that their partner needs treatment as well. A recent study demonstrated the need for more effective partner treatment strategies in adolescents infected with STIs.[25] Encourage your patients to either have their partners come to you for treatment, or refer them to a health department for treatment. It may be helpful to give the adolescent a referral card for his or her partner that includes the diagnosis. Our previous patient cases illustrate our approach to the diagnosis and treatment.

> Patients with gonococcal infections should be treated for chlamydia as well.

CASE 1 Judy has acquired a new partner in the past month, is not using barrier contraception, and has a mucopurulent cervicitis. Given this history, the diagnosis is most likely chlamydia, rather than gonorrhea. Chlamydia is more common than gonorrhea, with symptoms presenting within 2 weeks to a month after exposure. In areas where gonorrhea is endemic, you should also test for gonorrhea at the first visit. Other considerations include her pregnancy test (negative) and whether she has a coexisting urinary tract infection; some evidence suggests that there is an increased risk for urinary tract infection if a woman has an STI. Although Judy would be allowed to receive confidential treatment by most statutes, her mother will likely request additional information about her daughter's medical problems. If you have not discussed confidential care with the mother before examining Judy and establishing a likely diagnosis, you may be placed in an uncomfortable situation, particularly if Judy told you she did not want her mother to know. Medical management should consist of a single 1-g dose of azithromycin (alternative would be doxycycline for 7 days), and recommending that her partner receive treatment. If the gonorrhea culture is positive, she should probably receive additional treatment, such as cefixime 400 mg.

CASE 2 Mike is also likely to have chlamydia, with or without gonorrhea. The majority of chlamydial and gonococcal infections are asymptomatic in both genders. Urine leukocyte esterase has a sensitivity of 75% to 80%,[26] so that a positive leukocyte esterase result may not represent an infection with either chlamydia or gonorrhea. In addition, some physicians feel that establishing a syndromic diagnosis ("You have a positive leukocyte esterase test, which usually implies a sexually transmitted infection, causing an inflammation of the urethra"), rather than an etiologic infection ("You have chlamydia") may be less likely to lead to behavioral change. Treatment should follow the regimens listed under urethritis in Table 2, and recommendation that his partner(s) receive evaluation and treatment.

Prevention

Discussion about STI prevention can occur at home, at school, and in the physician's office. Education and awareness are necessary, but not sufficient, to lead to behavioral changes that will lessen the risk of STIs. Adolescents must recognize the prevalence and symptoms of STIs, as well as the potential for these infections to be asymptomatic.

Primary prevention. Primary prevention focuses on decreasing the number of new cases of STIs by avoiding exposure and preventing the infection. This consists of providing accurate information about STIs, postponing sexual involvement, encouraging consistent condom use, and development and implementation of appropriate vaccination programs for STIs. A recent article reported that condom use at last intercourse among sexually active teens increased over the past decade,[27] consistent with data from earlier national surveys (Figure 2).[28-30]

Secondary prevention. Secondary prevention aims to decrease the number of existing cases through early detection and treatment, also decreasing the prevalence. Teens should know the symptoms and also the possibility of absence of symptoms for STIs. Because much transmission of STIs occurs through asymptomatic pools,[31] the most effective approach may entail more aggressive screening of high-risk asymptomatic carriers such as adolescents. Screening is recommended every 6 to 12 months, depending on the patient's history of previous infections and multiple partners.

Tertiary prevention involves minimizing sequelae of the infections.

Conclusion

The study of adolescent sexual behavior is fueled by major public health and social problems. Preventive methods have become national objectives. One of the most important contributions we can make as physicians is to communicate with adolescents about sexual behavior and risk prevention. Although such discourse has long been advocated by professional organizations, most adolescents report not having received these services.[32] Focusing on prevention will help control the spread of these infections.

References

1. Cates W. Estimates of incidence and prevalence of sexually transmitted diseases in the United States. American Social Health Association Panel. *Sex Trans Dis* 26: S2-7, 1999.

2. Donovan P. Confronting a hidden epidemic: the Institute of Medicine's report on sexually transmitted diseases. *Fam Plann Perspect* 29: 87–89, 1997.

3. Centers for Disease Control and Prevention. Premarital sexual experience among adolescent women—United States, 1970-1988. *MMWR* 39: 929–932, 1991.

4. Gevelber MA, Biro FM. Adolescents and sexually transmitted diseases. *Pediatr Clin North Am* 46: 747–766, 1999.

5. Fisher W, Byrne D, White L, et al. Erotophobia-erotophilia as a dimension of personality. *J Sex Res* 25: 123–151, 1998.

6. Ammerman SD, Perelli E, Adler N, Irwin CA. Do adolescents understand what physicians say about sexuality and health? *Clin Pediatr* 31: 590–595, 1992.

7. Rosenthal SL, Lewis LM, Succop PA, et al. Adolescent girls' perceived prevalence of sexually transmitted diseases and condom use. *J Dev Behav Pediatr* 18: 158–161, 1997.

8. Centers for Disease Control and Prevention. Fact Sheet: Youth Risk Behavior Survey Trends: Centers for Disease Control and Prevention; 1991, 1993, 1997, 1999.

9. American Social Health Association: Teenagers know more than adults, but knowledge among both groups is low. *STD News* 3: 1, 5, 1996.

10. Harrison H, Costin M, Meder J, et al. Cervical Chlamydia trachomatis infection in university women: Relationship to history, contraception, ectopy, and cervicitis. *Am J Obstet Gynecol* 153: 244–251, 1985.

11. McGrath JW, Strasburger VC, Cushing AH. Secretory IgA in cervical mucus. *J Adolesc Health* 15: 423–425, 1994.

12. Centers for Disease Control and Prevention. Youth Risk Behavior Surveillance—United States, 1999. *MMWR* 49: 1–96, 2000.

13. Rosenthal SL, Biro FM, Succop PA, et al. Age of first intercourse and risk of sexually transmitted disease. *Adolesc Pediatr Gynecol* 7: 210–213, 1994.

14. Abma J, Driscott A, Moore K. Young women's degree of control over first intercourse: an exploratory analysis. *Fam Plann Perspect* 30: 12–18, 1998.

15. Goldenring JM, Cohen E. Getting into adolescent heads. *Contemporary Pediatr* July: 75–90, 1988.

16. Merrill JM, Laux LF, Thornby JI. Why doctors have difficulty with sex histories. *South Med J* 83: 613–617, 1990.

17. Rosenthal SL, Biro FM. Communication with adolescents and their families. *Adolesc Pediatr Gynecol* 4: 57–61, 1991.

18. Rosenthal SL, Lewis LM, Succop PA, et al. Adolescents' views regarding sexual history taking. *Clin Pediatr* 38: 227–233, 1999.

19. Rosenthal SL, Burklow KA, Biro FM, et al. The reliability of high-risk adolescent girls' report of their sexual history. *J Pediatr Health Care* 10: 217–220, 1996.

20. Siegel DM, Aten MJ, Roghmann KJ. Self-reported honesty among middle and high school students responding to a sexual behavior questionnaire. *J Adolesc Health* 23: 20–28, 1998.

21. Rawitscher L, Saitz R, Friedman L. Adolescents' preferences regarding human immunodeficiency virus (HIV)-related physician counseling and HIV testing. *Pediatrics* 96: 52–58, 1995.

22. Centers for Disease Control and Prevention, Division of STD Prevention. *Sexually Transmitted Disease Surveillance*, 1999. September 2000.

23. Fox KK, Knapp JS, Holmes KK, et al. Antimicrobial resistance in Neisseria gonorrhoeae in the United States, 1988–1994. *J Infect Dis* 175: 1396–1403, 1997.

24. Tanaka M, Nakayama H, Haraoka M, et al. Antimicrobial resistance of Neisseria gonorrhoeae and high prevalence of ciprofloxacin-resistant isolates in Japan, 1993 to 1998. *J Clin Microbiol* 38: 521–525, 2000.

25. Oh MK, Boker JR, Genuardi FJ, et al. Sexual contact tracing outcome in adolescent chlamydial and gonococcal cervicitis cases. *J Adolesc Health* 18: 4–9, 1996.

26. Bowden FJ. Reappraising the value of urine leukocyte esterase testing in the age of nucleic acid amplification. *Sex Transm Dis* 25: 322–326, 1998.

27. Santelli JS, Lindberg LD, Abma J, et al. Adolescent sexual behavior: estimates and trends from four nationally representative surveys. *Fam Plann Perspect* 32: 156–165, 194, 2000.

28. Centers for Disease Control and Prevention. Trends in sexual risk behaviors among high school students–US,1991–1997. *MMWR Morb Mortal Wkly Rep* 47: 749–752, 1998.

29. Abma J, Chandra A, Mosher WD, et al. Fertility, family planning and women's health: new data from the 1995 National Survey of Family Growth. *Vital Health Stat* 23: 1–114, 1997

30. Sonenstein FL, Ku L, Lindberg LD, et al. Changes in sexual behavior and condom use among teenage men: 1988 to 1995. *Am J Public Health* 88: 956–959, 1998.

31. Zimmerman-Rogers H, Potterat JJ, Muth SQ, et al. Establishing efficient partner notification periods for patients with chlamydia. *Sex Transm Dis* 26: 49–54, 1999.

32. Shuster MA, Nell RM, Petersen LP, Kanouse DE. Communication between adolescents and physicians about sexual behavior and risk prevention. *Arch Pediatr Adolesc Med* 150: 906–913, 1996.