# Prevention of sexually transmitted infections

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## INTRODUCTION

Sexually transmitted infections (STIs) are common and preventable causes of morbidity and serious complications. Untreated chlamydial and gonococcal infection may result in pelvic inflammatory disease, which can lead to infertility, ectopic pregnancy, and chronic pelvic pain in 10 to 20 percent of cases [1]. STIs can also result in adverse outcomes in pregnancy, including spontaneous abortion, still birth, premature birth, and congenital infection [2]. Finally, the presence of STIs can facilitate HIV transmission [3-5]. Thus, primary prevention of STIs needs to be given high priority.

The comprehensive approach to STI prevention is based on five major strategies [6]:

- Accurate sexual health assessment (including sexual orientation and gender identification), with education and counseling on ways to avoid STIs
- Pre-exposure vaccination for vaccine-preventable STIs
- Identification of both asymptomatic and symptomatic individuals with STIs
- Effective diagnosis, treatment, counseling, and follow-up of infected individuals
- Evaluation, treatment, and counseling of sex partners of infected individuals

This topic addresses sexual health assessment, counseling, vaccination, and antimicrobial-

based preventive strategies.

Screening for STIs is discussed elsewhere. (See "Screening for sexually transmitted infections".)

Diagnosis, treatment, and follow-up of individual STIs are discussed in the specific topic reviews. Prevention of HIV infection is also discussed in more detail elsewhere. (See "HIV infection: Risk factors and prevention strategies".)

Prevention of sexual transmission of Zika virus is discussed in detail elsewhere. (See "Zika virus infection: An overview", section on 'Sexual transmission'.)

## SEXUAL HEALTH ASSESSMENT

**Approach** — An assessment of sexual health and behavior is critical to appropriately targeting individuals for STI screening ( table 1) and prevention counseling. At a minimum, a sexual health assessment should include questions regarding the patient's sexual orientation and gender identification as a lead-in to more specific questions that will assess the need for further STI evaluation, testing, and treatment. The "Five P's" approach is a framework to further assess an individual's sexual health by systematically and non-judgmentally asking about partners, prevention of pregnancy, protection against STI, sexual practices, and past history of STI ( table 2). In addition, a comprehensive sexual history should also include other aspects of sexual health, including positive (enjoyment) and negative (pain, coercion) features. Assessment of any history of substance use, which may be associated with increased risk for STI, is also important.

Rather than focusing on the risks for STIs, we favor framing the approach to STI prevention as a more positive sexual health approach that acknowledges the acquisition of STIs in the context of otherwise normal sexual behaviors [7]. A risk-based approach has limitations. It tends to perpetuate the stigma surrounding STIs, which can deter individuals disproportionally affected by STIs from seeking care and prevention services [8]. A risk-based approach is also not particularly helpful for persons who perceive themselves to be in monogamous relationships or otherwise at low risk. Furthermore, certain sexual behaviors may not be associated with an increased risk for all STIs (eg, with the use of pre-exposure prophylaxis, the risk of HIV with condomless sex is substantially decreased but the risk of other STIs is unaffected) [9]. Shifting to a sexual health paradigm

can promote a change in the discourse on STI prevention that should inform sexual education in families, schools, faith-based institutions, and other societal platforms. Additionally, "normalization" of sexual behavior may facilitate STI prevention in the health care setting.

**Factors associated with STI acquisition** — A comprehensive sexual assessment should be able to identify behavioral factors that increase the risk of STI acquisition. These include:

- New sex partner in past 60 days
- Condomless vaginal, anal, or oral sex with multiple sex partners or with a sex partner with multiple concurrent sex partners
- Sex with partners recently treated for an STI
- Trading sex for money or drugs
- Sexual contact (oral, anal, penile, or vaginal) with sex workers

**Disproportionately affected populations** — Some individuals warrant specific considerations for STI screening and counseling because they belong to particular groups associated with a high prevalence of STIs. (See "Screening for sexually transmitted infections".)

**Adolescents** — Health care providers should routinely ask adolescents about sexual activity and should offer screening for STIs and counseling on prevention to sexually active adolescents [6]. (See "Screening for sexually transmitted infections", section on 'Screening recommendations' and "Sexually transmitted infections: Issues specific to adolescents", section on 'Evaluation for STIs'.)

In the United States, approximately one-half of the estimated 19 million incident STIs each year occur in young people aged 15 to 24 years [10]. The United States Centers for Disease Control and Prevention (CDC) created the Youth Risk Behavioral Surveillance System, a school-based periodic survey to monitor health behaviors associated with morbidity, including STIs, among adolescents. In 2017, 39.5 percent of high school students had any history of sexual intercourse (down from 41 percent in 2015 and 54 percent in 1991), and 9.7 percent reported four or more lifetime sexual partners (down

from 12 percent in 2015 and 19 percent in 1991) [11]. These favorable trends are partly offset by the decreased proportion of sexually active students reporting condom use at last sexual intercourse, from 63 to 57 percent between 2003 and 2015, to 54 percent in 2017, after having increased from 46 percent in 1991 [10-12].

**Men who have sex with men** — A careful sexual health assessment, as outlined above, should be conducted for all male patients regardless of sexual orientation, and prevention counseling should be offered accordingly [13,14]. Clinicians should also routinely ask patients about symptoms consistent with common STIs, including urethral discharge, dysuria, ulcers, or anorectal symptoms. Men who have sex with men (MSM) warrant particular consideration in the approach to STI prevention. (See "Screening for sexually transmitted infections", section on 'Assessing risk'.)

Despite significant advances in the prevention of HIV transmission, particularly through the use of antiretroviral medications, MSM are still disproportionally affected by the HIV epidemic.

In addition, increased rates of syphilis, gonorrhea, and chlamydial infections have been reported in many cities in the United States and Europe and disproportionately affect MSM with HIV. The resurgence of STIs, particularly gonorrhea and syphilis, among MSM has been documented since the late 1990s and has been linked to the availability of effective antiretroviral therapy (ART), which has reduced the fear of AIDS [9]. MSM also have a higher than typical risk of sexual exposure to viral hepatitis. (See "Syphilis in patients with HIV" and "Syphilis: Epidemiology, pathophysiology, and clinical manifestations in patients without HIV", section on 'Epidemiology' and "Epidemiology and pathogenesis of Neisseria gonorrhoeae infection", section on 'Epidemiology' and "Epidemiology of Chlamydia trachomatis infections".)

More recently, MSM receiving pre-exposure prophylaxis (PrEP) to prevent HIV acquisition have been shown to have a higher prevalence of other STIs. As an example, in a study of over 650 individuals initiating PrEP in San Francisco, California, no new HIV infections were identified, but over 40 percent reduced the use of condoms, and 50 percent had an incident STI within 12 months [15]. The success of ART-based HIV prevention has effectively uncoupled epidemiologic synergy between HIV and other STIs and has led to a "new normal," in which HIV prevention and STI prevention have become unlinked [9]. Thus, routine screening for bacterial STIs is an emerging standard of care for patients

living with HIV and persons using PrEP. (See "Administration of pre-exposure prophylaxis against HIV infection", section on 'Routine monitoring and counseling'.)

In addition, outbreaks of invasive meningococcal disease have been detected among MSM in several cities in the United States and Europe. Although not an STI per se, *Neisseria meningitidis* can be transmitted through close contact, including kissing and sexual contact. (See "Epidemiology of Neisseria meningitidis infection", section on 'Men who have sex with men'.)

**Transgender and non-binary individuals** — Transgender individuals identify with a gender that is opposite from their sex at birth. Non-binary persons do not identify with either sex or identify somewhere on a spectrum between the sexes. Gender identity is distinct from sexual orientation, and factors associated with STI acquisition vary widely in this population. Overall, transgender/non-binary individuals have a higher prevalence of sexually transmitted and nonsexually transmitted HIV infection and STIs than the general population [16]. STI screening and counseling in this population should be tailored to the individual's anatomy and sexual behavior. (See "Screening for sexually transmitted infections", section on 'Transgender individuals'.)

**People with HIV** — High rates of STIs have been identified through screening programs among people with HIV worldwide. Routine STI screening and counseling of people with HIV are recommended in order to reduce the spread of STIs, particularly because some STIs, in turn, can increase HIV transmission. (See "Screening for sexually transmitted infections", section on 'Patients with HIV'.)

**Pregnant women** — Because of the potential for high morbidity among pregnant women with STIs and poor fetal outcomes following maternal infection, all pregnant women should be screened for STIs at the first prenatal visit [6]. In the United States, the resurgence of congenital syphilis underscores the importance of this recommendation [17]. Women disproportionally exposed to STIs, including those with new and/or potentially untreated partners and those living in communities with high STI prevalence, should be screened more often during pregnancy. Details on screening pregnant women are discussed elsewhere. (See "Prenatal care: Second and third trimesters", section on 'Screen for sexually transmitted infections' and "Prenatal care: Initial assessment", section on 'Infection'.)

Prevention of sexual transmission of Zika virus among pregnant women is discussed in

detail elsewhere. (See "Zika virus infection: Evaluation and management of pregnant women", section on 'Prevention'.)

## SCREENING

The identification and treatment of persons with STIs and their partners are a key strategy in the prevention of STIs ( table 1). STI screening is discussed in detail elsewhere. (See "Screening for sexually transmitted infections".)

## PREVENTION COUNSELING

Interventions focused on behavioral modification are a major element of the public health approach to STI risk reduction and control. The United States Preventive Services Task Force recommends behavioral counseling interventions to prevent STIs for all sexually active adolescents and for adults who are disproportionately affected by STIs because they can reduce STI rates and reduce behavior associated with STI exposure [18]. The United States Centers for Disease Control and Prevention (CDC) also emphasizes the importance of prevention counseling for all sexually active adolescents and for all adults who have received an STI diagnosis, have had an STI in the past year, or have multiple partners [6].

Behavioral interventions should be offered to provide information on STI transmission, educate about behaviors that can increase exposure to STIs, and aim to increase motivation to adjust behavior to reduce STI exposure. Specific sexual practices that are important to highlight include condomless anal sex and sex with multiple partners, potentially amplified by concomitant use of alcohol or drugs [19]. Proper condom use should be reviewed, and women should be counseled that contraceptive methods that are not mechanical barriers offer no protection against HIV or other STIs. (See 'Male condom use' below.)

Behavioral interventions can be administered in any outpatient setting and include in-person counseling, telephone support, and other media-delivered messages (videos, websites, text messaging, written material). Although interventions characterized by multiple sessions over a short period in a peer-group setting appear to be associated with the greatest reductions in STIs, they are resource intensive; briefer, single-session

interventions can also be effective and may be more practical. Given the lack of continuity of care in the STI clinical environment, CDC recommendations emphasize the possible utility of brief, single-session counseling sessions [20]. In such settings, other low-intensity interventions, such as waiting room videos, can also be useful counseling strategies. Resources and training documents on behavioral intervention strategies can be found at the CDC Effective Interventions webpage.

Even patient-centered counseling that involves a discussion tailored to the individual situation can be performed during a single, brief clinic session [6]. One useful framework for patient-centered counseling is the "Ask, Screen, Intervene" curriculum, developed by the National Network of STD/HIV Prevention Training Center in partnership with the AIDS Education and Training Centers [21]. Within this framework, following an assessment of the patient's sexual health and indications for screening (see 'Sexual health assessment' above and "Screening for sexually transmitted infections"), elements of brief behavioral counseling for risk reduction include:

- Discussing how various sexual behaviors can expose a person to STIs
- Assessing the patient's understanding and beliefs about STI transmission
- Assessing the circumstances that affect the patient's sexual behavior
- Assessing the patient's readiness to change
- Negotiating a behavioral goal
- Identifying a concrete and realistic first step toward the goal

Additional details and example questions are found in the table ( table 3). Providers can also use motivational interviewing techniques to move clients toward achievable behavioral goals. (See "Overview of psychotherapies", section on 'Motivational interviewing' and "Motivational interviewing for substance use disorders".)

A 2020 systematic review identified 37 randomized and 2 nonrandomized trials evaluating the efficacy of a variety of behavioral interventions [22]. The review noted with moderate certainty evidence that these interventions reduce the risk of STI in sexually active adolescents and adults disproportionately affected by STIs. In a meta-analysis of 19 of those trials, behavioral interventions were associated with a reduction in STI incidence over the follow-up time, most commonly 6 to 12 months (pooled odds ratio 0.66, 95% CI 0.54-0.81), although there was substantial statistical and clinical heterogeneity. Larger effect sizes were observed in studies that evaluated adolescents, high-intensity

interventions (ie, >2 hours), or group counseling. Other outcomes highlighted in the systematic review included higher odds of condom use, lower rates of condomless sexual encounters, and fewer sexual partners with behavioral interventions.

Although most studies have evaluated high-intensity behavioral interventions, certain low-intensity behavioral interventions can also be effective, especially if large groups of persons can be exposed to a simple intervention. As an example, a controlled study following over 40,000 patients in three United States STI clinics demonstrated an almost 10 percent reduction in incident STIs among those exposed to a waiting room condom promotion video ("Safe in the City") [23].

## VACCINES

Vaccinations are available for the prevention of several infections that are sexually transmitted or associated with sexual activity; these include hepatitis A, hepatitis B, human papillomavirus (HPV), and *N. meningitidis*.

Individuals with advanced immunodeficiency may have an impaired response to vaccination, and multiple doses may be required to achieve an adequate antibody response. (See "Immunizations in patients with HIV".)

**Hepatitis A** — Vaccination against hepatitis A virus is recommended for men who have sex with men (MSM), people who use injection and noninjection drugs, people with HIV, people with chronic liver disease, people with close contact to others who have hepatitis A, and anyone traveling to countries where hepatitis A is endemic [6]. In 2006, hepatitis A vaccination was incorporated into the routine childhood vaccination schedule in the United States. Two doses administered at least six months apart are recommended. Post-vaccination serologic testing is not recommended in immunocompetent individuals because most persons respond to the vaccine. (See "Hepatitis A virus infection: Treatment and prevention" and "Immunizations in patients with HIV", section on 'Hepatitis A vaccine'.)

Hepatitis A virus replicates in the liver and is shed in high concentrations in feces from two weeks before to one week after the onset of clinical illness. Since sexual transmission of hepatitis A probably occurs because of fecal-oral contact, common barrier measures, such as condoms, are ineffective in preventing acquisition of this disease. The effectiveness of

dental dams during oral sex to prevent hepatitis A transmission is not known. (See "Hepatitis A virus infection: Treatment and prevention".)

**Hepatitis B** — The primary risk factors associated with hepatitis B virus (HBV) infection among adolescents and adults are condomless sex with an infected partner, condomless sex with more than one partner, and history of other STIs. MSM and persons who inject drugs are considered particularly vulnerable to HBV acquisition [6].

In the United States, the Centers for Disease Control and Prevention's (CDC's) Advisory Committee on Immunization Practices (ACIP) recommends hepatitis B immunization for all unvaccinated adults presenting to an STI clinic, including those who did not complete their immunization series [24]. Patients with a history of HBV vaccination should have either documentation of immunization or serologic testing for hepatitis B surface antibody. An effective vaccine for HBV infection has been available for over 30 years; in the United States, it has been part of the routine childhood immunization schedule since 1994. In 2017, 73.6 percent of infants received HBV vaccination within three days of birth [25]. As the cohort that received standard childhood immunization ages, overall coverage among adults will increase.

Appropriate screening tests and the vaccine administration schedule are discussed elsewhere. (See "Hepatitis B virus immunization in adults".)

**Human papillomavirus** — Several human papillomavirus (HPV) vaccines are available for the prevention of HPV infection. In the United States, immunization with HPV vaccine is recommended by the ACIP in individuals 9 to 26 years of age [26]. Nevertheless, immunization coverage has been disappointing, with only 51 percent of adolescents aged 13 to 17 years fully immunized in 2018 [27]. Thus, assessment of immunization status and provision of HPV vaccine in all practice settings should remain a priority.

Details on vaccine types, administration, efficacy, and side effects are discussed elsewhere. (See "Human papillomavirus vaccination".)

**Neisseria species** — Although not an STI per se, *N. meningitidis* can be transmitted through close contact, including kissing and sexual contact. Outbreaks and clusters of meningococcal meningitis have been reported among MSM in the United States (eg, New York City) and Europe [28,29]. Meningococcal vaccination is indicated for MSM who may have close contact with other MSM from the sites of those outbreaks and is recommended

for all people with HIV.

An effective vaccine for *N. gonorrhoeae* has been elusive, in part because knowledge about specific immune mechanisms that protect against gonococcal infection is lacking. Additionally, infection does not confer immunity to future reinfection, which is likely related to the antigenic variability on the surface of *N. gonorrhoeae*. Some of these same challenges exist for *N. meningitidis* type B vaccines, but not for vaccines against the A, C, Y, and W135 serotypes. An observational study reported a small but significant decrease in gonorrhea among recipients of an outer membrane vesicle (OMV) meningitis B vaccine, offering possible clues to future approaches to gonococcal vaccine development [30]. The efficacy of this OMV meningitis type B vaccine for the prevention of gonorrhea is under study, but its use is not recommended for this purpose.

## MALE CONDOM USE

Condom use is one of the most effective means of preventing STIs [31]. Both the United States Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) assert the protective value of condoms in preventing STIs, and the WHO has incorporated condoms as an essential component in public health strategies to prevent STIs [6,32]. The amount of protection provided by condom use for the prevention of HIV and other STIs is difficult to establish given the ethical limitations of conducting randomized controlled trials. (See 'Efficacy' below.)

**Instructions on use** — Patients should be advised that condoms must be used consistently and correctly to be effective in preventing STIs [6].

Latex condoms are the type most commonly used in studies of STI prevention (see 'Efficacy' below). Polyurethane male condoms likely provide similar protection. Condoms made of other synthetic material and "natural membrane" condoms (sometimes referred to as "lambskin") should not be used for STI prevention, as they are too porous to prevent transmission of common pathogens, especially viruses.

Latex condoms should not be used five years after the manufacturing date or past the expiration date. A new condom should be used for each sex act, and it should be handled carefully to avoid tears or damage. The condom should be placed on after the penis is erect and prior to genital, oral, or anal contact with the partner.

Adequate lubrication with vaginal and anal sex should be ensured, but if exogenous lubrication is needed, only water-based lubricants should be used with latex condoms since oil-based lubricants (petroleum jelly, mineral oil) can weaken latex. Either water- or oil-based lubricants can be used with polyurethane condoms.

To prevent slippage, the penis should be withdrawn while erect and the condom should be held firmly against the base of the penis during withdrawal.

Condoms are regulated as medical devices. In the United States, each latex condom manufactured is tested electronically for holes before packaging. Failure of condoms usually results from inconsistent or incorrect use rather than condom breakage [6].

**Efficacy** — Overall, evidence supports the efficacy of condoms in preventing most STIs. Studies on the efficacy of condom use are subject to a number of limitations [33]. Assessment of condom use is generally by self-report, which may be unreliable. Incorrect use of condoms that would reduce their efficacy is rarely evaluated, and frequency of condom use is usually recorded as a static measure, when it may change over time. Each of these factors would underestimate the efficacy of appropriate condom use.

Nevertheless, in 2000, an expert panel convened by the National Institutes of Health performed a critical review of available scientific literature on the efficacy of condoms and concluded that condom use prevented HIV transmission in both men and women during vaginal intercourse and prevented gonorrhea in men [34]. It noted that there were insufficient data to draw conclusions on the ability of condoms to prevent other STIs [34]. However, since this publication, multiple other prospective studies have been reported that have contributed substantially to understanding the protective role of condoms in other STIs, including chlamydia, gonorrhea, herpes simplex type 2, trichomoniasis, and human papillomavirus [35].

The following discusses condom efficacy by specific STI:

- **HIV** – HIV can be transmitted through anal, penile-vaginal, and oral intercourse, but the far greatest risk is with anal intercourse. Consistent and proper use of condoms is estimated to prevent HIV transmission by approximately 80 to 95 percent [36-38]. (See "HIV infection: Risk factors and prevention strategies", section on 'Condom use'.)

- **Gonorrhea, chlamydia, and *Trichomonas*** – These organisms cause the majority of nonviral STIs worldwide. Precise transmission rates of these organisms are unknown

but thought to be high [34]. Data on gonorrhea suggest an average transmission of one infection for every two exposures. Gonorrhea and chlamydia are more efficiently transmitted from males to females; male to female transmission of *N. gonorrhoeae* is approximately fourfold more efficient than female to male. A systematic review of studies published from 1966 to 2004 evaluated the effectiveness of condom use in preventing gonorrhea and chlamydia; most studies reviewed demonstrated a reduced risk of infection [39]. As an example, in a prospective study of adolescent African-American females, self-reported 100 percent condom use was associated with a lower incidence of gonorrhea, chlamydia, or trichomoniasis (18 versus 30 percent among those who did not use condoms consistently) [40]. Similarly, studies among female sex workers have shown associations between condom use promotion and decreased risk of gonorrhea, chlamydia, and *Trichomonas* infections [35,41,42].

Additionally, among women with a history of pelvic inflammatory disease (PID), consistent use of condoms has been associated with lower rates of recurrent PID, chronic pelvic pain, and infertility [43].

- **Genital herpes** – Transmission of herpes simplex viruses (HSV) type 1 and type 2 can occur during symptomatic and asymptomatic periods due to intermittent viral shedding. Consistent condom use has been demonstrated to decrease the risk of HSV-2 transmission to an uninfected partner by up to 96 percent, although this appears more effective in preventing transmission from men to women than vice versa [44-46]. (See "Prevention of genital herpes virus infections", section on 'Condom use'.)

- **Human papillomavirus** – Condom use has been associated with a reduction in the risk of acquiring human papillomavirus (HPV) infection, clearance of infection, and higher rates of regression of cervical intraepithelial neoplasia in women and penile lesions in men [47-53]. As an example, in a study of 82 females who reported no prior sexual encounters, consistent condom use was associated with a 70 percent lower risk of incident HPV infection compared with condom use <5 percent of the time [47]. Condom use was also effective in preventing cervical intraepithelial lesions. In a separate study of over 3000 men who have sex with women and had no baseline HPV infection, self-reported consistent condom use was associated with a decreased 12-month incidence of anogenital HPV infection among those with no steady sexual partner (hazard ratio 0.54, 95% CI 0.3-0.95, compared with no condom use) [52]. There

was no detected association between condom use and HPV infection among men who had a steady sexual partner, regardless of whether they were monogamous or nonmonogamous.

- **Syphilis** – *Treponema pallidum* is transmitted by direct contact with syphilitic sores, which may be present on the external genitalia, vagina, anus, rectum, lips, and mouth; only a few organisms are required to infect a person through abraded skin. The primary chancre is often painless but teeming with spirochetes. A systematic review of condom use and risk of STIs determined that only two studies were rigorously designed to longitudinally assess the effects on incident syphilis; one study suggested a significantly reduced risk of syphilis among condom users [54].

**Potential risk of spermicides** — Condoms lubricated with spermicides are no more effective than other lubricated condoms in protecting against the transmission of HIV and other STIs. Studies of spermicides containing nonoxynol-9 (N-9) have produced conflicting results on the ability to prevent STIs other than HIV [55,56]. However, two randomized controlled trials reported an increased risk of HIV acquisition with frequent use of N-9, possibly due to disruption of the genital epithelium [56].

**Other barrier methods** — Most data on the efficacy of condoms are related to male condom use rather than female condom use [34]. In several randomized controlled trials, male condoms have been superior to other barrier methods in preventing new STIs, and other studies have reported very low uptake of the female condom [56]. The data on the protective effect of cervical diaphragms are mixed, and these should not be relied upon for STI prevention [6]. Use of a latex diaphragm with lubricant gel in addition to condoms had no additive effect on preventing HIV, chlamydia, or gonorrhea [57,58].

## ANTIMICROBIAL-BASED PREVENTION STRATEGIES

### Post-exposure prophylaxis of bacterial STIs

**For partners of patients diagnosed with syphilis, gonorrhea, chlamydia, or Trichomonas** — In the United States, the Centers for Disease Control and Prevention (CDC) recommends that sexual partners of patients diagnosed with syphilis, gonorrhea, chlamydia, or *Trichomonas* infection be presumptively treated for the pathogen that was identified in the index patient [6]. Partners unable or unwilling to be clinically evaluated

can be treated for gonorrhea and/or chlamydia through the use of expedited partner therapy. (See 'Partner services' below.)

**For victims of sexual assault** — Pre-emptive empiric treatment of STIs is recommended in this setting, since many assault victims will not return for a follow-up visit, and treatment based upon microbiologic testing results is therefore problematic [6]. In addition, patients often prefer immediate treatment. This is discussed in detail elsewhere. (See "Evaluation and management of adult and adolescent sexual assault victims" and "Patient education: Care after sexual assault (Beyond the Basics)".)

**For individuals disproportionally affected by STIs** — Among individuals disproportionally affected by STIs, including men who have sex with men (MSM) (see 'Factors associated with STI acquisition' above), post-exposure prophylaxis (PEP) strategies appear to reduce the incidence of certain bacterial STIs, but until their long-term effects, including the impact on bacterial resistance rates, can be established, these approaches remain experimental [59,60].

As an example, in an open-label randomized trial of approximately 200 MSM who were already enrolled in a trial of pre-exposure prophylaxis for HIV, doxycycline for STI PEP, administered as two 100 mg pills within 72 hours of a condomless sexual exposure, reduced the incidence of chlamydia (hazard ratio [HR] 0.30, 95% CI 0.13-0.70) and syphilis (HR 0.27 95% CI 0.07–0.98) over a median of nine months follow-up [60]. There was no effect on gonorrhea rates, likely because of the prevalence of tetracycline resistance among *N. gonorrhoeae*. Gastrointestinal side effects were somewhat limiting, and 20 percent of participants discontinued STI PEP.

In another study, 30 MSM with HIV who had syphilis at least twice since their HIV diagnosis were randomly assigned to either daily doxycycline (one 100 mg tablet) or a financial incentive-based contingency management arm for remaining STI-free [59]. During 48 weeks of follow-up, the doxycycline group was less likely to test positive for *N. gonorrhoeae, C. trachomatis*, or syphilis (odds ratio 0.27, 95% CI 0.09-0.83).

**Antiretroviral-based prevention of HIV** — Several effective strategies for HIV prevention employ the use of antiretroviral agents.

One of the most effective methods for prevention of HIV transmission is viral suppression of individuals with HIV. Effective antiretroviral treatment reduces HIV viral load in blood,

semen, vaginal fluid, and rectal fluid to very low levels and reduces the risk of sexual HIV transmission by approximately 95 percent in HIV-serodiscordant couples [61,62]. Decreasing the community viral load by maximizing HIV diagnoses and effective linkage to effective HIV care can lead to dramatic reductions in HIV transmission [63]. (See "HIV infection: Risk factors and prevention strategies", section on 'Treatment as prevention'.)

For individuals without HIV who have high risk for HIV exposure and are committed to medication adherence and close follow-up, pre-exposure antiretroviral prophylaxis against HIV (HIV PrEP) is an effective strategy for prevention of HIV infection. This issue is discussed in detail elsewhere. (See "Administration of pre-exposure prophylaxis against HIV infection".)

Although data are limited, observational studies have suggested a benefit of post-exposure antiretroviral prophylaxis (HIV PEP) in reducing the risk of HIV infection following sexual or other exposure to HIV [64-69]. This topic is discussed in detail elsewhere. (See "Management of nonoccupational exposures to HIV and hepatitis B and C in adults".)

**Suppressive therapy for herpes simplex virus** — Antiviral suppression of herpes simplex virus (HSV) is effective in decreasing the risk of transmission of HSV to an uninfected sex partner [6]. This is discussed in detail elsewhere. (See "Treatment of genital herpes simplex virus infection", section on 'Suppressive therapy'.)

Epidemiologic and biologic studies have suggested that genital HSV infection facilitates transmission and acquisition of HIV. However, antiviral suppression of HSV does not reduce the risk of HIV transmission from an HIV/HSV-coinfected individual nor does it reduce the risk of HIV acquisition in an individual with HSV.

**Limited efficacy of topical microbicides** — Topical microbicides have been proposed as STI preventive agents by providing chemical, biologic, and physical barriers to infection at the mucosal surface (eg, vagina or rectum) [70]. Classes of microbicides include surfactants, membrane disruptors, favorable modifiers of the vaginal environment, viral entry inhibitors, and reverse transcriptase inhibitors [71]. Delivery systems include gel formulations and vaginal rings, which are engineered for sustained drug release [72].

However, clinical trials of microbicides (such as PRO2000) for the prevention of STIs such as gonorrhea, chlamydia, and syphilis have not demonstrated substantial efficacy [73].

Studies of topical antiretroviral agents for the prevention of HIV acquisition are discussed

elsewhere. (See "Administration of pre-exposure prophylaxis against HIV infection", section on 'Alternatives to daily oral therapy'.)

## PARTNER SERVICES

"Partner services" refers to actions by the provider or public health officials to identify and arrange for evaluation and treatment of sex partners of patients diagnosed with STIs [6]. From a public health standpoint, partner services can potentially decrease the spread of STIs and decrease the risk of reinfection of the index patient. The intensity of this effort varies among agencies and geographic areas. At the very least, clinicians should advise patients diagnosed with STIs to notify their partners and encourage them to be evaluated. In the United States, the Centers for Disease Control and Prevention (CDC) recommends that public health surveillance programs provide partner services for all persons who test positive for HIV and early syphilis and for those who are suspected to have cephalosporin-resistant gonorrhea [6,74].

Ideally, all sex partners of individuals diagnosed with any STI would receive clinical evaluation; however, there are circumstances when that is not possible. Expedited Partner Therapy (EPT) is the clinical practice of treating heterosexual sex partners of patients diagnosed with chlamydia or gonorrhea by providing medications or prescriptions to the patient to take to his/her partner without the health care provider first examining the partner. EPT has been shown to reduce reinfection of the index patient in several randomized clinical trials [75-77]. Both the CDC and the American College of Obstetricians and Gynecologists (ACOG) support the use of EPT as a method to prevent chlamydial and gonorrheal infection when a patient's partners are unable or unwilling to seek medical care [78,79]. EPT is legal or permissible in all but one state in the United States. EPT should be accompanied by patient counseling and written treatment instructions, with written encouragement to seek additional medical evaluation to screen for other STIs, including HIV. (See "Treatment of Chlamydia trachomatis infection", section on 'Expedited partner therapy' and "Treatment of uncomplicated Neisseria gonorrhoeae infections", section on 'Expedited partner therapy'.)

EPT is not recommended for men who have sex with men (MSM), in part because of the high risk of HIV and syphilis among these individuals [80]. It is recommended that they present for evaluation and treatment to minimize missed opportunities to diagnose these

infections.

## OTHER PREVENTION MODALITIES

**Male circumcision** — Numerous studies suggest a decreased risk of STI acquisition in males who have been circumcised; this is particularly evident for HIV infection [81].

Nonsurgical circumcision measures appear to be safe and effective but have not yet been studied for their effect on HIV or STI prevention [82].

**HIV infection** — The efficacy of male circumcision in preventing HIV acquisition among heterosexual men, women, and men who have sex with men is discussed in detail elsewhere. (See "HIV infection: Risk factors and prevention strategies", section on 'Male circumcision'.)

**Other STIs** — Results of several studies suggest that male circumcision is associated with a reduced risk of viral STIs, including herpes simplex virus (HSV) type 2 and human papillomavirus (HPV), but not of gonorrhea or chlamydia [83-86]. As examples, several trials in Africa have suggested a relative reduction in HSV-2 seroconversion among men of approximately 25 to 40 percent following circumcision [85-87]. With regards to HPV infection, circumcision reduces acquisition and increases clearance of high-risk types among men and reduces HPV transmission to female sex partners by approximately 25 percent [88-91]. In contrast, circumcision did not reduce the risk of gonorrhea, chlamydia, or *Trichomonas* during two years of follow-up [92,93]. This variation may result from the site of infection, as gonorrhea and chlamydia infect the urethra, while viral infections tend to involve the foreskin, where dendritic cells play a prominent role.

An effect on the incidence of syphilis has also not been identified in these trials, possibly due to the low overall rate of syphilis in the study populations [86].

The relationship between circumcision and chancroid or lymphogranuloma venereum (LGV) is unclear, but the best available data suggest a protective effect against chancroid [94] and possibly LGV [95,96]. A reduction in any infection associated with genital ulcers is important because the presence of these ulcers facilitates acquisition/transmission of HIV.

There is also evidence that urethral *Mycoplasma genitalium* infection is less prevalent in circumcised men [97].

**Outreach** — Outreach approaches to provide testing or preventive services to individuals disproportionally affected by STIs are frequently employed to engage populations who may not seek traditional facility-based health services [98,99]. With widespread use of the internet and mobile technology, these have emerged as avenues to reach individuals with preventive services [100]. As an example, increases in syphilis in the United States and Europe have been associated with meeting new and anonymous sex partners on the internet [101-103]. In response to this trend, some public health initiatives have created website-based prevention interventions and online syphilis-testing recruitment programs [104,105]. (See "Syphilis in patients with HIV".)

**Strategies to improve sexual health** — Some experts have argued that sexual health interventions in the United States are fragmented, leading to poor health outcomes (eg, STIs, teen pregnancy), decreased productivity among young adults, and overall higher health care costs. Such experts have suggested that a unified sexual health strategy should be developed to help decrease stigma, improve the delivery of care, enhance sex education, and ensure access to contraceptives [106,107].

**Anti-poverty measures** — Poverty has been shown to contribute to HIV and STI incidence among women [108]. A cluster-randomized trial in young women in Malawi suggests that anti-poverty measures and economic development can be important tools in STI prevention [109,110].

## SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Sexually transmitted infections".)

## INFORMATION FOR PATIENTS

UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5$^{th}$ to 6$^{th}$ grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces

are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Basics topics (see "Patient education: Chlamydia and gonorrhea (The Basics)" and "Patient education: Genital herpes (The Basics)")
- Beyond the Basics topics (see "Patient education: Chlamydia (Beyond the Basics)" and "Patient education: Genital herpes (Beyond the Basics)")

## SUMMARY AND RECOMMENDATIONS

- The comprehensive approach to sexually transmitted infection (STI) prevention is based on five major strategies (see 'Introduction' above):
  - Accurate sexual health assessment, with education and counseling of individuals on ways to avoid STIs
  - Pre-exposure vaccination for vaccine-preventable STIs
  - Identification of both asymptomatic and symptomatic individuals with STIs
  - Effective diagnosis, treatment, counseling, and follow-up of infected individuals
  - Evaluation, treatment, and counseling of sex partners of infected individuals
- Sexual health assessment through routine sexual histories is critical to allow targeted STI screening and prevention counseling ( table 2). Factors associated with higher STI incidence include new or multiple sex partners, sex partners with recent STI, no or inconsistent condom use when having sex with multiple partners or with a partner who has multiple partners, trading sex for money or drugs, and sexual contact with sex workers. Adolescents, pregnant women, people with HIV, men who have sex with men (MSM), and transgender individuals warrant specific considerations for screening and counseling because of the high rate of STIs among these populations. (See 'Sexual health assessment' above.)
- In addition to one-time screening for HIV infection in all adults and adolescents, all

individuals being evaluated for STI screening or diagnosis should be tested for HIV infection. Screening for other STIs depends on the individual's sexual practices and demographic ( table 1). Screening for STIs is discussed in detail elsewhere. (See "Screening for sexually transmitted infections" and "Screening and diagnostic testing for HIV infection".)

- Behavioral counseling interventions can reduce rates of STI in sexually active adolescents and adults who are disproportionately affected by STIs. They include in-person counseling, telephone support, and other media-delivered messages. Patient-centered counseling can be performed during a single brief session and entails assessing the patient's understanding of STI transmission, discussing the patient's sexual behavior, assessing the patient's willingness to change, negotiating a goal for behavioral change, and identifying a concrete and realistic step toward that goal ( table 3). (See 'Prevention counseling' above.)

- Vaccination is an important strategy to prevent several infections that are sexually transmitted or associated with sexual activity (see 'Vaccines' above):

  - Hepatitis A vaccine, for nonimmune MSM, individuals with chronic liver disease, people with HIV, and individuals with risk factors for hepatitis A virus infection, including injection drug use (see "Hepatitis A virus infection: Treatment and prevention", section on 'Indications')

  - Hepatitis B vaccine, for nonimmune individuals with STI risk factors, including MSM, people who use injection drugs, and people with HIV (see "Hepatitis B virus immunization in adults", section on 'Indications')

  - Human papillomavirus (HPV) vaccine, for all females and males ages 9 to 26 years (see "Human papillomavirus vaccination")

  - Meningococcal vaccine, for individuals exposed to outbreaks (including MSM) and individuals with HIV, among others

- STI prevention efforts should also include the use of barrier methods, including male and female condoms. Use of male condoms has been associated with a decreased risk of transmission of HIV, chlamydia, gonorrhea, herpes simplex virus, and HPV. (See 'Male condom use' above.)

- Effective antimicrobial-based preventive strategies include antiretroviral treatment as prevention, pre-exposure prophylaxis, and post-exposure prophylaxis to prevent HIV infection as well as suppressive antiviral therapy of individuals with genital herpes simplex virus (HSV) to prevent transmission. These issues are discussed in detail elsewhere. (See "Prevention of genital herpes virus infections", section on 'Chronic suppressive therapy in discordant couples' and "HIV infection: Risk factors and prevention strategies", section on 'Clinical approach to HIV prevention'.)

- Expedited partner therapy for sexual partners of patients diagnosed with gonorrhea or chlamydia who cannot be directly evaluated is an effective strategy to reduce STI reinfection rates. (See 'Partner services' above.)

- Male circumcision can reduce HIV acquisition among heterosexual men. It has also been associated with a decreased risk of infection with HSV and HPV. (See 'Male circumcision' above and "HIV infection: Risk factors and prevention strategies", section on 'Male circumcision'.)

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## GRAPHICS

### STI screening recommendations by gender and population

| Gender | Population | Routine screening recommendation | Screening frequency | Additional screening recommendations and comments |
|---|---|---|---|---|
| Women | Age <25 years | Genital chlamydia | Annually | Screen for syphilis, trichomoniasis, HBV, and HCV if at increased risk.* |
| | | Genital gonorrhea | Annually | |
| | | HIV | At least once | |
| | Age ≥25 years | HIV | At least once | Screen for gonorrhea, chlamydia, syphilis, trichomoniasis, HBV, and HCV if at increased risk.* |
| | Pregnant | Genital chlamydia | First trimester (if <25 years or at increased risk*) | Repeat screening for these infections in third trimester if at increased risk.<br>All pregnant women at risk for HCV infection should be screened at the first prenatal visit.<br>Pregnant HIV-infected women are also screened for trichomoniasis at the first prenatal visit. |
| | | Genital gonorrhea | First trimester (if <25 years or at increased risk*) | |
| | | Syphilis | First trimester | |
| | | HIV | First trimester | |
| | | HBV | First trimester | |
| | HIV-infected | Genital chlamydia | Annually | |
| | | Genital gonorrhea | Annually | |
| | | Genital trichomoniasis | Annually | |
| | | Syphilis | Annually | |
| | | HBV | First visit | |
| | | HCV | First visit | |
| Men | HIV-uninfected MSW | HIV | At least once | Screen for gonorrhea, chlamydia, syphilis, HBV, and HCV if at increased risk.¶<br>Targeted screening venues for chlamydia include adolescent clinics, STI clinics, and correctional facilities. |
| | HIV-uninfected MSM | Genital chlamydia | At least annually | More frequent screening (every three months) for chlamydia, gonorrhea, and syphilis is recommended in those with risk factors. More frequent screening for HIV and HCV may also be warranted.Δ |
| | | Rectal chlamydia (if exposed) | At least annually | |
| | | Genital gonorrhea | At least annually | |
| | | Rectal gonorrhea (if exposed) | At least annually | |

| | | | | |
|---|---|---|---|---|
| | | Pharyngeal gonorrhea (if exposed) | At least annually | |
| | | Syphilis | At least annually | |
| | | HIV | At least annually | |
| | | HAV | First visit | |
| | | HBV | First visit | |
| | | HCV | At least once | |
| | HIV-infected MSW | Genital chlamydia | Annually | |
| | | Genital gonorrhea | Annually | |
| | | Syphilis | Annually | |
| | | HBV | First visit | |
| | | HCV | First visit | |
| | HIV-infected MSM | Genital chlamydia | At least annually | More frequent screening (every three months) for chlamydia, gonorrhea, and syphilis is recommended in those with risk factors. More frequent screening for HCV may also be warranted.[Δ] |
| | | Rectal chlamydia (if exposed) | At least annually | |
| | | Genital gonorrhea | At least annually | |
| | | Rectal gonorrhea (if exposed) | At least annually | |
| | | Pharyngeal gonorrhea (if exposed) | At least annually | |
| | | Syphilis | At least annually | |
| | | HAV | First visit | |
| | | HBV | First visit | |
| | | HCV | At least annually | |

STI: sexually transmitted infection; HBV: hepatitis B virus; HCV: hepatitis C virus; MSW: men who have sex only with women; MSM: men who have sex with men; HAV: hepatitis A virus.

* Increased risk factors for gonorrhea, chlamydia, and trichomoniasis in women include prior infection, particularly in the preceding 24 months; multiple sex partners within the past year; suspicion that a recent partner may have had concurrent partners; new sex partner in the past three months; exchanging sex for drugs or money within the past year; and residing in an area of high STI prevalence.

¶ Increased risk factors for gonorrhea and chlamydia in MSW include an infection in the preceding 24 months.

Δ Increased risk factors for gonorrhea, chlamydia, syphilis, and HIV among MSM include multiple or anonymous partners; intravenous drug use; sex in conjunction with illicit drug use, including methamphetamines; and sex partners who engage in these activities. Increased risk factors for hepatitis C infection among MSM include HIV infection, high community HCV prevalence and incidence, high-risk sexual behaviors, and concomitant ulcerative STIs or STI-related proctitis.

*Adapted from: California Department of Public Health, Sexually Transmitted Diseases Branch. California STD screening recommendations, 2015. Available at: https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/CA_STD-Screening-Recs.pdf#search=std%20screening%20recommendations (Accessed on August 30, 2017).*

Graphic 103391 Version 8.0

## The five Ps: Partners, prevention of pregnancy, protection from STIs, practices, and past history of STIs

| |
|---|
| **Partners** |
| Do you have sex with men, women, or both? |
| In the past 2 months, how many partners have you had sex with? |
| In the past 12 months, how many partners have you had sex with? |
| Is it possible that any of your sex partners in the past 12 months had sex with someone else while they were still in a sexual relationship with you? |
| **Prevention of pregnancy** |
| What are you doing to prevent pregnancy? |
| **Protection from STIs** |
| What do you do to protect yourself from STIs and HIV? |
| **Practices** |
| To understand your risks for STIs, I need to understand the kind of sex you have had recently. |
| Have you had vaginal sex, meaning "penis-in-vagina" sex? |
| If yes: |
| Do you use condoms: never, sometimes, or always? |
| Have you had anal sex, meaning "penis-in-rectum/anus" sex? |
| If yes: |
| Do you use condoms: never, sometimes, or always? |
| Have you had oral sex, meaning "mouth-on-penis/vagina"? |
| For condom answers: |
| If never: |
| Why do you not use condoms? |
| If sometimes: |
| In what situations (or with whom) do you not use condoms? |
| **Past history of STIs** |
| Have you ever had an STI? |
| Have any of your partners had an STI? |
| **Additional questions to identify HIV and viral hepatitis risk:** |
| Have you or any of your partners ever injected drugs? |
| Have you or any of your partners exchanged money or drugs for sex? |
| Is there anything else about your sexual practices that I need to know about? |

STI: sexually transmitted infection; HIV: human immunodeficiency virus.

*Adapted from: Workowski KA, Berman SM. Sexually transmitted diseases guidelines, 2015. MMWR Recomm Rep 2015; 64:1.*

Graphic 61677 Version 8.0

## Framework for sexually transmitted infection risk reduction counseling

| | |
|---|---|
| **Ask** | Routinely obtain a sexual and substance use history for all patients to assess risk.<br>*Reinforce confidentiality; be tactful, clear, and nonjudgmental; check assumptions.*<br>▪ "To provide the best care, I ask all my patients about their sexual activity - so tell me about your sex life."<br>▪ "Tell me about your partners." (gender, number, new partners, partners with other partners)<br>▪ "What types of sex have you been having?" (vaginal, anal, oral)<br>▪ "How do you protect your partners and yourself during sex?" |
| **Intervene** | Provide patients with brief, tailored, behavioral interventions for risk reduction.<br>▪ Discuss risk with patients:<br>• Unprotected sexual activity<br>• Anonymous partners<br>• Patient or partners with recent STI<br>• History of recreational or intravenous drug use (party drugs, methamphetamines)<br>• Exchange of sex for money or drugs<br>• Recent incarceration<br>▪ Assess patient's knowledge and misconceptions about STI transmission and assess attitudes and beliefs:<br>• "What are your concerns about giving or getting an STI?"<br>▪ Assess circumstances affecting behaviors (what, where, and with whom; triggers):<br>• "What makes it difficult to use condoms with your partners?"<br>• "How do you tell your partner about your HIV status/your STI infection?"<br>▪ Assess patient's readiness to change<br>▪ Negotiate a behavioral goal:<br>• "What is one thing you can do to reduce your risk of getting HIV or another STI?"<br>▪ Identify a first step toward the goal that is:<br>• Concrete<br>• Incremental<br>• Individualized<br>• Realistic |
| Know the resources in your community that provide support and care for social and mental health, substance abuse, or reproductive concerns. | |

STI: sexually transmitted infection.

*Adapted from: National Network of STD/HIV Prevention Training Center. Ask, Screen, Intervene Pocket Guide. http://nnptc.org/resources/ask-screen-intervene-pocket-guide/ (Accessed on December 16, 2016).*

Graphic 111349 Version 1.0

## Contributor Disclosures

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